Nutrition Health Promotion Programme In Middle to High Income School Settings

A dissertation submitted in partial fulfillment of the requirement for the award of

DOCTORATE OF PHILOSOPHY

(Foods and Nutrition)

BY

SOMILA SURABHI

(M.Sc Foods and Nutrition)

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Vadodara, Gujarat, India

DECEMBER 2013

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DEDICATED

TO AL MIGHTY GOD

AND

TO MY PARENTS

CERTIFICATE

This is to certify that the research work embodied in the thesis has been carried out independently by **Ms. Somila Surabhi** in pursuit of doctorate degree in Foods and Nutrition, and represents her original work.

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Somila Surabhi

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURES

Annexure No.	Title
1	Informed Consent Letter for the Parents and the students to Initiate A Nutrition Health Promotion Program in the School
2	NFSHI questionnaires (with the four modules)
3	NFSHI score cards
4	Canteen questionnaire
5	Teacher's questionnaire (have to be typed)
6	Cut of values of the biochemical parameters
7	Doctor's certificate
8	Informed Consent Letter For Parents to Conduct Biochemical Estimations On Their Children
9	Questionnaire used to elicit information regarding dietary and lifestyle behaviors before and after the intervention
10	Health card (present in CD)
11	Power point presentation- NHE session for the students (present in CD)
12	Power point presentation- Orientation session for the parents In CD (present in CD)
13	Posters & bookmarks (Present in CD)
14	Ist set of tiffin menus
15	Parent Consent Letter to Make Changes In The School Environment
16	Letter to Initiate Healthy Tiffin Program
17	Informed Consent Letter to Initiate Iron Folic Acid Supplementation
18	Tiffin auditing checklist for the teachers
19	Power point presentation- NHE session for the parents (Present in CD)
20	Letter For Parents To Attend Awareness And Capacity Building Sessions (under weight management)
21	KAP questionnaires of parents for underweight management

22	KAP questionnaires of students for underweight under weight management
23	Letter For Parents To Attend Awareness And Capacity Building Sessions (Over weight and obesity management)
24	KAP questionnaires of parents for over weight management
25	Module for parents on weight management
26	IInd set of tiffin menus
27	KAP questionnaires of students for overweight management

ABBREVIATIONS

AHA	American Heart Association
ATP III	Adult Treatment Panel III
BMI	Body Mass Index
BP	Blood Pressure
CAD	Coronary Artery Disease
CBSE	Central Board of Secondary Education
CDC	Center for Disease Control
CO	Cholesterol Oxidase
CSHP	Comprehensive School Health Program
DBP	Diastolic Blood Pressure
GOI	Government of India
GSEB	Gujarat Secondary & Higher Secondary Education Board
GSHS	Global School Health Survey
HDL-C	High Density Lipoprotein Cholesterol
IDF	International Diabetes Association
IFA	Iron Folic Acid
LDL- C	Low Density Lipoprotein- Cholesterol
MHSES	Middle to High Socio Economic Status
NCF	National Curriculum Framework
NFSHI	Nutrition Friendly School Health Index
NHE	Nutrition Health Education
NHES	National Health Education Standards
NCERT	National Council of Educational Research and Training
NCF	National Curriculum Framework
NHE	Nutrition Health Education
NHT	Nutrition Health Team
NIH	National Institute of Health
PA	Physical Activity
RDA	Recommended Dietary Allowances
SBP	Systolic Blood Pressure
SHP	School Health Profile
SHPPS	School Health Policies and Practices Study
TG	Triglyceride
WC	Waist Circumference
NASPE	National Association for Sport and Physical Education
USPSTF	U.S. Preventive Services Task Force
VLDL- C	Very Low Density Lipoprotein- Cholesterol
WC	Waist Circumference
WHtR	Waist to height Ratio
WHO	World Health Organization
YRBSS	Youth Risk Behavior Surveillance System

The present study was conceptualized with the objective to first map the prevalence of malnutrition (overweight including obesity, underweight and anemia) among the adolescents in middle to high income schools, evaluate the nutrition health content of the International, National and state curriculum and then plan need based one and a half year nutrition and health promotion program by creating enabling environment in the school campus by offering healthy food choices to the students, capacity building of school administration, parents & teachers on nutrition and health issues of adolescents and foster their participation in the program.

For this purpose, two convent (coeducational) Gujarat Secondary & Higher Secondary Education Board (GSEB) schools with comparable fee structure were selected. Nutrition health promotion program (intervention) was planned and implemented in the experimental school while the control school was only used to compare nutritional status and dietary and lifestyle behaviors at baseline and after intervention. The consent forms, explaining the purpose and methodology of data collection, were distributed to all the children of classes V-VII, with adolescents aged 10-13 years. All those students whose parents and children themselves consented to participate in the study (273 in Experimental school and 92 in control school) were selected as subjects of the study. The text books of national (CBSE) and state board (GSEB), covered very few essential topics on healthy eating (NCERT: 13.6% vs GSEB: 9.1%) and physical activity (NCERT: 37.5% vs GSEB: 18.8%) when compared to international, CDC recommendations. The National Curriculum was slightly better than the state (Gujarat) Curriculum, though both need improvement.

Self assessment of school ethos and environment using school health index with four related modules, was done by newly formed NHT members (school administration, teachers, students and parents), Results showed that there were no written policies related to nutrition and health in both the schools. In the areas of physical education and physical activity programs, more weaknesses (experimental: 50% vs control: 70%) were observed than the strengths (experimental: 40% vs control: 30%) in both the schools. However, with respect to health education imparted) and nutrition services offered there were no policies related to the nutrition and health services were being practiced in both the schools. The canteen services were not nutrition friendly, and the canteen service providers and the teachers had no knowledge about nutritional aspect.

Nutritional assessment of the study subjects revealed triple burden of malnutrition from MHSES (under weight: 53.7%, anemia: 49.3% and overweight and obesity: 25.2%). Central obesity as indicated by high WHtR and High WC was 37.0% and 9.0% of the study subjects respectively. The study subjects having high WC and high WHtR were six times at risk of developing sub optimal blood pressure.

Sub optimal high blood pressure among these study subjects was as high as 21.4%. Similarly,

46.5% and 28.2% of the overweight and obese subjects were identified as dyslipidemics according to ATP III and AHA classifications respectively, while 5.6% were identified as having Glucose intolerance. Among five dietary and lifestyle behaviors, low intake of fruits and vegetable (≤ 400 gm/day) was observed in more than half (56.7%) of the study subjects.

Central obesity was ($p \leq 0.01$) more in boys than in girls (42.6% vs 26.0%) as indicated by WHtR. Similarly, the unhealthy habit of consuming carbonated (sweetened) beverages was ($p \leq 0.01$) more in boys than in girls (19.0% vs 8.1%). Though, more percentage of girls ($p \leq 0.01$) consumed breakfast irregularly than boys.

For creating enabling environment, two sets of 6 days cyclic menus (providing $1/3^{rd}$ of the RDA and iron rich) were provided to parents. Tiffin auditing results showed that the percentage of study subjects bringing healthy tiffin increased from 49.9% at baseline to almost 100.0%. Parent's participation, was very poor (0.04%) during the first orientation meeting, which improved slightly to 22.0% in the first NHE session to 33.0% in the second NHE session. Also the knowledge of parents who attended the NHE sessions improved significantly after the NHE sessions. Canteen services providing healthy beverage options in a five day pilot trial, showed a consistent demand for butter milk and flavoured milk as compared to the sweetened beverages.

After 3 to 4 months of weekly IFA supplementation, a mild change in percent prevalence (49.3at baseline to 48.7% after supplementation) of anaemia (though non significant) was observed. Significant reductions in prevalence o of anemia e of was seen in very good compliance group (56.6 Vs. 40.8) followed by average compliance group (50 Vs. 40) and good compliance group (59.3 to 52.5). In the poor compliance group however, a very highly significant ($p \leq 0.001$) increase in anaemia prevalence from baseline (18.7 Vs. 68.7) was observed. Significant improvement (from baseline)

in academic scores of the study subjects in supplemented group (IFA) as compared to the non-supplemented group (191.2±45.20 Vs. 169.86±48.53). Similarly, when comparisons were made in the academic scores obtained between anaemic (174.38±45.46 Vs. 179.57±45.56) and non anaemic (187.87±82 Vs. 190.6±82) subjects the data clearly demonstrated a significant improvement after IFA supplementation in both the groups from their respective base line values. Nutrition health education (NHE) sessions and capacity building sessions for the students also showed marked improvement in knowledge of the study subjects.

After one and a half years nutrition health promotion program (intervention), the overall prevalence of malnutrition (overweight including obesity, under nutrition and anemia) between the two schools showed trends (non significant) towards reduction in malnutrition from baseline in the Experimental school (78.8% vs 77.9%}, while the control school showed increase in malnutrition rates (79.3% vs 82.6%).

Nutrition health and promotion program had a very highly significant impact (($p \leq 0.001$) in reducing sub optimal blood pressures of the study subjects in the Experimental school from its baseline values (23.8% vs 4.1%), while they increased significantly in the control school (14.1% vs 35.9%). Similarly very highly significant lower levels of sub optimal blood pressure were recorded in Experimental school as compared to control group (4.1% vs 35.9%) at the end of nutrition health promotion program, though at baseline no significant differences existed between both the groups at baseline. Within the schools also, decreasing trend was observed (very highly significant) in experimental school than in the control school, where the prevalence increased (very highly significantly) after the intervention period

Similarly, the impact of one and a half years nutrition health promotion program (intervention) was also observed in overweight and obese subjects with respect to their fasting lipid and glucose levels. The results showed that after the intervention, significant ($p \leq 0.05$) and highly significant ($p \leq 0.01$) lower prevalence of dyslipidimea between the two schools were observed, according to ATP III (experimental: 19.5% vs control: 46.4%) and AHA (experimental: 9.8% vs control: 42.9%) classifications respectively. Within the schools, significant ($p \leq 0.05$) reduction in dyslipidemia was observed in the experimental school from its baseline values, according to ATP III (37.2% vs 19.5%) and AHA (20.9% vs 9.8%) classifications. However, in the control school, according to ATP III, non significant

decrease (60.7% vs 46.4%) and according to AHA non significant increase (39.3% vs 42.9%) was observed from the respective baseline values.

The practice of unhealthy behaviors by the study subjects in the experimental school, very highly significantly ($p \leq 0.001$) decreased from their baseline values for (carbonated/ sweetened beverage intake: 17.6% vs 7.1%, fast food intake: 42.9% vs 17.2%, Low fruits and vegetable intake: 59.0% vs 15.4%, physical inactivity: 34.8% vs 6.0%), while highly significantly ($p \leq 0.01$) decreased in TV watching/ computer playing (41.8% vs 32.2%). On the contrary, in the control school, very highly significant ($p \leq 0.001$) increase was observed in percent prevalence of study subjects who consumed carbonated (sweetened) beverages (8.7% vs 13.0%), became physically inactive (22.8% vs 88.0%). While significant increase ($p \leq 0.05$) was observed in the l who consumed fruits and vegetable less than 400 gm/day (50.0% vs 67.4%). Similarly, with respect to fast food intake (18.5% vs 22.8%) and TV watching / computer playing (40.2% vs 58.75), also significant increase was observed in the control school from their respective baseline values. After the nutrition health promotion program (intervention), the percent prevalence of more than or equal to 3 cumulative unhealthy behaviors was very highly significantly ($p \leq 0.001$) lower in the experimental school subjects as compared to those in control school subjects (4.1% vs 52.2%). Within the schools also, a very highly significant ($p \leq 0.001$) decrease, in the percentage of subjects, having cumulative unhealthy behaviors was seen in the experimental school (30.0% vs 4.1%), while the reverse trend was seen in the subjects of the control school (9.8% vs 52.2%).

Thus the results of the present study clearly demonstrate that the need based nutrition health promotion program works in school settings and holds an immense potential to help children and adolescents modify their dietary and lifestyle behaviors, prevent occurrence of any NCD risk factors at young age. This in turn helps the nation to have healthy productive population. Hence, school nutrition health policies should be framed and implemented in all the schools (government or non government). Also the school health policies should include age specific key aspects of health and nutrition should have technical experts in nutrition who have the knowledge and skills to implement the entire program effectively in the school. The effectiveness of nutrition health promotion program in a school setting depends highly on the participation of school administration, teachers and parents. Hence, school administration and

teachers need to be made aware about their roles and responsibilities in improving the immediate and future health of their students which will greatly help in reducing the disability adjusted years of life (DALY) and improve productivity.

Therefore, a multi component nutrition health promotion program should be an integral part of all schools irrespective of their type and governments can make it either mandatory or give incentives to schools who implement the program like giving accreditation as a nutrition friendly school or providing subsidized land for kitchen and ground area etc.

Worldwide, the global population comprises of 1.2 billion of adolescents (10-19 years) and around 243 million (20%) of them live in India (UNICEF 2011). Adolescence, the second decade of life, is a transitional period between childhood and adulthood. It is also the most challenging period, in which an individual undergoes major physical, biological and hormonal changes resulting into psychosocial, behavioural and sexual maturation between the age of 10 -19 years. The relatively uniform growth of childhood is suddenly altered by an increase in the velocity of growth during adolescence making them nutritionally vulnerable for several reasons (Sawyer et al 2012).

Adolescents are often thought of as a healthy group and hence are the neglected ones. It is a period when health problems that have serious immediate consequences can occur or when problem behaviours that have serious adverse effects on health during adulthood can be initiated. Hence, adolescence is the window of opportunity to set the stage for a healthy and productive adulthood and to reduce the likelihood of health problems in the years to come (WHO 2012).

With the epidemiological and nutritional transition, coupled with globalization of economies, nutritional problems with industrialized countries become increasingly prevalent in low-and middle income countries, notably malnutrition (over nutrition, under nutrition and micronutrient deficiencies). Many times, among adolescent population, problems of under nutrition and over nutrition coexist along with micronutrient deficiencies, especially anemia, which frequently goes unrecognized where it compromises their capacity to learn, due to reduced cognitive ability, poor school attendance thereby affecting optimal productivity (FAO 2007).

However, contrary to the hypothesis, that over nutrition and under nutrition are the problems of high or low socio economic strata respectively, very few studies globally and in India, have reported the prevalence of double burden of malnutrition among adolescents belonging to middle to high socio economic status (Özgüven et al 2010, Opara et al 2010, Iyer et al 2010). As childhood obesity is considered a threat for the onset of adulthood non communicable diseases (NCDs), central obesity and high blood pressure during childhood are also the concerns as they are also significantly correlated with the NCDs. (Kelishadi et al 2007, McCarthy and Ashwell 2006).

Globally, anaemia affects 1.62 billion people, which corresponds to 24.8% of the population. Similarly, 25.4 % of school aged children globally are anemic (WHO 2008). According to NFHS III report in India, 56% of ever married women between the age of 15-45 years were reported to be anemic (NFHS 2005-2006). Till now, anemia has always been reported among the adolescent girls only from under privileged group (Choudhary and Dhage 2008). However, triple burden of malnutrition (double burden with anemia) along with NCD modifiable risk factors (high waist circumference, hypertension and unhealthy dietary and lifestyle practices) have not been reported among the adolescents, either globally or in India.

The Ottawa Charter for Health Promotion (Ottawa 1986) has had a major influence on school health in the last 20 years. Following on the lines of Baby Friendly Hospitals Initiative, WHO Expert Meeting on Childhood Obesity initiated Nutrition-Friendly Schools Initiative (NFSI) to combat the pandemic of double burden of malnutrition along with micronutrient deficiencies by designing integrated school based programs and interventions (WHO 2006).

Therefore, school nutrition and health promotion programmes can be initiated, as they provide the most effective and efficient way to reach adolescents, by reaching them at any influential stage in their lives during childhood and adolescence when lifelong nutrition patterns are formed and by providing a setting to incorporate nutrition and health education in the curriculum or initiating separate intervention programs. Hence, various school based public health approaches, such as regular nutritional screening, providing micronutrient supplements, ensuring its consumption and nutrition behavior development are the most cost – effective approaches (Gorely et al 2009, Steyn et al 2009). School intervention programs also provide an opportunity for parents participation, as they are the first role models for their children, and help in reinforcing the healthy dietary and lifestyle practices outside the school (Epstein 2011).

Also, of many objectives of the global strategy for the prevention and control of non communicable diseases, promoting interventions to reduce the main shared modifiable risk factors, like unhealthy diets, and physical inactivity, through various settings is considered an appropriate approach to reach many at one time. Hence, school settings have been considered the best buys by WHO to address the NCD risk

factors early in life by initiating nutrition and health promotion programs which will enable them to enter healthy and productive adulthood (WHO 2008).

Hence, the following study was conceptualized with the aim to conduct a situational analysis of the adolescents from two private schools of Vadodara, then based on the results of the situational analysis, a nutrition health promotion program was designed for the adolescents. The broad and specific objectives of the study are as follows:

BROAD OBJECTIVE

To study the impact of a nutrition and health promotion program in adolescents (10-12 years) in a school setting.

SPECIFIC OBJECTIVES

1. To review National Curriculum Framework (NCF, 2005) and Gujarat board curriculum being followed by Central Board of Secondary Education (CBSE) and Gujarat Secondary & Higher Secondary Education Board (GSEB) respectively, with regards to essential topics on health and nutrition.
2. To assess the school ethos and environment with respect to nutrition and health services in the school with the help of Nutrition Friendly School Health Index (NFSHI) adapted from Nutrition Friendly School Initiative (NFSI), and School Health Index (SHI).
3. To assess the canteen services in the school for the nutritional quality of the items being sold in it.
4. To assess the knowledge of the science and physical activity teachers regarding nutrition and health aspects with the help of a pretested questionnaire.
5. To conduct situational analysis of the adolescents with respect to their anthropometric, biophysical, biochemical, dietary and lifestyle practices, and meal pattern with the help of a pretested questionnaire adapted from Global School Health Initiative (GSHI).
6. To create enabling environment in the school, by building capacities of the teachers for tiffin auditing, of parents to provide healthy tiffin and by improving the available nutrition services (canteen) in the school.
7. To improve parents' knowledge attitude and practice, by conducting awareness and capacity building sessions pertaining to understanding various aspects of

adolescents and building their capacity to manage underweight and overweight problems faced by their children.

8. To improve anemia status of adolescents by necessary IFA supplementation (60mg elemental iron+ 0.5 mg folic acid) for 3 months.
9. To improve knowledge, attitude and practices of the adolescents regarding healthy dietary and lifestyle practices by nutrition health education and capacity building sessions.
10. To assess the impact of one and a half year "nutrition health promotion programme" on the anthropometric, biophysical, biochemical, dietary and lifestyle practices of the children by comparing the results with a control school.

Adolescence: An age of opportunity

The world is home to 1.2 billion adolescents aged 10–19 years who are standing at the crossroads between childhood and the adult world. As they stand at these crossroads, so do societies at large – the crossroads between losing out on the potential of a generation or nurturing them to transform society. As adolescents flourish, so do their communities, hence, it is a collective responsibility of the community in ensuring that adolescence does in fact become an age of opportunity (UNICEF 2010). Around 243 million of the adolescents live in India, accounting for nearly one quarter of the total population, deserving our attention as they hold the key to breaking vicious cycle of malnutrition (UNICEF 2011).

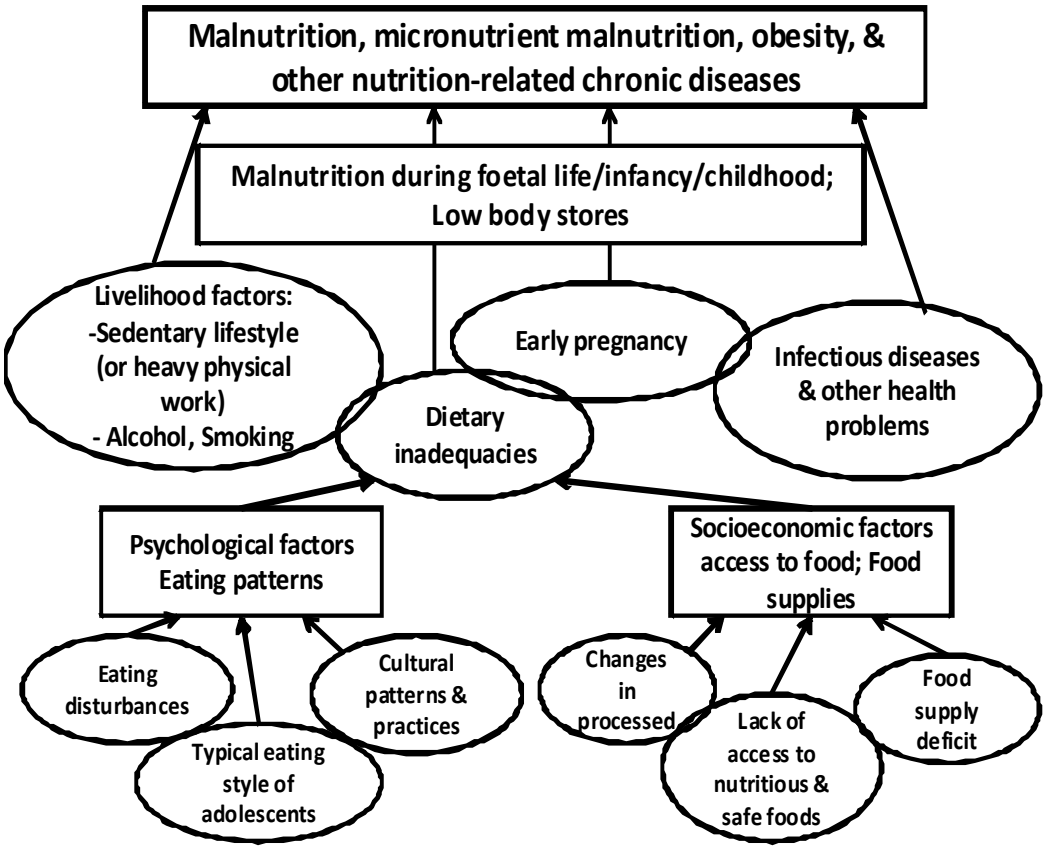
As per WHO, apart from the growth spurt, what makes adolescents nutritionally vulnerable, is their risk taking behavior and influence of the environment because they are in an impressionable age. Malnutrition, (under nutrition or over nutrition) during adolescence initiates a vicious chain of events affecting the most productive years of life and putting next generation at an increased risk (WHO, 2005).

The diagrammatic representation (Figure 2.1) of the vicious cycle of malnutrition demonstrates how adolescent health is altered and affected by the social, psychological and ecological factors, leading to dietary inadequacies and compromised health status. This causes physiological changes resulting in fetal malnutrition acting as a gateway for malnutrition to transcend into the next generation.

Hence, the major concerns of adolescent health as identified by WHO (Sawyer et al 2012) are:

- Under nutrition and associated deficiencies, often originating earlier in life;
- Iron deficiency anemia and other micronutrient deficiencies
- Obesity and associated cardiovascular disease risk markers
- Early pregnancy
- Inadequate or unhealthy diets and lifestyles

Figure 2.1: A conceptual framework of nutritional problems and causal factors in adolescence



Source: WHO Discussion Papers On Adolescence, 2005

Nutrition, hence, becomes a challenge in these years given the fact that appropriate nutrition in adolescence can help to break the viscous cycle of malnutrition. Moreover, nutrition education may help to bestow healthy behaviors in adolescents hence reducing or delaying the development of risk factors of non communicable diseases (NCDs) in adult years (Sawyer et al., 2012).

Hence, NCD-related deaths are increasing, especially in low and middle-income countries (WHO 2011) and over half are associated with behaviors that begin or are reinforced during adolescence, including tobacco and alcohol use, poor eating habits, and lack of exercise (WHO 2002). Global trends indicate that these NCD-related behaviors are on the rise among young people, and that they establish patterns of

behavior that persist throughout life and are often hard to change (WHO 2012). Adolescence is a time when the influence of peers and parents, as well as the targeted marketing of unhealthy products and lifestyles, is significant (WHO 2012, Ralph 2006). Hence, adolescence is arguably the last best chance to build positive health habits and limit the negative ones. Hence, interventions aimed at reducing the burden of NCDs, must include addressing risk factors during adolescence also (WHO 2012).

Chronic diseases have multiple preventable risk factors, which operate at different levels, from the most proximal (i.e. biological), to the most distal (i.e. structural). These risk factors can be classified as 'modifiable' and 'non-modifiable'. Modifiable determinants include factors that can be altered, such as individual and community influences, living and working conditions and socio-cultural factors. On the other hand, non-modifiable determinants include those factors that are beyond the control of the individual, such as age, sex and hereditary factors.

Hence, biological factors include:

- High blood cholesterol
- Genetics
- Early life origin
- Excess body weight- high body mass index
- Hypertension
- Type 2 diabetes

Behavioral (lifestyle) risk factors include:

- Poor diet
- Physical inactivity
- Tobacco usage
- Inappropriate use of alcohol

Social determinants of health include underlying causes of health problems such as urbanization and globalization, environmental factors (obesogenic, structural environment), socio economic status, working and living conditions and socio-cultural factors that affect the health of the population. These also place individuals at risk for the development of non-communicable diseases.

Therefore, chronic non-communicable diseases and their associated risk factors are a major contributor to the burden of disease in developed countries as well as in developing countries (Iyer et al 2011, Mushtaq et al 2011, Özgüven et al 2010, Opara et al 2010, Khadilkar et al 2010, Goyal et al 2010, Jeemon et al 2009, Bhardwaj et al 2008, Shah et al 2008, Tang et al 2007, Srihari et al 2007). They are also becoming a major public health challenge worldwide among the adolescents also (WHO 2011, Khuwaja et al 2007).

Chronic non-communicable diseases are largely due to preventable and modifiable risk factors (high blood cholesterol, high blood pressure, obesity, physical inactivity, unhealthy diet, tobacco use and inappropriate use of alcohol) resulting in various long-term disease processes, culminating in premature morbidity, high mortality rates and economic loss attributable to stroke, heart attack, tobacco- and nutrition-induced cancers, obstructive lung diseases and many others (Steyn et al 2006).

An extensive literature also demonstrates that NCDs are more likely to occur with unhealthy diet, physical inactivity, active and passive smoking, and use of betel nut and smokeless tobacco (Khowaja et al 2010, Weiderpass 2010, Ali et al 2009, Khuwaja et al 2007). Hence, prevention of these modifiable risk factors has positive effects on reducing NCDs rates and all-cause mortality (Weiderpass 2010, Ramachandran et al 2006). Thus it is reported that up to 80% of deaths due to heart disease, stroke, and type 2 diabetes and 40% of deaths due to cancers could be prevented by eliminating known modifiable dietary and lifestyle risk factors (WHO 2011).

The World Health Organization also supports the fact that NCDs are becoming an emerging public health problem among the adolescents, and hence, advocates the health promotion programs among this age groups also, as many serious diseases in adulthood have their roots in adolescence (WHO 2011, Michaud et al 2007).

Prevalence of NCD risk factors among the adolescents belonging to middle to high socio economic status

Overweight and obesity

Continuous changes in the body composition intricate the definition of obesity and overweight during periods of growth (childhood & adolescence), making it age, gender and race specific. Hence, various cut offs have been developed over the years to assess the nutritional status of children and adolescents.

Assessment of nutritional status of children and adolescents with different indicators

Overweight is generally defined as weight that exceeds the threshold of a criterion standard or reference value while obesity is defined as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired (Opara et al 2010). In simpler terms obesity is caused when energy is consumed in surplus of what can be spent. This surplus is stored in the body in fat cells which enlarge and multiply to accommodate excess of energy resulting in the clinical condition of obesity.

Evaluation of body fat and its distribution can be done by accurate measurements of the fat which requires special techniques, some of which are often expensive and not useful for children. Careful measurement of height and weight is currently the initial step in the clinical assessment or in school setting to screen over weight/ obese/ underweight children, as it is cost effective, feasible and with high accuracy (Bray 1992).

Anthropometry based on weight and height measurements is one of the commonly used methods of identifying obese people and can detect children at higher risk for nutritional and health disease (WHO 1997). The likelihood of nutritional disorders can be diagnosed by comparing an anthropometric index with reference values. The body mass index (weight in Kg / $(Height)^2$ in meters) is widely accepted and used in adult anthropometry with highest and lowest limits of normality based on statistical criterion relating the higher mortality of people having higher or lower BMI than these values (Bellizi et al 1999).

The use of BMI for nutritional evaluation of children and adolescents has become more common after Must et al (1991) published the percentile values according to age and sex which were considered by WHO as reference values to classify adolescents as overweight and obese. Since then alternative percentile curves for children have been proposed by several authors (Table 2.1). The reference used and the type of obesity indicators used influence the prevalence of overweight / obesity rates (Abrantes et al 2002).

Cole et al 2000 developed international cut off points for BMI for over weight and obesity by sex between 2-18 years, defined to pass through BMI of 25 and 30 kg/mt^2 at age of 18 years, by averaging data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore and United States. Cole et al standards were recommended by International Obesity Task Force (IOTF) and were internationally used for classification of overweight and obesity in children after 2000.

The Centre for Disease Control and Prevention (CDC) at Atlanta introduced the clinical use of BMI in new and revised BMI for age charts for young males and females aged 2-20 years using data from National Health Examination Survey cycle II and III, data from National Health and Nutrition Examination Survey (NHANES) I and II and data for children for 2-6 years of age from NHANES III which was being used largely (Kuczmarski et al 2000).

Later, the need to develop an appropriate single growth reference for the screening, surveillance and monitoring of school aged children and adolescents was also stirred by two contemporary events:

i. The increasing public health concern over childhood obesity (Lobstein et al 2004) and
ii. The April 2006 release of the WHO Child Growth Standards for preschool children based on a prescriptive approach (WHO 2006).

As countries proceed with the implementation of growth standards for children under 5 years of age, the gap across all centiles between these standards and existing growth references for older children became a matter of great concern. It is now widely accepted that using descriptive samples of populations that reflect a secular trend towards overweight and obesity to construct growth references results inadvertently in

an undesirable upward skewness leading to an underestimation of overweight and obesity, and an overestimation of undernutrition (De Onis 2004).

Table 2.1: Summary of common standards to classify over weight and obesity in children

Standard	Year	Age group	Sample size	Subjects	Criterion used to develop cut off points
Must et al (WHO)	1991	6-74 years with 1 year interval	20839	US NHANES I	>85th percentile of BMI for over weight >95th percentile of BMI for obesity
Cole et al (IOTF)	2000	2-18 years with 6 months interval	192727	Six large national survey on children from Brazil, Great Britain, Hong Kong, Netherlands, Singapore and US.	Age and Sex specific BMI cut offs related to adult cut off of BMI 25 for over weight and BMI 30 for obesity at the age of 18.
CDC	2000	2-20 years with 6 months interval	11096	US NHES II, III and NHANES I, II, III	Age and sex specific BMI growth charts: >85th percentile of BMI for over weight >95th percentile of BMI for obesity
Agarwal et al	2003	5-19 years with 1 year interval	19557	Private school children from 23 schools of 12 cities from India	>85th percentile of BMI for over weight >95th percentile of BMI for obesity
WHO (2007)	2006	0-5 years			
WHO (2007)	2006	5-18 years		Data from 1977 National Center for Health Statistics (NCHS)/WHO growth reference (1-24) were merged with data from the under – five growth standards' cross sectional sample (18-71 months) to smooth the transition between the two samples.	≥85th percentile of BMI for over weight ≥97th percentile of BMI for obesity

The reference previously recommended by WHO for children above 5 years of age, i.e. the National Center for Health Statistics (NCHS)/WHO international growth reference (WHO 1995), had several drawbacks (Wang et al 2006). In particular,

- The body mass index-for-age reference, developed in 1991(Must et al 1991), only started at 9 years of age,
- Grouped data annually and
- Covered a limited percentile range.

Many countries pointed to the need to have body mass index (BMI) curves that start at 5 years and permit unrestricted calculation of percentile and *z*-score curves on a continuous age scale from 5 to 19 years. The need to harmonize growth assessment tools conceptually and pragmatically prompted an expert group meeting in January 2006 to evaluate the feasibility of developing a single international growth reference for school aged children and adolescents (Butte et al 2007, Butte et al 2006). The experts agreed that appropriate growth references for these age groups should be developed for clinical and public health applications. They also agreed that a multicentre study, similar to the one that led to the development of the WHO Child Growth Standards for 0 to 5 years, would not be feasible for older children, as it would not be possible to control the dynamics of their environment. Therefore, as an alternative, the experts suggested that a growth reference be constructed for this age group using existing historical data and discussed the criteria for selecting the data sets.

However, now studies are being conducted to compare the various growth standards for their use. Pascal et al, in 2011 compared the two international growth references indicating the prevalence of thinness (BMI for age) in children and adolescents in the Seychells, Africa. The two international references were International survey cut offs (IS cut offs) developed by Cole et al in 2000 for children aged 6 to 18 years and WHO 2007 growth references for 5-19 years children. The prevalence of the first thinness (low BMI for age) category was higher with the WHO cut-offs than with the IS cut-offs. Further more studies have compared the prevalence of thinness (BMI for age) categories in school-aged children based on the IS and the WHO cut-offs (Baya et al 2010, Khasnutdinova and Grjibovski 2010, Gomes et al 2009, Silva et al 2008,). Studies in Russia (Khasnutdinova and Grjibovski 2010) and Brazil (Gomes et al 2009, Silva et al 2008), indicate the prevalence of thinness (low BMI for age) higher when

assessed with the WHO 2007 growth references than with the lS cut-offs, while the opposite was found in Bolivia (Baya et al 2010). Hence, there is a need for studies assessing the performance of the IS and WHO 2007 cut-offs of thinness (low BMI for age) in different populations.

For Asian population, health experts have suggested a lower BMI scale because of evidence showing higher susceptibility of Asians to the risk of obesity related disease such as high blood pressure, abnormal cholesterol and development of diabetes risk if their BMI is >23 kg/mt^2**.** As the global standard for measuring over weight and obesity is based on western criterion the BMI cut off needs to be adjusted for Asians (James 2004).

Therefore, the need was felt to establish normal reference for BMI for diagnostic purpose of obesity and thinness for Indian children. Ethnic group specific standards are more appropriate for comparing health compromised children especially in country like India where the problem is more pronounced for under nutrition than over nutrition. There were no standards available for BMI percentiles for Indian affluent children on an accepTable number of children. So the data on affluent school children (5-18 years) of 23 public schools from 12 different cities in India was assessed and percentiles for BMI, height, weight and SFT were calculated in relation to age and sexual maturity also (Agarwal et al 2003).

Recently, **Stigler et al (2011)** compared the three growth references, i.e., IOTF reference, new WHO 2007 reference and national reference (Agarwal standards). The study reported that the IOTF reference consistently classified participants in a lower weight status category, compared with the national reference (k=0.57) and the WHO reference (kappas index =0.69). The agreement between the WHO and the national references was higher (kappas index =0.84).

However, to date, all published studies of childhood obesity in India have used the IOTF reference, the national reference (Aggarwal et al 2003), or an old WHO reference to measure weight status among school-going youth. The new WHO reference may be a better choice, compared to the IOTF reference, WHO references (2007) does not appear to underestimate obesity and can still be used to compare trends, globally.

Prevalence of overweight and obesity among middle to high socio economic status (MHSES) adolescents

Worldwide

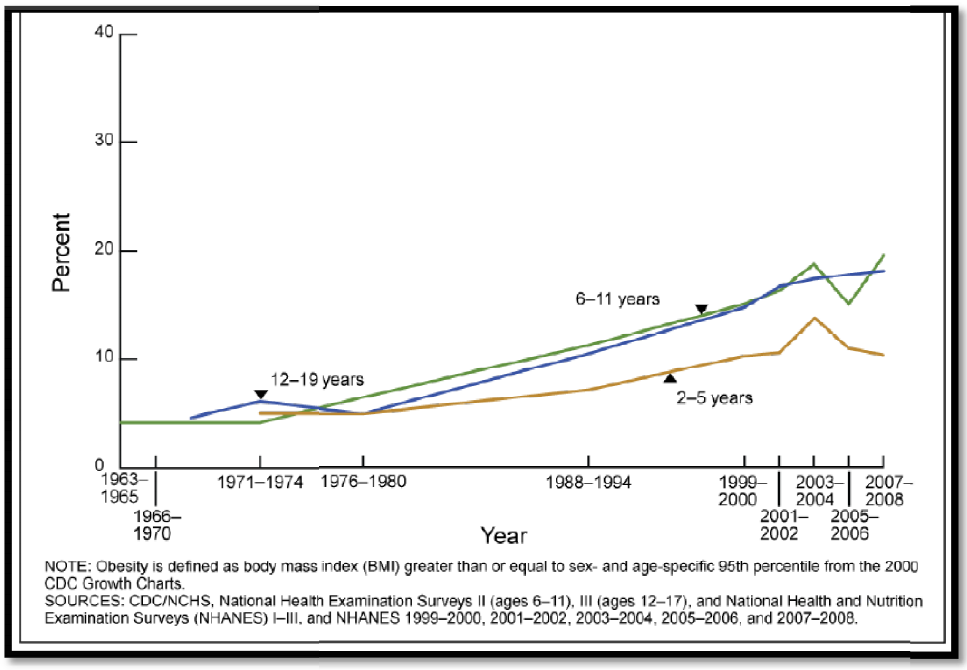
Childhood and adolescent obesity is growing at an alarming rate presenting it as a serious public health concern and is further forecasted to increase dramatically in most parts of the world giving no reprieve (Wang and Lobstein 2006). In several industrialized countries and in societies that have been undergoing rapid socioeconomic transitions, obesity has increased at an accelerated rate.

The results from 1963-2008 National Health and Nutrition Examination Survey (NHANES), showed the increase in obesity that occurred from 1976–1980 (Figure 2.2). Among adolescents aged 12–19, obesity increased from 5.0% to 18.1% during the same period (NHANES 2007-2008) indicating a continuous increase in the obesity trends in all age groups. According to Ogden and Caroll in 2010, the obesity trend was also observed to be high in boys than girls (16.7% non Hispanic white boys vs 14.5% non Hispanic white girls; 26.8% Mexican American boys vs 17.4% Mexican American girls).

A five year longitudinal cohort study of a socioeconomically and ethnically diverse sample of school students aged 11-12 years from 36 schools of London showed, the prevalence of overweight and obesity (combined) to be almost 25%, with higher rates in girls at 29% using IOTF standards (Wardle et al 2006).

Figure 2.2: Trends in Obesity among children and adolescents:

United States, 1963-2008



Bergen Growth Study from European region (Norway), was conducted on children and adolescents aged 2-19 years to assess the prevalence of over weight and obesity (according to IOTF standards). The secondary data from a national health survey was assessed, which depicted 13.8 % of children and adolescents (2-19 years) being overweight (including obesity) and 2.3% being obese alone. Among the adolescent age groups the prevalence of overweight (including obesity) was 17.0 (6-11 years) and 11.7% (12-19 years),Obesity per se was present in 3.6% (6-11 years) and 1.6% (12-19 years). (Julisson et al 2010)

The prevalence of overweight and obesity is now not only the problem of the developed countries, but, it is also affecting the children and adolescents from the developing countries as shown in African regions, which undergoing nutritional transition, and urbanization. From 2002 to 2006 (the overweight increased from 12.6% to 31.9% and obesity from 3.8% to 8.1% for the respective years among adolescents using IOTF standards (Armstrong et al 2006, Stettler 2002,)

Another study, conducted in Egypt, among adolescents (10-18 years) using CDC 2000 growth charts also depicted high prevalence of overweight (including obesity) at 19% (Ella et al 2011).

Some studies also depict the fluctuating trends of overweight and obesity with gender, like in South Africa, 25 % of girls (13-19 years) were found to be overweight (obesity inclusive) by IOTF criteria though for boys the reported prevalence was lower at 7% (Lobstein et al 2004). However in 2008, males were found to be more over weight (8.1% vs 1.3-8.1%) and obese (0-2.7% vs 0-1.9%) than females using IOTF standards. (Akinpelu 2008)

Coming to the Asia, consisting of all the developing countries undergoing nutritional transition, urbanization and globalization, many studies showed the rising prevalence of over weight and obesity in adolescents. A study in 2005 conducted in one of the Arabian countries (Yemen), on school going children (10-15 years) showed the prevalence of over weight as 6.2% and 1.8% obesity, using IOTF standards (Raja'a and Bin Mohanna 2005). Similar study from Iraq, on adolescents (6-12 years) showed nearly same prevalence of over weight (6.0%) and obesity (1.3%). A recent review study from Arab regions, on school children (6–18 years) reported the prevalence of overweight and obesity (IOTF standards) in the range of 18%–46.9%, among boys and ranged from 17.6% to 46.9% among girls (Musaiger 2011). However, later most evidence from several studies indicated that obesity has become a major public health issue in Arab countries although it varies widely from one Arab country to the other (Musaiger 2011).

Southern Asia also shows the presence of overweight and obesity among adolescents. All the studies conducted in Iran, used CDC 2000 Growth Standards to identify over weight and obese adolescents. In Iran, Mostafavi in 2005 and Gargari in 2004 conducted study on adolescents in different regions. The results demonstrated similar prevalence of over weight (11.3-11.6%) and obesity (2.9- 3.6%). Again in 2006, in Tehran, very high percentage of over weight (21.1%) and obesity (7.8%) in adolescents (7-18 years) were reported (Moayeri 2006). A study in 2009, conducted in Birjand, reported the low prevalence of overweight (4.8%) and obesity (1.8%) among adolescents (7-18 years). Females (5.8%) were reported to be more over weight than males (3.7), however reverse was in obesity, males (2.1%) being more obese than

females (1.5%). The reason for low prevalence in Birjand (Iran) was unknown (Taheri 2009).

Another study conducted in Pakistan, among children and adolescents aged 6-17 years, showed high prevalence of over weight (19.0%) and obesity (6.0%). The standard growth reference used was CDC 2000 Growth standards (Aziz 2009). The above trends in various parts of Asia, demonstrates clearly, the rising trend of over weight and obesity among the adolescents and the need to initiate preventive measures at population level.

In India

In Indian society chubbiness is perceived as sign of affluence and good health. Traditionally, in India, a chubby child is regarded as healthy and well nurtured, accomplished to face the brunt of life. However, as we urbanize more and more into this new millennium, obesity especially, childhood obesity presents a grave threat to the health (Bhave et al, 2004)

In various studies conducted in different cities of India, lack of agreement on use of any one particular reference standards to classify obesity in adolescents has resulted in dearth of good nationally representative data and further inconsistencies between the studies of classification of obesity make it difficult to compare the data from the studies.

Srihari et al (2007), nevertheless, reviewed the available literature on nutritional status of Indian school children (6-18 years) from middle and high socio economic status (MHSES) and reported the trends in obesity and overweight as shown in Table (2.2).The review studies, using various growth references, shows a higher prevalence of overweight in the northern part of the country ranging from 10.9-29 %.

From the eastern region, only two studies were reported, indicating very low prevalence of over weight and obesity among adolescents. Bisai et al (2010), reported 5.69% of over weight and 0.79% of obese adolescents (10 – 12 years) in Midnapur town from West Bengal belonging to low middle to high income groups, with girls (7.20%) being more over weight than boys (4.22%). Another study was carried out on adolescents from class VIII to XII), belonging to capital city of Manipur. The

prevalence of over weight among these adolescents was 4.2% and obesity was 0.8%. In both the studies, IOTF standards were used to define adolescent's nutritional status.

Table 2.2: Prevalence of overweight and obesity among children aged 6-18 years from middle to high socio economic status (MHSES) groups

Region, [Year of data collection]	Age in years	Overweight (%)			Obesity (%)		
		Total	Boys	Girls	Total	Boys	Girls
Northern India							
Delhi, N=5000 , [2000]	4-18	29.0	–	–	6.0	–	–
Delhi, N=3861, [2001]	10-16	24.7	23.1	27.7	7.4	8.3	5.5
Punjab, [1999]	9-15	14.2	15.7	12.9	–	–	–
Punjab, N=640 [2000-2001]	10-15	10.9	9.9	12.0	5.6	5.0	6.3
Western India							
Baroda, N=5329 [2001-2004]	12-18	8.5	8.0	9.0	1.5	1.4	1.7
Pune, N=1228 [2003]	10-15	19.9	19.9	–	5.7	5.7	–
Southern India							
Chennai	10-15						
[1981, N=707]		9.62	–	–	5.94	–	–
[1998, N=610]		9.67	–	–	6.23	–	–
Chennai, N=4700 [July-Nov 2000]	13-18	–	17.8	15.8	–	3.6	2.9

Source: Srihari et al, Indian Paediatrics, 2007

In 2006, a study conducted in a western state of Rajasthan (Udaipur), which included 268 affluent children (12-17 years). The study reported over weight and obesity as only 4.8% and 3.7% respectively by IOTF standards (Kaneria et al 2006). Looking, into the present rise of childhood obesity in other parts of India, more studies need to be under taken, to study the current scenario in the state of Rajasthan.

A multi centric study from Maharashtra (Pune) in 2010, indicated a high prevalence of over weight and obesity among children and adolescents (2-17 years). The study was conducted in eleven affluent urban schools, from five geographical zones (central

zone, east zone, north zone, south zone, and west zone) of India. Over weight and obesity was reported as 18.2% according to IOTF standards, which increased to 23.9% after applying WHO 2007 growth standards. The prevalence of overweight and obesity was higher in boys than girls. Hence, suggesting the use of WHO 2007 Growth Standards here after. (Khadilkar et al 2010)

Coming to Gujarat region, the capital city (Ahmadabad) also projected the high prevalence of over weight and obesity among adolescents (12-18 years) in different SES (middle to high). The BMI of each child was determined and adjusted for expected BMI at age 18 (Goyal et al 2010).The prevalence of overweight among children was 65% from middle SES compared to 33.2% in high SES group. While a reverse trend was observed regarding the obesity prevalence, more (70.0%) children from high SES being obese than middle SES (30.0). The gender difference also showed different pattern. The boys belonging from middle SES were more over weight than girls (67.4 vs 60.8%), while in high SES, girls were more over weight than boys (38.0% vs 30.6%).

Another study from Gujarat, also indicates the high prevalence of overweight and obesity. The study was conducted in Vadodara city on 6-12 years school going children. the schools selected for the study represented middle to high income group. According to IOTF standards, the total prevalence of over weight and obesity was 20.3% (over weight: 14.4%, obesity: 5.9%). No sex difference was observed. More girls were over weight (15.2% vs 13.7%) while more boys (6.8% vs 4.9%) were obese. (Iyer et al 2011).

Hence, it can be concluded that irrespective of the SES and gender, the prevalence of overweight and obesity are on the increasing trend.

Moving on to northern region, the prevalence of over weight and obesity in adolescents belonging to middle to high SES also existed in this region. A study involving affluent families of Amritsar district of Punjab, showed the prevalence of over weight and obesity as 9.9% and 4.95 % respectively among boys (10–15 years) as compared to 11.9% of overweight and 6.31 % obese in girls, by applying CDC 2000 Growth standards (Sidhu et al 2005) Another study in Patiala district of Punjab, involved five private schools and total of 1250 school children in the age group of 6-

15 years. According to IOTF standards, 7.6% of the children were found to be obese, indicating a rise in the prevalence of obesity. The data also reported that more than half of the females were obese than males (64.2% vs 35.8%). Both the studies, carried out in Punjab state, indicated that girls are more at risk of NCDs than boys (Marwah et al 2012).

A review study, conducted in 2008 in Delhi region, on childhood obesity, reported an increase overweight/obesity prevalence in urban children in Delhi from 16% in 2002 to about 24% in 2006. Also, the prevalence among adolescent children (14-17 y) was 29% belonging to private schools (Bharadwaj et al 2008)

Another study conducted during the same (2008) year in Delhi, shows the prevalence of over weight and obesity in middle to high SES (Kaur et al 2008). The study involved children in the age group of 5-18 years, belonging to different SES (low, middle and high). The prevalence of over weight and obesity was lower in middle SES (6.5% and 0.6% respectively) than high SES (15.3 and 6.8 respectively).

The southern region is also affected by the rising trend of child hood obesity. A study conducted in Karnataka state (Davangere), on adolescence from middle to high SES, reported the prevalence of obesity (IOTF standards) as 5.7%, in subjects studying between 5th and 10th standard. Prevalence of obesity was reported, to be more in girls (8.82%) than boys (4.42%) as reported by Kumar et al in 2005. Similarly, two studies from Tamil Nadu (Chennai), reported the prevalence of overweight and obesity amongst girls, ranging from 9.6 % - 15.8 % and 2.9 % to approximately 6% respectively. For boys, overweight was reported to be 17.8 % and obesity 3.6 %, indicating boys being more over weight and girls being more obese (Srihari et al 2007).

Another state from southern region, Andhra Pradesh, reports the prevalence of over weight among the urban adolescents (12-17 years). According to IOTF standards, the prevalence of over weight was 7.2%, with girls (8.2%) being more over weight than boys (6.1%). The adolescents belonging to private schools were significantly more over weight (9.6%) than government schools (Balakrishna 2007).

The difference in prevalence of over nutrition among different SES, could again be observed from a study in Kochi, Kerala (Cherian et al 2012). The study was

conducted on school going children (6-15 years) from different SES (upper, middle and lower class). The authors applied CDC 2000 Growth standards to screen over weight and obese subjects. The data revealed that, over all obesity and over weight prevalence among girls (5.3% vs 12.1% respectively) was more than boys (3.0% vs 10.2% respectively). Looking into the SES category also, in upper income groups (UIG) females were more obese (10% vs 5%) and overweight (28% vs 16%) than boys. While in the middle income group (MIG), obesity was present in similar percent of girls and boys (4% vs 3%), with more boys (12%) being overweight than girls (5%).

After reviewing the above studies, it s clear that over weight and obesity is increasing among the adolescents and if the preventive measure are not taken at the right time, the prevalence will be on a continuous rise with far reaching health consequences for the future generation.

2.2.1c Co existence of under nutrition and over nutrition among middle to high socio economic status (MHSES) adolescents

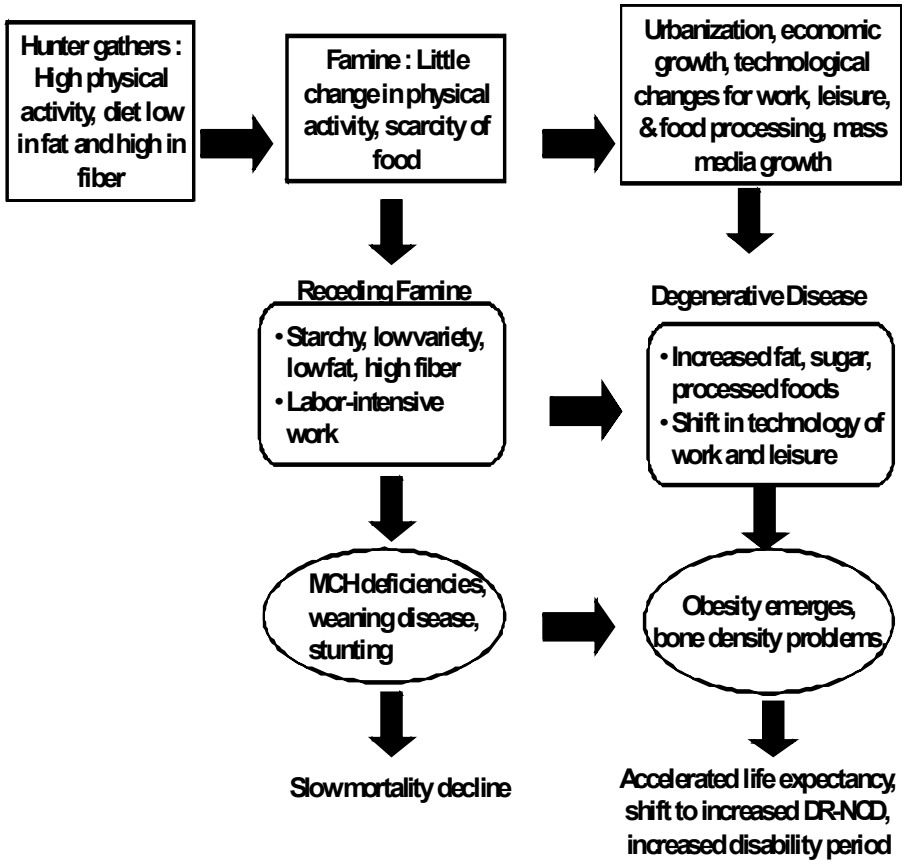
Nutrition during adolescence plays an important role in the individual's life. Malnutrition in adolescence encompasses under nutrition as well as over nutrition (Butte et al 2007). Under nutrition implies being underweight (low weight for one's age), stunting (too short for one's age), or deficient in vitamins and minerals (Opara et al 2010). Long-term under nutrition is an important cause of stunting or short height-for-age (Coly 2006).

The emerging health crises due to the coalescing of the health effects of under nutrition and over nutrition in the same countries, communities and even households, has been termed the double burden of malnutrition (Thiam et al 2006).

This phenomenon has been attributed to the polarized model of epidemiological nutrition transition (Figure 2.3) from stage 1 to stage 2, creating an obesogenic environment (Kennedy et al 2007, Uauy and Solomons 2006). To stem this current and projected epidemic of morbidities and premature mortalities due to diet-related chronic disease, there has been a call for the protection of foetal and childhood growth, which is central to the prevention of both under and over nutrition (Opara et al 2010, Barker 2004, Barker et al 2005, Ene-Obong 2001). There is a call for the surveillance of trends of the major risk factors for the double burden of mal-nutrition

such as stunting, underweight, obesity, dietary patterns etc (Opara et al 2010, Shumei et al 2002).

Figure 2.3: Stages of nutrition transition



Nutrition research in India has focused primarily on the problem of under nutrition, particularly among vulnerable women and children. There is ample evidence of an emerging nutrition transition in India. The rising urbanization and improvements in economic development has lead to concurrent under and over nutrition in the population. The nutrition transition is closely related to the demographic and epidemiological transition. Large shifts have occurred in diet and in physical activity patterns, particularly in the last decades. (Iyer et al. 2011)

Worldwide

Very few studies have been conducted in the developing countries, to study the prevalence of coexistence of over nutrition and under nutrition among adolescents from middle to high income groups or developing countries that are under going nutritional transition. A study in Europe, was undertaken in Turkish adolescents (14-18 years) from both public and private schools to study the double burden of malnutrition. For the screening of under nourished children NCHS standards were used and for over weight and obesity, > 85th percentile (CDC 2000 Growth standards) were used. Results revealed the coexistence of under nutrition (4.4% stunted and 5.0% under weight) and over nutrition (16.8% overweight and obese). Although frequency of being underweight in adolescents of low SES was higher than in adolescents of other SES groups, the difference was not significant. Frequency of being overweight and obese in adolescents of middle SES was higher compared to that in adolescents belonging to other socioeconomic groups, but the difference was not significant. Same percentage of males and females had stunting, while more boys were under weight than girls. Regarding over weight and obesity, it was present more in girls than in boys.(Özgüven et al 2010)

Another study conducted in African country (Nigeria), showed the coexistence of over nutrition and under nutrition. the study was carried out on children (2.5 – 14 years). The standards used to define to Stunting, was <-2SD of the WHO 2003 reference standard height for age and sex (Z-score). Underweight: was defined as <-2SD of WHO 2003 reference BMI for age and sex (Z-score). Obesity: was defined as >+2SD of BMI for age and sex (Z-score). The prevalence of underweight in the private schools was 27.3%, being higher in girls (15.6%) than boys (11.7%). The prevalence of stunting, in private schools, was 17.6% with more percent of stunted boys than girls (9.7% vs 7.9%). The prevalence of obesity according to Opara et al (2010), in private schools was 11.1% with girls being more likely to be obese (6.9%) than boys (4.2%).

The double burden of malnutrition is also evident in the Asian region. A study conducted in Eastern Asia (China), was based on adolescents aged 11-16 years from the urban region (Tang et al 2007). The cut off standards used for overweight and obesity were IOTF and for under weight, NCHS/CDC growth charts (< 5th percentile).

The prevalence of overweight, obesity and underweight was 4.9%, 0.6%, and 13.1% respectively. Over weight and obesity prevalence was more in boys (5.8% and 0.9% respectively) than in girls (4.1% and 0.3% respectively). The prevalence of under weight was significantly higher in boys (16.0%) than girls (10.3%).

Similarly, a study conducted in western Asia (Arabian country: Qatar) on adolescents (10-17 years) from urban and semi urban districts of Qatar (Raja'a and Bin Mohanna 2005). The cut off standards used for overweight and obesity were IOTF and for under weight, NCHS/CDC growth charts (< 5^{th} percentile). The results demonstrated that the prevalence of overweight, obesity and underweight was high in boys (28.6%, 7.9% and 8.6% respectively) than girls (18.9%, 4.7% and 5.8% respectively).

The coexistence of over nutrition and under nutrition is also present in few regions of Southern Asia. The developing country, like Iran showed the prevalence of over weight, obesity and underweight was 8.6%, 1.5% and 16.2 % respectively. The study was conducted on adolescents (14-18 years).

In India

In the Indian context also, the coexistence of over nutrition and under nutrition is prevalent, although very few studies have been conducted to estimate the double burden of malnutrition together in the same population. A review study by Srihari (2007), on affluent school going children (6-18 years), revealed the double burden in this group also. Overweight and obesity were defined according to IOTF standards and under weight by NCHS standards. The results revealed the presence of 8.5-29% and 1.5-7.4% of subjects being over weight and obese respectively. Prevalence of under nutrition was also present in 10-13 % of the subjects belonging to the same SES. (Srihari 2007).

Another review study, conducted for children from 10-19 years also demonstrated the same trend. Over weight and under weight were defined using two criterias: national (Agarwal cut offs) and international (Cole standards). The proportion of overweight children was highest in the highly urban category (19.1% and 13.4% as per Indian and international criteria, respectively). Overall, 9.9% of boys and 7.9% of girls were overweight by either criteria. While in the urban and highly urban areas, the prevalence of under weight was 14.1% and 9.8%, respectively, according to Indian

criteria and 27.1% and 19.2%, respectively, according to international criteria. (Jeemon et al 2009)

Coming to Gujarat state, a study conducted in private school, on children from class 7th, also revealed coexistence of double burden in the study subjects. In this study, the nutritional status of the study subjects were classified according to the national standards (Agarwal standards). Hence, the results revealed, 9.2% and 5.5% of the subjects being overweight and obese respectively. The girls were more over weight than boys (13.3% vs 4.1%) while boys were more obese than girls (8.3% vs 3.3%). The results also revealed, 70.3% of the subjects being underweight with no gender difference. (Shah et al 2008)

Another study (Iyer et al 2010) from Gujarat (Vadodara), was conducted on adolescents (12-16 years) and the cut offs for overweight and obesity used were CDC 2000 growth standards and Must et al, while for under weight, 5th percentile values for BMI of Must et al (1991), Agarwal standards and CDC standards were applied. Using CDC standards 11.59 % boys and 7.84 % girls were found to be overweight, where as 2.89 % and 3.92% of boys and girls were found to be obese. The prevalence of underweight as defined by three classifications, namely, Must et al, CDC and Agarwal was found to be more in boys (30.4, 30.4, and 8.6% respectively) than in girls (11.7, 5.8, and 33.9% respectively).

Thus it can be concluded that in all the regions of the world as well as in India, double burden of malnutrition coexists, and nutritional assessment for adolescents should take into consideration the indices of both overweight including obesity and under weight.

Hypertension

Hypertension, in adults is a known risk factor for coronary artery disease (CAD), while the presence of childhood hypertension contributes to the early development of CAD. It is known as a "silent killer" which goes undetected during childhood unless it is specifically looked for **(Kaur et al 2013, Sundar et al 2013)**. Therefore, early detection of hypertension along with its precipitating or aggravating factors are

important if one is to evolve measures so that complications of hypertension can be prevented.

The cut offs used for classifying high blood pressure in children and adolescents are used recommended in "The Fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents". BP standards based on sex, age, and height provide a precise classification of BP according to body size. The revised BP Tables now include the 50th, 90th, 95th, and 99th percentiles (with standard deviations) by sex, age, and height **(NIH 2005)**.

The classifications are:

Normal BP: is defined as SBP and DBP that is less than the 90th percentile for sex, age, and height.

Prehypertension: is defined as average SBP or DBP levels that are greater than or equal to the 90th percentile, but less than the 95th percentile.

Hypertension: is defined as average SBP or DBP that is greater than or equal to the 95th percentile for sex, age, and height on at least three separate occasions. In all the studies mentioned below, the above mentioned classification for high blood pressure in children and adolescents have been used.

Hypertensive children tend to have other medical problems also, such as obesity, high blood lipids and/or diabetes mellitus. Risk factors like smoking, physical inactivity, obesity and improper diet are well recognized. Cardiovascular diseases, particularly hypertension, account for high mortality in the form of cardiovascular strokes in countries like India, Taiwan and Japan **(Khor 2008)**. Studies from Boston and Pennsylvania had reported that the role of hypertension as a risk factor is defined and familial aggregation of blood pressure and tracking phenomenon support the concept that children with hypertension are likely to be hypertensive adults and will be at risk for early Coronary heart disease **(Soudarssanane et al 2008)**.

Though the above mentioned literature recommends that children and adolescents should be screened for hypertension in early years of life, to prevent cardiovascular events and death in adulthood, U.S. Preventive Services Task Force (USPSTF),

highlights the need to have more evidence to balance the benefits and harms of screening for primary hypertension (stage I) in asymptomatic children and adolescents **(Moyer 2013)**.

2.5.2a Prevalence of hypertension

Worldwide

The prevalence of hypertension in children and adolescents in the United States has been reported at 1% to 5%. However, in obese children, it is estimated to be 11% **(Moyer 2013)**. While in Brazil, hypertension among children and adolescents aged 2-18 years, was classified using Brazilian Guidelines of Blood Hypertension. The prevalence was found to be 70.5% **(Noronha et al 2012)**.

In Europe, also high prevalence of pre hypertension (22.9%) and hypertension (24.1%) among the children and adolescents aged 5-12 years, was reported. The classification used was referred from NIH 2005 (Kollias et al 2011).

Moving to Asian region, no studies could be retrieved which have reported the prevalence of pre hypertension or hypertension in adolescents, while only one study in Malaysia reported pre hypertension (12.23%) and hypertension (13.4%) among primary school children. The reference used to classify hypertensive subjects was 4th report on diagnosis of hypertension in children and adolescents from NIH 2005 (Chandrashekhar et al 2013).

In India

In India, though very few studies have been conducted to map the prevalence of pre hypertension and hypertension among children and adolescents, they show emerging trends of hypertension.

A study from eastern region, West Bengal (Kolkata), reported 2.9% hypertension among the adolescents aged 10-19 years, using WHO 1996 hypertension classification (Saha et al 2008).

WHO criteria for hypertension for 10–18 years age group had been adapted from Task Force on Blood Pressure Control in Children which was generated from mean systolic/ diastolic blood pressure equal to or greater than 95th percentile for age. For

persons aged 18 years and above, hypertension is defined as systolic blood pressure of ≥140mmHg or a level of diastolic blood pressure of ≥90mmHg.

From the western region, a study from Rajasthan (Udaipur) was conducted to assess the prevalence of hypertension among all the adolescents of various categories of age groups (9-10, 10-11 and 11-12 years). The study reported high prevalence of hypertension in 10-11 years (36.6%) and 11-12 years (41.1%) than 9-10 years (30.0%). The hypertension values were measured and compared with Ghai 2002 (Mogra and Kaur 2012).

Another study from Gujarat (Anand), reported 10.8% prehypertension and 9.2% hypertension in children and adolescents aged 5-18 years. However, in girls, overall prevalence of prehypertension and hypertension was found to be more (10.31%) than boys (9.63%). The classification used for identifying hypertension was IVth report on diagnosis for children and adolescents (Verma and Singh 2012, NIH 2005).

From the northern region, only two studies could be retrieved which showed the prevalence of hypertension among children and adolescents in this region. A study from Punjab (Amritsar) reported the prevalence of hypertension to be 7.5%, among children and adolescents aged 6-14 years. The children, whose blood pressure levels exceeded 95th percentile (for age and sex) of the Report of the Second Task Force (1987), were considered as hypertensive (Prabhjot 2005, JNC VII 2003).

Another recent study, in Delhi assessed the prevalence of hypertension according to the socio economic status of the children aged 5- 16 years, with the help of The Fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents" **(NIH 2005)**. The results revealed that the prevalence of high Systolic Blood Pressure (SBP) in low income group (LIG) and middle income group (MIG) was 3.8% and 4.4%, respectively. While Diastolic Blood Pressure (DBP) was 2.6% and 4.1% in LIG and MIG respectively (Kaur et al 2013).

The prevalence of hypertension among the children and adolescents was also observed in southern region of India, in a study conducted on adolescents aged 13-17 years. The study reported the high prevalence of hypertension than any other regions of India, i.e., 21.5% indicating an emerging epidemic among this age group (Sundar et al 2013).

Hypertension in children and adolescents are well correlated with high BMI, central obesity and family history (Prabhjot 2005, Kaur et al 2013, Sundar et al 2013, Kollias et al 2011, Chandrashekhar et al 2013, Saha et al 2008, Verma and Singh 2012, NIH 2005, Sundar et al 2013).

Thus, the above studies show that hypertension during childhood and adolescents is rising and there is a need to take various steps to reduce or curtail this rising trend.

Poor dietary habits (low intake of fruits and veg, skipping breakfast, high carbonated bev, high snacks)

Nutrition is a major modifiable determinant of chronic non-communicable diseases, with scientific evidence supporting the view that alterations in diet and activity have effects on health throughout life. Non-communicable diseases are linked to high consumption of energy dense foods, made of animal origin and of foods processed or prepared with added fat, sugar and salt (Bourne et al 2002, Jaisheeba et al 2012, Kumari and Krishna 2011, Rema and Vasanthamani 2011).

Low fruits and vegetable Intake

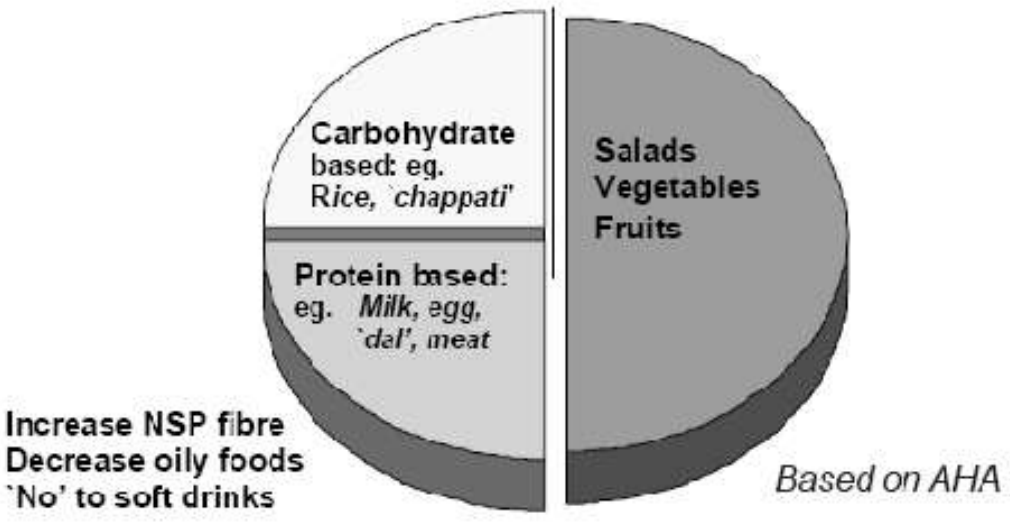
A diet high in fruits and vegetables is considered to be panacea for a number of health risks given its high antioxidant and rich mineral content. Fruits and vegetables are high in fibre and water content hence promotes satiety and decrease total energy intake by displacing energy-dense foods (Krebs et al, 2007). Consuming a diet high in these is hence associated with lower risks for numerous chronic diseases, including cancer and cardiovascular diseases.

Nevertheless, recognizing the plethora of scientific evidence on the relationship of low fruit and vegetable intake and development of non-communicable diseases, joint WHO/FAO report recommends 400g of fruit and vegetables intake per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases and alleviation of several micronutrient deficiencies, especially in less developed countries (WHO 2004).

Indian Academy of Paediatrics (IAP) on the other hand gives a simple "Indianised" message (Figure 2.4) based on recommendations of American Heart Association as a

'Thali' wherein 50% (half) should be full of vegetables, salads and fruits (Bhave et al, 2004).

Figure 2.4: Recommended constituents of day's food intake



Source: IAP National Task Force for Childhood Prevention of Adult Diseases: Childhood Obesity, Bhave et al, IAP recommendations, 2004

However, low fruits and vegetables have been associated with high BMI values, no consumption of milk and milk products and regular consumption of junk food (high calorie intake) outside home and high intake of carbonated beverages (Mandal and Mandal 2012, Thakre et al 2011, Goyal et al 2010, Bansal et al 2013).

Fast foods intake / sweetened carbonated beverages consumption / breakfast skipping

Backed by strong and attractive advertising, the advent of western fast food joints has had a bearing on the eating habits and preferences of the adolescent populations in the developing world. With a spread of health awareness in the developed countries, fast food stores have now moved towards the developing world and so have reported a rapid growth in these countries. Increase in the availability and promotion of energy dense foods in the developing world has lead to the development of unhealthy dietary behaviours by affecting and modifying the preferences in children and adolescents

(Hasting et al 2006). Food messages at fast food outlets also promote and encourage eating away from home (Lobstein et al, 2006). For example, fast food stores like McDonald's offer collecTable models, toys, puzzles and child attractive food packages (happy meal) designed specifically to influence the child's choice. Market research in Russia in 2005 showed children aged five years, were rapidly adapting to 'western' foods as 81% reported to be regularly eating potato chips, 66% regularly consumed carbonated drinks whereas 78% and 70% reported regular chocolate and chewing gum consumption (Russian legislative overhaul, 2005).

In a study assessing the relationship between eating food purchased away from home and longitudinal change in body mass index (BMI), z-score among girls (8-12 year), found that the frequency of eating quick-service food at baseline was positively associated with change in BMI z-score and participants who ate quick-service food twice a week or more at baseline had the greatest mean increase in BMI z-score compared to those who ate quick-service food once a week or not at all (Thompson et al, 2004).

Further, Taveras et al (2005), in a study, examined the cross-sectional and longitudinal associations between consumption of fried foods away from home (FFA) and BMI which revealed that at baseline, frequency of eating FFA was associated with greater intakes of total energy, sugar-sweetened beverages, and trans fat, as well as lower consumption of low-fat dairy foods and fruits and vegetables. The longitudinal results revealed that increasing (over 1 year) consumption of FFA "never or <1/week" to "4 to 7/week" was associated with increasing BMI compared with those with low consumption of FFA at baseline and 1 year later. The study hence, suggested that increasing consumption of FFA over time may lead to excess weight gain.

Huge portion sized and high in calories from simple sugars and fat, fast food snacks/drinks increase the total energy intake and promote increased conservation and accumulation of fat ensuing from postprandial carbohydrate oxidation thus altering fuel partitioning which increases the risk of overweight and obesity (Kaur et al 2008, Goyal et al 2010, Bansal et al 2013). Similarly in a study from urban Vadodara, Gandhi (2004) found that the higher percentage of overweight and obese children

consumed $\geq$ 30% calories from fat hence showing the role of a high fat diet in development of overweight and obesity.

The relationship of carbonated drinks per se, with BMI is still unclear. Although several studies show an association between sweetened beverage consumption and risk of obesity (Ludwig et al 2001), few indicated a weak or negative relationship (Krebs et al 2007). Dubois et al (2007), in a study conducted on 2,103 preschool children in Canada, concluded that regular (more than 3 days per week) sugar-sweetened beverage (carbonated and fruit drink) consumption between meals may put young children at a greater risk for overweight where as, Forshee and Storey (2003) found no association between consumption of carbonated beverages and BMI in American children and adolescents (6-19 years). No data is available on this association in India and so this area needs further research to establish these findings in an Indian setting.

Though no linear relationship between sweetened-beverage consumption and BMI has been established Rajeshwari et al (2005) in Bogalusa Heart study found that children with increased sweetened beverage intake compromised on their recommended milk consumption nevertheless accounting for unhealthy behaviours.

Thus, IAP National Task Force for Childhood Prevention of Adult Diseases (2004), contemplates that a shift from a traditionally micronutrient rich diet to energy dense highly processed, micronutrient poor foods with greatly increased portions and high calorie snacks coupled with junk food and cola revolution may be one of the main contributors to the increasing prevalence of overweight in Indian children and adolescents leading to grave consequences (Bhave et al 2004, Bansal et al 2013, Goyal et al 2010, Thakre et al 2011).

Breakfast is considered the most important meal of the day (Adolphus et al 2013). Children who consume breakfast regularly, are more likely to have adequate nutrient intakes including higher intake of dietary fiber, total carbohydrate and lower total fat and cholesterol levels (Deshmukh-Taskar et al 2010). Breakfast also contributes to the daily micronutrient intake (Balvin Frantzen et al 2013). Iron, B vitamins (folate, thiamine, riboflavin, niacin, vitamin B_6, and vitamin B_{12}) and Vitamin D are approximately 20–60% higher in children who regularly eat breakfast compared with

breakfast skippers (Gibson 2003). It also helps in maintaining normal body mass index (BMI). Two systematic reviews report that children and adolescents who regularly consume breakfast have reduced likelihood of being overweight (Szajewska and Ruszczynski 2010, de la Hunty et al 2013).

Breakfast consumption is also associated with other healthy lifestyle factors. Children and adolescents who do not consume breakfast are more likely to be less physically active and have a lower cardio respiratory fitness level (Sandercock et al 2010). Moreover, breakfast positively affects learning in children in terms of behavior, cognitive, and school performance (Hoyland et al 2009). Also, a few studies indicate that breakfast skipping could be part of a constellation of other unhealthy dietary behaviours that compound the many deleterious effects of obesity on health (Keski-Rahkonen et al 2003, Cho et al 2003, Wilsgaard et al 2005).

However, in India, no studies have been conducted to look into the beneficial or harmful effects of breakfast consumption on nutritional status (BMI), or other lifestyle behaviors (physical inactivity or on screen time).

Physical Inactivity

Physical activity (PA) is any activity that increases one's heart rate and makes one get out of breath for some of the time. Physical activity can be done in sports, playing with friends, exercising or walking to school. Some examples of physical activity are running, fast walking, biking, dancing, or football.

Therefore, the recommended levels of PA for children and adolescents by American dietary guidelines (2005) are, at least 60 minutes of moderate intensity physical activity most days of the week, preferably daily. IAP, on the other hand recommends least 30 minutes of cumulative moderate exercise (equivalent to walking briskly) plus an additional 20 minutes of vigorous exercise (equivalent to running), three times a week similar to the WHO (2010) physical activity guidelines.

Physical activity has an important role in maintaining health and fitness. As Centre of Disease Control (CDC) reiterates, regular physical activity reduces people's risk for various chronic degenerative diseases (heart attack, colon cancer, diabetes, and high blood pressure). It may also help to reduce the risk of obesity and overweight.

Both organized and unorganized sport and physical activity were reported to have a positive effect in reducing the risk of overweight (10–24% reduced risk) as well as obesity (23–43% reduced risk) by Tremblay and Willams (2003) in their study on 7,216 Canadian children (7-11 years). Given its important role, lack of physical activity has been reported to lead to accumulation of excess of calories leading to an increased susceptibility to overweight and obesity.

Centre for Disease Control (CDC, 2007) reported about two-thirds of young people in grades 9–12 were not engaged in recommended levels of physical activity apart from the fact that daily participation in high school physical education classes dropped from 42% in 1991 to 33% in 2005.

According to WHO – NIN obesity study on urban adolescents carried out during 2007 in Andhra Pradesh, multi logistic regression analysis revealed that the risk of over weight was 3 times higher among the adolescents, who did not participate in out door games and sports and 2 times among the adolescents who did not participate in household activities. (Laxmaiah et al 2007)

Another study conducted among adolescents residing in Karnataka revealed that the risk of getting over weight or obese is 21 times higher among those who participated in < 2 hrs in any type of physical acitivity (Kotian et al 2010)

Micronutrient deficiencies: Anemia

Various factors have been shown to be associated with the prevalence of iron deficiency anaemia namely, increased physiological requirements at certain stages of life cycle, low bio availability of iron, inadequate dietary intake of iron, blood losses, parasitic infestation (Chandra and Kutty 2008).

Prevalence of anemia among MHSES adolescents

Worldwide

The burden of anaemia is highest in South East Asia including Pakistan, Nepal, Bangladesh and India. It is well documented that iron deficiency anaemia is an important public health problem in most developing countries. It is more prevalent micronutrient deficiency among adolescents. WHO estimates that 27% of adolescents

in developing countries are anaemic; the International Center for Research on Women (ICRW) studies documented high rates in Nepal (42%), Cameroon (32%) and Gautemala (48%) and in India also more than 55% of the adolescents population has been reported to be suffering from Iron Deficiency Anaemia (Adolescent Nutrition 2006).

A study in Baghdad on 1051 adolescent children from High (n=487) and Low socio economic area (n= 564) established the prevalence of iron deficiency anaemia among adolescents in high socio economic area was 12.9% compared with 17.6% in low socio economic area **(Sharbatti et al 2003)**.

In Bangladesh **(Persson et al 2000)**, 31% children showed below the cut-off point for anaemia (<11.5 g/dl haemoglobin). Serum ferritin levels lower than 12.0 mg/l was reported in 30% of the children and 14% were suffering from iron deficiency anaemia.

In India

National Health Family Survey III (2005-06) reports the prevalence of anemia as high as 24.3% to 56.2% among the adolescents population.

The overall prevalence of anaemia among adolescents was relatively higher in the states of West Bengal (88-90%), Orissa (78-82%), Madhya Pradesh (72-76%) and Andhra Pradesh (73%).

Srihari et al. (2007), reviewed twelve studies and reported that anaemia prevalence (haemoglobin concentration <120 g/L) ranged from 19-88% across five different cities in India (Delhi, Punjab, Baroda, Pune, Chennai). A survey reported by Lancet (2002) revealed that nutritional anaemia affects 79% of children in the lowest economic strata and 64 per cent in the better-off families (Table 2.4).

Table 2.4: Prevalence of Iron Deficiency Anaemia in adolescents

Author	Country	Study subjects		Prevalence of Anaemia	
		Girls	Boys	Girls	Boys
Ahmed et al. (2004)	Bangladesh	12-15 years	---	22%	---
Gupta et al. (2002)	Peru, Indonesia and Bangladesh	adolescent girls	---	25-30%	---
Shah et al. (2002)	Nepal	11-18 years	---	68.8%	---
Gawarika et al. (2006)	Ujjain city	10.5 – 18 yrs	-----	65.02%	---
Agarwal et al. (2003)	North East Delhi	Adolescent girls	---	45%	---
Kanani and Shah (2001)	Vadodara	12- 15	---	12% [1] 30% [2]	---

Source: Srihari et 2007

Sen and Kanani, 2006, in their study stated very high prevalence (67%) of anaemia in adolescent girls of Vadodara. Though no case of severe anaemia was found; 32.6 % girls were mildly anaemic (Hb = 11.0-11.9 g/dL) and 34.7 % girls were moderately anaemic (Hb = 7.1-10.9 g/dL).

In the review of literature under the topic of anaemia extensive data was available for adolescent girls very few studies were conducted for adolescent boys. However, as can be seen in Table 2.6, the prevalence of iron deficiency anaemia amongst girls, ranged from 22- 78%.

The paucity of data on anemia levels in Indian adolescents especially points to the fact that this most important and vulnerable age group has remained neglected by researchers and policy makers.

Factors associated with anemia

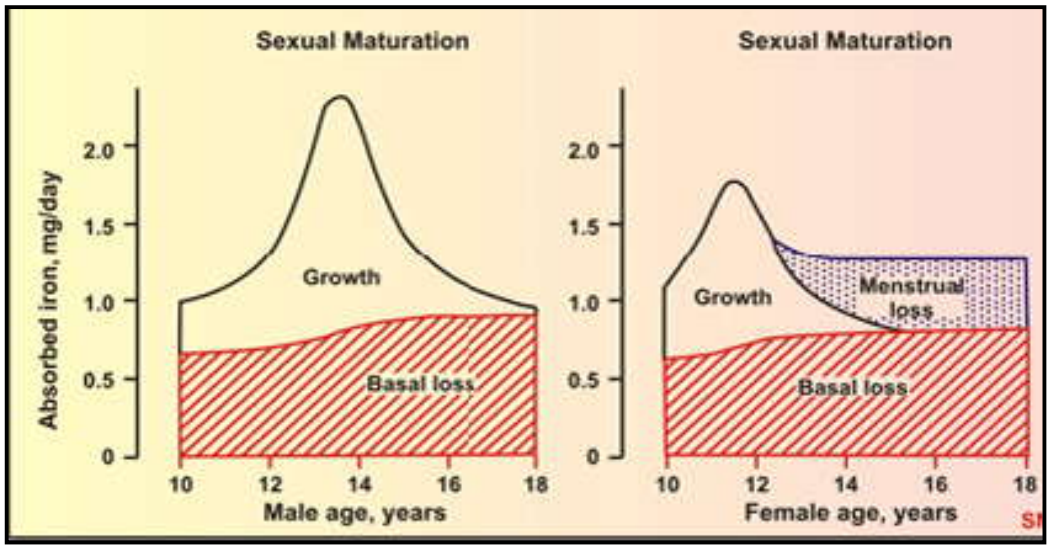
Increased Iron Requirement

The requirement for dietary iron arises from three major needs of body: endogenous loss of iron, requirement for growth and building up of iron stores over the period from infancy to adolescent (Kanani and Poojara 2000).

The requirements for iron are highest during infancy and adolescence when the iron stores are completely depleted and the rate of growth is as its peak, resulting in a negative iron balance (Rees et al 2008)

. The peak need for iron has been shown to be more closely related to maximal growth spurt and maturation than to age. Growth implies a corresponding increase in the total haemoglobin mass and for this formation of new haemoglobin, iron is needed (Woodruff and Duffield 2000). Besides iron is essential for the formation of myoglobin and is a cofactor of number of enzymes system. Iron requirements remain higher in girls after menarche to replace the menstrual losses and in boys in this phase due to muscle mass development (Figure 2.5). Therefore, iron demand increases during accelerated growth in adolescent particularly due to increase in biochemical activities and physical parameters such as increase in height of about 22cm, increase in blood volume from 2.5 to 6.0 liter and haemoglobin increment by 8gm/dl.

Figure 2.5 Iron needs during adolescence



Low bioavailability of the dietary iron

Bioavailability of iron is defined as that fraction of iron in food which is absorbed and utilized by the body. Low bioavailability of iron refers to simple, monotonous diets based on cereals, roots, tubers, maize, beans, whole wheat, sorghum (rich iron inhibitor). The average iron absorption varies extremely, ranging from 1-5% from plant origin foods and 10-25% from animal origin foods (Gawarika et al 2006, Anupama et al 2002). The bio availability of iron is low in predominantly cereal based diets as in India, because of their high phytate and phosphate content. Tanins present in tea are also known to inhibit the absorption of iron when consumed with meal is shown in the Table 2.3. Among the adolescent girls of Gujarat drinking tea with thepla and bhakri is common (Gawarika et al 2006).

Table 2.3: Bioavailability of iron from typical Indian meal

Meal	Bioavailability
Wheat chapattis, potato, vegetable and tea	1.8
Rice, Dal, Potato, vegetable and milk	4.5
Ragi balls, potato vegetable and tea	0.9
Sorghum, potato, vegetable and tea	0.8
Wheat bhakris	3.8
Wheat bhakris with tea	2.5

Source: Seshadri, 1996

Parasitic infestation

Adolescent iron requirements are even higher in developing countries because of infectious disease and parasitic infestation that cause iron loss **(**Kanani and Poojara 2000). Parasites can increase iron requirement through blood loss or by impairing iron absorption. Iron requirement increase incases in case of chronic blood loss cause by parasitic infection.

High parasitic infestation rate (30-80%) could be one of the major cause of anaemia (Tiwari, 2000). Hook worm infestation load can induce the iron deficiency anaemia, especially in children and adolescents, whose dietary iron is low and whose body iron stores are exhausted due to increased demand of iron for growth. Even normal levels of dietary iron intake may not be sufficient to protect from anaemia in the situation of high hook worm load.

Koukounari et al (2008) reviewed the relation between parasitc infection and anaemia among Kenyan School children (aged 10-21 years). The study reported that children heavily infected with parasite were also more likely to be anaemic (more than 90% in both cases) compared to uninfected children. Similarly other study was carried out by Uddin and Khanum (2008**)** in two different districts (Kutumbopur and Gazirchat) of Bangladesh and reported that parasitic infestation was observed among 33.82% adolescent where as in the other district the prevalence was 84.21%. Parasitic infestation was observed much higher in Gazirchat than Kutumbopur. The prevalence of anaemia was high in Kutumbopur (94.83%) than Gazirchat (41.2%) but the correlation between anaemia and parasitic infestation was statistically insignificant.

SABLA program has been initiated by Government of India to improve the nutritional and iron status of adolescent girls, in view of the widespread prevalence of anemia (56.2%). On comparing the high prevalence of anemia among the urban regions of five cities (Delhi, Punjab, Baroda, Pune, Chennai), 19% - 88% (Srihari et al 2007) with the 56.2%, it is clearly seen that the children from middle to high socio economic remain neglected due to absence of any such policy in private schools.

Though the current school health promotion program has been started for private schools also, the implementation and the IFA supplementation part still remains neglected in private schools on the pretext that children from private schools are not anemic.

Functional consequences of anemia

Reduced learning capacity and cognitive development

The term 'cognition' has broad application and refers to activities, chiefly thinking, reasoning, problem solving and psychological processes such as attention, memory and learning (McCann and Ames 2007)

Laboratory animal studies have shown reduced aldehyde oxidase activity in iron deficient rats that resulted in accumulation of serotonin and 5-hydroxyindol compounds, which have been reported to produce drowsiness, decrease attentiveness, and decreased ability to learn. Thus it is postulated that iron deficiency anaemia may lead to defects in cognitive development and function in human (Sen and Kanani 2005).

In animals, deficits in motor activity are consistently associated with severe iron deficiency and anaemia A (McCann & Ames, 2007). The study also suggested behavioural and cognitive deficits in children older than two years of age and adolescents.

Even mild anaemia had an impact on cognitive function of adolescent girls which aggravated with fall in haemoglobin levels (Sen and Kanani, 2006). A study reported that the scholastic performance was influenced by nutritional status. The study related anaemia and IQ (mental function) and found a significantly greater proportion of children with higher IQ among non-anemic children. (Parmar et al 2005)

Reduced work capacity

Anaemia represents a major threat to tissue oxygenation, hence certain tissues and organ that require much oxygen may suffer resulting in diminished capacity to perform energy consuming task. The key role that haemoglobin plays in transporting oxygen accounts for the diminished work capacity. Tissues develop slugginess in action owing to inadequate oxidation. Breathlessness and palpitation are commonly experienced by anaemic people (Bruner 2006). A study conducted in Vadodara demonstrated deleterious impact of anaemia on physical work capacity of adolescent girls (Sen and Kanani, 2006).

Loss of appetite

Iron deficiency leads to loss of appetite or anorexia. With loss of appetite the consumption of the food decreases, intern decreasing the growth and also worsening the condition of anaemia due to decreased micronutrients intake (Sen and Kanani, 2006).

Effect on growth

Growth is adversely affected in anaemic adolescents. Weights of anaemic children tend to be lower than those of normal children (Anupama & Manjula 2002).

In a study done by Bhanushali et al 2011, children with iron deficiency anaemia weighed less and shorter than those who were normal. Supplementation with iron resulted in better growth velocity. A systematic review showed that weekly iron supplementation (60 mg of elemental iron) has a beneficial impact on linear growth in anaemic children (Jack et al 2012).

Reduced immunocompetence

Nutritional status is one of the crucial factors that influence human immunity mechanism. Iron is essential for the normal development of immunity and deficiency of iron may be expected to impair immune responses (Basu et al 2005).

An expert group of WHO (2000) reported that individuals with nutritional anaemia revealed that individual with nutritional anaemia tend to have more frequent infections.

Iron deficiency anaemia may impair immunocompetence thus compromising health. There is a decrease in morbidity as the iron status improved.Some controversial views have been expressed regarding the association between morbidity and anaemia. Some literature highlights anaemia is a cause of morbidity occurrences and some studies support anaemia as a consequence of morbidity (Chandra and Kutty 2008).

Adolescents apparently have a low prevalence of infections and disease compared to children under five and the elderly, they receive little health and nutrition attention (WHO 2006). Programmes addressing adolescent nutrition in south east asian region are very few, small, experimental, and mostly for the under privileged section (WHO 2006). They are mainly aimed at the prevention and control of anemia among adolescents.

Thus it can be concluded that adolescents from middle to high socio economic schools also suffer from triple burden of malnutrition.

Health promotion

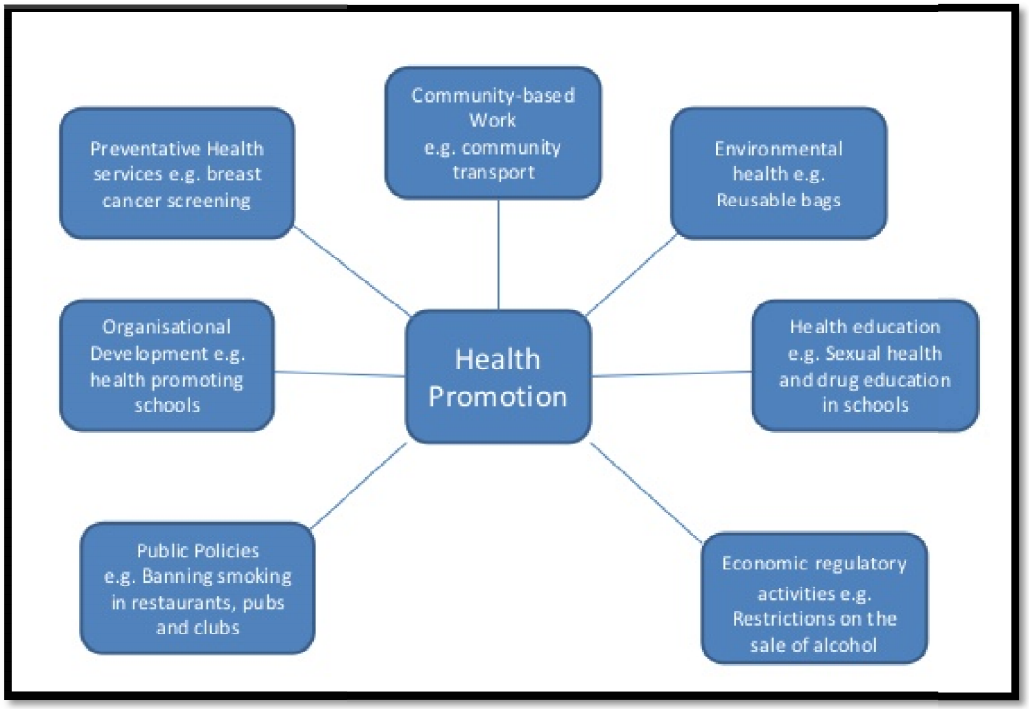
Health promotion is the process that enables people to improve or have greater control over their health. The aim of health promotion is to help an individual or a group to reach a state of complete physical, mental and social well- being, by

- Enabling them to identify and realize aspirations
- Satisfy their own requirements of being well
- Change with the environment

Health promotion makes it possible for people to have more control over the determinants of health and thereby improve their health. Health promotion encompasses range of activities, as explained in Figure 2.6.

Health promotion is not alone the responsibility of health sector, while the individuals themselves, community groups / schools, health professionals, health service institutions and governments should also be made aware of the problems and motivated to participate in the health promotion programs.

Figure 2.6: Health promotion encompasses a range of activities



Source: Kreuter et 2003

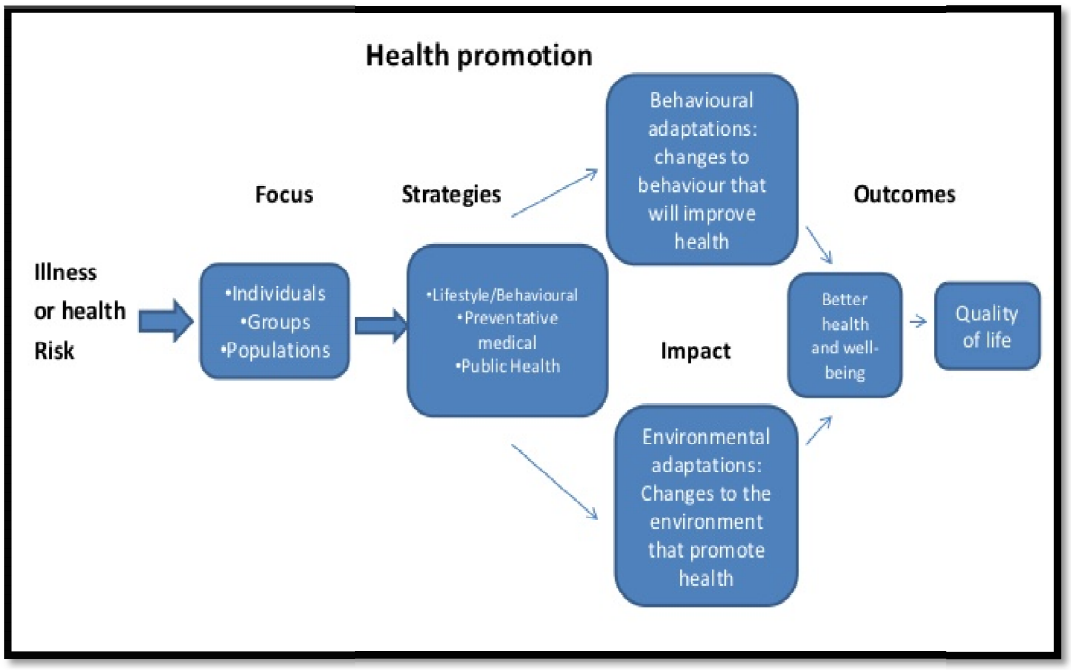
Health promotion approaches

It ranges from individually focused interventions (such as posters providing positive health messages) to development of a national health promoting policy (such as school health promotion program). Figure 2.7, explains the framework of health promotion.

2.6.1a Lifestyle / behavioural approaches

Lifestyle / behavioural approaches are concerned with individual or groups whose behavioural or social situations place them at greater risk of developing unhealthy lifestyle. These approaches target smaller "at risk" groups within a population to change their behaviors. This is based on the theory that a change in behavior of a small percentage of the whole population results in significantly more people changing behaviors.

Figure 2.7: A framework for health promotion



Source: Kreuter et 2003

Individual lifestyle approaches

The individual lifestyle approach to health promotion is based on the principles that the major causes of morbidity and mortality are diseases resulting from poor dietary and lifestyle behavior choices. Hence, with relevant information, people will change their actions and way of thinking to improve their health.

Socio cultural environmental approach

The socio cultural environment approach promotes health by addressing the social determinants of health, such as access to food, housing, income, employment, transport and education and factors such as addiction, social isolation and early life experiences. Health promotion commonly in the socio- cultural environment approach includes:

- Creating environments that support nutrition and health (eg. A school developing a nutrition policy to promote healthy eating and selling nutritious food in the canteen).
- Working with communities to strengthen their development (eg. A school working with families to reinforce the nutrition and health messages to children outside school hours).
- Advocating for public policy (eg. A school becoming a health promoting school).

Preventive medical approach

Preventive medical approaches are the traditional approaches of the health sector, which regards health as the absence of illness and disease. These approaches are directed at the way living things function. Example: high blood pressure, lack of immunization etc. These approaches also focus on the treatment and prevention o diseases. The current school health promotions program in India are based on medical approaches with identifying diseases through sporadic check ups and referrals.

Public health approach

Public health approaches aim to provide the maximum benefit for the largest number of people. They are concerned with preventing disease or injury from occurring or reoccurring, promoting health, and returning health to populations and communities following natural or man- made disasters.

Health promotion strategies

A life-course perspective is essential for the prevention and control of non communicable diseases. This approach starts with maternal health and prenatal nutrition, pregnancy outcomes, exclusive breastfeeding for six months, and child and adolescent health; reaches children at schools, adults at worksites and other settings, and the elderly; and encourages a healthy diet and regular physical activity from youth into old age (WHO 2009).

Strategies to reduce non communicable diseases should be part of broader, comprehensive and coordinated public health efforts. All partners, especially governments, need to address simultaneously a number of issues. In relation to diet, these include all aspects of nutrition (for example, both overnutrition and undernutrition, micronutrient deficiency and excess consumption of certain nutrients); food security (accessibility, availability and affordability of healthy food); food safety; and support for and promotion of six months of exclusive breastfeeding. Regarding physical activity, issues include requirements for physical activity in working, home and school life, increasing urbanization leading to long travel time and less amount of time available for physical activity, and various aspects of city planning (like having cycle pathways, community centers etc) transportation, safety and access to physical activity during leisure time (WHO 2009).

Strategies need to be based on the best available scientific research and evidence; comprehensive, incorporating both policies and action and addressing all major causes of non communicable diseases together; multisectoral, taking a long-term perspective and involving

all sectors of society; and multidisciplinary and participatory, consistent with the principles contained in the Ottawa Charter for Health Promotion (WHO 1986) and confirmed in subsequent conferences on health promotion and recognizing the complex interactions between personal choices, social norms, economic and environmental factors (WHO 2009).

Milestones in health promotion

There are different milestones in health promotion, conceived during the conferences held over a period of time. The following milestones are:

- The Ottawa Charter for Health Promotion *17-21 November 1986*
- Adelaide Recommendations on Healthy Public Policy *5-9 April 1988*
- Sundsvall Statement on Supportive Environments for Health *9-15 June 1991*
- Jakarta Declaration on Leading Health Promotion into the 21st Century *21-25 July 1997*
- Mexico Ministerial Statement for the Promotion of Health: From Ideas to Action *5-9 June 2000*
- The Bangkok Charter for Health Promotion in the Globalized World *7-11 August 2005*
- The Helsinki statement on Health in All Policies (Helsinki, Finland, 10-14 June 2013)

The Ottawa Charter for Health Promotion (17-21 November 1986)

The first International Conference on Health Promotion, held in Ottawa from 17-21 November 1986, presented this CHARTER for action to achieve Health for All by the year 2000 and beyond. This conference was primarily a response to growing expectations for a new public health movement around the world. Discussions focused on the needs in industrialized countries, but took into account similar concerns in all other regions.

Prerequisites for Health

The fundamental conditions and resources for health are:

- Peace,
- Shelter,
- Education,
- Food,
- Income,
- A sTable eco-system,
- Sustainable resources,
- Social justice, and equity.

Improvement in health requires a secure foundation in these basic prerequisites. Hence the three main strategies for the implementation of the health promotion programs are: advocate, enable and mediate.

Advocate

Good health is a major resource for social, economic and personal development and an important dimension of quality of life. Political, economic, social, cultural, environmental, behavioural and biological factors can all favour health or be harmful to it. Health promotion action aims at making these conditions favourable through advocacy for health.

Enable

Health promotion focuses on achieving equity in health. Health promotion action aims at reducing differences in current health status and ensuring equal opportunities and resources to enable all people to achieve their fullest health potential. This includes a secure foundation in a supportive environment, access to information, life skills and opportunities for making healthy choices. People cannot achieve their fullest health potential unless they are able to take control of those things which determine their health. This must apply equally to women and men.

Mediate

The prerequisites and prospects for health cannot be ensured by the health sector alone. More importantly, health promotion demands coordinated action by all concerned: by governments, by health and other social and economic sectors, by nongovernmental and voluntary organization, by local authorities, by industry and by the media. People in all walks of life are involved as individuals, families and communities. Professional and social groups and health personnel have a major responsibility to mediate between differing interests in society for the pursuit of health.

Health promotion strategies and programmes should be adapted to the local needs and possibilities of individual countries and regions to take into account differing social, cultural and economic systems.

❖ ***Health promotion action strategies as proposed in Ottawa charter***

They major five health promotion action strategies are:

i. Build Healthy Public Policy

Health promotion goes beyond health care. It puts health on the agenda of policy makers in all sectors and at all levels, directing them to be aware of the health consequences of their decisions and to accept their responsibilities for health.

Health promotion policy combines diverse but complementary approaches including legislation, fiscal measures, taxation and organizational change. It is coordinated action that leads to health, income and social policies that foster greater equity. Joint action contributes to ensuring safer and healthier goods and services, healthier public services, and cleaner, more enjoyable environments.

Health promotion policy requires the identification of obstacles to the adoption of healthy public policies in non-health sectors, and ways of removing them. The aim must be to make the healthier choice the easier choice for policy makers as well.

ii. Create Supportive Environments

Our societies are complex and interrelated. Health cannot be separated from other goals. The inextricable links between people and their environment constitutes the basis for a socioecological approach to health. The overall guiding principle for the world, nations, regions and communities alike, is the need to encourage reciprocal maintenance - to take care of each other, our communities and our natural environment. The conservation of natural resources throughout the world should be emphasized as a global responsibility.

Changing patterns of life, work and leisure have a significant impact on health. Work and leisure should be a source of health for people. The way society organizes work should help create a healthy society. Health promotion generates living and working conditions that are safe, stimulating, satisfying and enjoyable. Systematic assessment of the health impact of a rapidly changing environment - particularly in areas of technology, work, energy production and urbanization - is essential and must be followed by action to ensure positive benefit to the health of the public. The

protection of the natural and built environments and the conservation of natural resources must be addressed in any health promotion strategy.

iii. Strengthen Community Actions

Health promotion works through concrete and effective community action in setting priorities, making decisions, planning strategies and implementing them to achieve better health. At the heart of this process is the empowerment of communities - their ownership and control of their own endeavours and destinies. Community development draws on existing human and material resources in the community to enhance self-help and social support, and to develop flexible systems for strengthening public participation in direction of health matters. This requires full and continuous access to information, learning opportunities for health, as well as funding support.

iv. Develop Personal Skills

Health promotion supports personal and social development through providing information, education for health, and enhancing life skills. By doing so, it increases the options available to people to exercise more control over their own health and over their environments, and to make choices conducive to health. Enabling people to learn, throughout life, to prepare themselves for all of its stages and to cope with chronic illness and injuries is essential. This has to be facilitated in school, home, work and community settings. Action is required through educational, professional, commercial and voluntary bodies, and within the institutions themselves.

v. Reorient Health Services

The responsibility for health promotion in health services is shared among individuals, community groups, health professionals, health service institutions and governments. They must work together towards a health care system which contributes to the pursuit of health. The role of the health sector must move increasingly in a health promotion direction, beyond its responsibility for providing clinical and curative services. Health services need to embrace an expanded mandate which is sensitive and respects cultural needs. This mandate should support the needs of individuals and communities for a healthier life, and open channels between the

health sector and broader social, political, economic and physical environmental components.

Reorienting health services also requires stronger attention to health research as well as changes in professional education and training. This must lead to a change of attitude and organization of health services which refocuses on the total needs of the individual as a whole person.

Adelaide Recommendations on Healthy Public Policy (South Australia, 5-9 April 1988)

The adoption of the Declaration of Alma-Ata a decade ago was a major milestone in the Health for All movement which the World Health Assembly launched in 1977. Building on the recognition of health as a fundamental social goal, the Declaration set a new direction for health policy by emphasizing people's involvement, cooperation between sectors of society and primary health care as its foundation.

Developing New Health Alliances

The commitment to healthy public policy demands an approach that emphasizes consultation and negotiation. Healthy public policy requires strong advocates who put health high on the agenda of policy-makers. This means fostering the work of advocacy groups and helping the media to interpret complex policy issues.

Educational institutions must respond to the emerging needs of the new public health by reorienting existing curricula to include enabling, mediating, and advocating skills. There must be a power shift from control to technical support in policy development. In addition, forums for the exchange of experiences at local, national and international levels are needed. The

Conference recommends that local, national and international bodies:

- Establish clearing-houses to promote good practice in developing healthy public policy;
- Develop networks of research workers, training personnel, and programme managers to help analyse and implement healthy public policy.

Sundsvall Statement on Supportive Environments for Health (Sweden, 9-15 June 1991)

The Third International Conference on Health Promotion: Supportive Environments for Health – the Sundsvall Conference - fits into a sequence of events which began with the commitment of WHO to the goals of Health For All (1977). This was followed by the UNICEF/WHO International Conference on Primary Health Care, in Alma-Ata (1978), and the First International Conference on Health Promotion in Industrialized Countries (Ottawa 1986). Subsequent meetings on Healthy Public Policy, (Adelaide 1988) and a Call for Action: Health Promotion in Developing countries, (Geneva 1989) have further clarified the relevance and meaning of health promotion. In parallel with these developments in the health arena, public concern over threats to the global environment has grown dramatically. This was clearly expressed by the World Commission on Environment and Development in its report Our Common Future, which provided a new understanding of the imperative of sustainable development.

The Conference highlighted four aspects of supportive environments:

i. The social dimension, which includes the ways in which norms, customs and social processes affect health. In many societies traditional social relationships are changing in ways that threaten health, for example, by increasing social isolation, by depriving life of a meaningful coherence and purpose, or by challenging traditional values and cultural heritage.
ii. The political dimension, which requires governments to guarantee democratic participation in decision- making and the decentralization of responsibilities and resources. It also requires a commitment to human rights, peace, and a shifting of resources from the arms race.
iii. The economic dimension, which requires a rechanneling of resources for the achievement of Health for All and sustainable development, including the transfer of safe and reliable technology.
iv. The need to recognize and use women's skills and knowledge in all sectors - including policymaking, and the economy - in order to develop a more positive infrastructure for supportive environments. The burden of the workload of women should be recognized and shared between men and

women. Women's community based organizations must have a stronger voice in the development of health promotion policies and structures.

Jakarta Declaration on Leading Health Promotion into the 21st Century (Jakarta, Indonesia, 21-25 July 1997)

The Fourth International Conference on Health Promotion: New Players for a New Era - Leading Health Promotion into the 21st Century, meeting in Jakarta from 21 to 25 July 1997, has come at a critical moment in the development of international strategies for health. It is almost 20 years since the World Health Organization's Member States made an ambitious commitment to a global strategy for Health for All and the principles of primary health care through the Declaration of Alma-Ata. It is 11 years since the First International Conference on Health Promotion was held in Ottawa, Canada. That Conference resulted in proclamation of the Ottawa Charter for Health Promotion, which has been a source of guidance and inspiration for health promotion since that time. Subsequent international conferences and meetings have further clarified the relevance and meaning of key strategies in health promotion, including healthy public policy (Adelaide, Australia, 1988), and supportive environments for health (Sundsvall, Sweden, 1991).

The Fourth International Conference on Health Promotion is the first to be held in a developing country, and the first to involve the private sector in supporting health promotion. It has provided an opportunity to reflect on what has been learned about effective health promotion, to re-examine the determinants of health, and to identify the directions and strategies that must be adopted to address the challenges of promoting health in the 21st century. The participants in the Jakarta Conference hereby present this Declaration on action for health promotion into the next century.

The Jakarta Declaration on Health Promotion offers a vision and focus for health promotion into the next century. It reflects the firm commitment of participants in the Fourth International Conference on Health Promotion to draw upon the widest possible range of resources to tackle health determinants in the 21st century.

Determinants of health: new challenges

The prerequisites for health are peace, shelter, education, social security, social relations, food, income, the empowerment of women, a sTable eco-system, sustainable resource use, social justice, respect for human rights, and equity. Above all, poverty is the greatest threat to health.

Demographic trends such as urbanization, an increase in the number of older people and the high prevalence of chronic diseases pose new problems in all countries. Other social, behavioural and biological changes such as increased sedentary behaviour, resistance to antibiotics and other commonly available drugs, increased drug abuse, and civil and domestic violence threaten the health and well-being of hundreds of millions of people.

New and re-emerging infectious diseases, and the greater recognition of mental health problems, require an urgent response. It is vital that approaches to health promotion evolve to meet changes in the determinants of health.

Transnational factors also have a significant impact on health. These include the integration of the global economy, financial markets and trade, wide access to media and communications technology, and environmental degradation as a result of the irresponsible use of resources.

These changes shape peoples values, their lifestyles throughout the lifespan, and living conditions across the world. Some have great potential for health, such as the development of communications technology, while others, such as international trade in tobacco, have a major negative impact.

Health promotion makes a difference

Research and case studies from around the world provide convincing evidence that health promotion is effective. Health promotion strategies can develop and change lifestyles, and have an impact on the social, economic and environmental conditions that determine health. Health promotion is a practical approach to achieving greater equity in health.

The five strategies set out in the Ottawa Charter for Health Promotion are essential for success:

- Build healthy public policy
- Create supportive environments
- Strengthen community action
- Develop personal skills
- Reorient health services.

There is now clear evidence that:

- Comprehensive approaches to health development are the most effective. Those that use combinations of the five strategies are more effective than single- track approaches.
- Particular settings offer practical opportunities for the implementation of comprehensive strategies. These include mega-cities, islands, cities, municipalities, local communities, markets, schools, the workplace, and health care facilities.
- Participation is essential to sustain efforts. People have to be at the centre of health promotion action and decision-making processes for them to be effective.
- Health learning fosters participation. Access to education and information is essential to achieving effective participation and the empowerment of people and communities.

These strategies are core elements of health promotion and are relevant for all countries.

New responses needed

To address emerging threats to health, new forms of action are needed. The challenge for the coming years will be to unlock the potential for health promotion inherent in many sectors of society, among local communities, and within families.

There is a clear need to break through traditional boundaries within government sectors, between governmental and nongovernmental organizations, and between the public and private sectors.

Cooperation is essential; this requires the creation of new partnerships for health, on an equal footing, between the different sectors at all levels of governance in societies.

Priorities for health promotion in the 21st Century

1. Promote social responsibility for health

Decision-makers must be firmly committed to social responsibility. Both the public and private sectors should promote health by pursuing policies and practices that:

- Avoid harming the health of individuals
- Protect the environment and ensure sustainable use of resources
- Restrict production of and trade in inherently harmful goods and substances such as tobacco and armaments, as well as discourage unhealthy marketing practices
- Safeguard both the citizen in the marketplace and the individual in the workplace
- Include equity-focused health impact assessments as an integral part of policy development.

2. Increase investments for health development

In many countries, current investment in health is inadequate and often ineffective. Increasing investment for health development requires a truly multisectoral approach including, for example, additional resources for education and housing as well as for the health sector.

Greater investment for health and reorientation of existing investments, both within and among countries, has the potential to achieve significant advances in human development, health and quality of life.

Investments for health should reflect the needs of particular groups such as women, children, older people, and indigenous, poor and marginalized populations.

3. Consolidate and expand partnerships for health

Health promotion requires partnerships for health and social development between the different sectors at all levels of governance and society. Existing partnerships need to be strengthened and the potential for new partnerships must be explored.

Partnerships offer mutual benefit for health through the sharing of expertise, skills and resources. Each partnership must be transparent and accounTable and be based on agreed ethical principles, mutual understanding and respect. WHO guidelines should be adhered to.

4. Increase community capacity and empower the individual

Health promotion is carried out by and with people, not on or to people. It improves both the ability of individuals to take action, and the capacity of groups, organizations or communities to influence the determinants of health.

Improving the capacity of communities for health promotion requires practical education, leadership training, and access to resources. Empowering individuals demands more consistent, reliable access to the decision-making process and the skills and knowledge essential to effect change.

Both traditional communication and the new information media support this process. Social, cultural and spiritual resources need to be harnessed in innovative ways.

5. Secure an infrastructure for health promotion

To secure an infrastructure for health promotion, new mechanisms for funding it locally, nationally and globally must be found. Incentives should be developed to influence the actions of governments, nongovernmental organizations, educational institutions and the private sector to make sure that resource mobilization for health promotion is maximized.

"Settings for health" represent the organizational base of the infrastructure required for health promotion. New health challenges mean that new and diverse networks need to be created to achieve intersectoral collaboration. Such networks should provide mutual assistance within and among countries and facilitate exchange of information on which strategies have proved effective and in which settings.

Training in and practice of local leadership skills should be encouraged in order to support health promotion activities. Documentation of experiences in health

promotion through research and project reporting should be enhanced to improve planning, implementation and evaluation.

All countries should develop the appropriate political, legal, educational, social and economic environments required to support health promotion.

Mexico Ministerial Statement for the Promotion of Health: From Ideas to Action (Mexico City, 5-9 June 2000)

Statement

Gathered in Mexico City on the occasion of the Fifth Global Conference on Health Promotion, the Ministers of Health who sign this Statement:

1. Recognize that the attainment of the highest possible standard of health is a positive asset for the enjoyment of life and necessary for social and economic development and equity.
2. Acknowledge that the promotion of health and social development is a central duty and responsibility of governments, that all sectors of society share.
3. Are mindful that, in recent years, through the sustained efforts of governments and societies working together, there have been significant health improvements and progress in the provision of health services in many countries of the world.
4. Realize that, despite this progress, many health problems still persist which hinder social and economic development and must therefore be urgently addressed to further equity in the attainment of health and well being.
5. Are mindful that, at the same time, new and reemerging diseases threaten the progress made in health.
6. Realize that it is urgent to address the social, economic and environmental determinants of health and that this requires strengthened mechanisms of collaboration for the promotion of health across al sectors and at all levels of society.
7. Conclude that health promotion must be a fundamental component of public policies and programmes in all countries in the pursuit of equity and better health for all.
8. Realize that there is ample evidence that good health promotion strategies of promoting health are effective.

The Bangkok Charter for Health Promotion in a Globalized World (7-11 August 2005)

Purpose

The Bangkok Charter affirms that policies and partnerships to empower communities, and to improve health and health equality, should be at the centre of global and national development.

The Bangkok Charter complements and builds upon the values, principles and action strategies of health promotion established by the *Ottawa Charter for Health Promotion* and the recommendations of the subsequent global health promotion conferences which have been confirmed by Member States through the World Health Assembly.

Audience

The Bangkok Charter reaches out to people, groups and organizations that are critical to the achievement of health, including:

- Governments and politicians at all levels
- Civil society
- The private sector
- International organizations, and
- The public health community.

Health promotion

The United Nations recognizes that the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without discrimination.

Health promotion is based on this critical human right and offers a positive and inclusive concept of health as a determinant of the quality of life and encompassing mental and spiritual wellbeing.

Addressing the determinants of health Changing context

The global context for health promotion has changed markedly since the development of the *Ottawa Charter*.

Critical factors

Some of the critical factors that now influence health include:

- Increasing inequalities within and between countries
- New patterns of consumption and communication commercialization global environmental change, and urbanization.

Further challenges

Other factors that influence health include rapid and often adverse social, economic and demographic changes that affect working conditions, learning environments, family patterns, and the culture and social fabric of communities.

Women and men are affected differently. The vulnerability of children and exclusion of marginalized, disabled and indigenous peoples have increased.

New opportunities

Globalization opens up new opportunities for cooperation to improve health and reduce transnational health risks; these opportunities include:

- Enhanced information and communications technology, and
- Improved mechanisms for global governance and the sharing of experiences.

Policy coherence

To manage the challenges of globalization, policy must be coherent across all:

- Levels of governments
- United Nations bodies, and
- Other organizations, including the private sector.

This coherence will strengthen compliance, transparency and accountability with international agreements and treaties that affect health.

Progress made

Progress has been made in placing health at the centre of development, for example through the Millennium Development Goals, but much more remains to be achieved; the active participation of civil society is crucial in this process.

Strategies for health promotion in a globalized world

Effective interventions

Progress towards a healthier world requires strong political action, broad participation and sustained advocacy. Health promotion has an established repertoire of proven effective strategies which need to be fully utilized.

Required actions

To make further advances in implementing these strategies, all sectors and settings must act to:

- Advocate for health based on human rights and solidarity
- Invest in sustainable policies, actions and infrastructure to address the determinants of health
- Build capacity for policy development, leadership, health promotion practice, knowledge transfer and research, and health literacy
- Regulate and legislate to ensure a high level of protection from harm and enable equal opportunity for health and well-being for all people
- Partner And Build Alliances with public, private, nongovernmental and international organizations and civil society to create sustainable actions.

Commitments to Health for All Rationale

The health sector has a key leadership role in the building of policies and partnerships for health promotion. An integrated policy approach within government and international organizations, as well as a commitment to working with civil society and the private sector and across settings, are essential if progress is to be made in addressing the determinants of health.

Key commitments

The four key commitments are to make the promotion of health:

a. Central to the global development agenda
b. A core responsibility for all of government
c. A key focus of communities and civil society
d. A requirement for good corporate practice.

1. Make the promotion of health central to the global development agenda

Strong intergovernmental agreements that increase health and collective health security are needed. Government and international bodies must act to close the health gap between rich and poor. Effective mechanisms for global governance for health are required to address all the harmful effects of:

- Trade
- Products
- Services, and
- Marketing strategies.

Health promotion must become an integral part of domestic and foreign policy and international relations, including in situations of war and conflict.

This requires actions to promote dialogue and cooperation among nation states, civil society, and the private sector. These efforts can build on the example of existing treaties such as the World Health Organization Framework Convention for Tobacco Control.

Call for action

Conference participants request the World Health Organization and its Member States, in collaboration with others, to allocate resources for health promotion, initiate plans of action and monitor performance through appropriate indicators and targets, and to report on progress at regular intervals. United Nations organizations are asked to explore the benefits of developing a Global Treaty for Health.

Worldwide partnership

This Bangkok Charter urges all stakeholders to join in a worldwide partnership to promote health, with both global and local engagement and action.

The Helsinki statement on Health in All Policies (Helsinki, Finland, 10-14 June 2013)

Policies designed to enable people to lead healthy lives face opposition from many sides. Often they are challenged by the interests of powerful economic forces that resist regulation. Business interests and market power can affect the ability of

governments and health systems to promote and protect health and respond to health needs. *Health in All Policies* is a practical response to these challenges. It can provide a framework for regulation and practical tools that combine health, social and equity goals with economic development, and manage conflicts of interest transparently. These can support relationships with all sectors, including the private sector, to contribute positively to public health outcomes.

Action for Government

To fulfill their obligations to their peoples' health and well-being by taking the following actions:

- Commit to health and health equity as a political priority by adopting the principles of Health in All Policies and taking action on the social determinants of health.
- Ensure effective structures, processes and resources that enable implementation of the Health in All Policies approach across governments at all levels and between governments.
- Strengthen the capacity of Ministries of Health to engage other sectors of government through leadership, partnership, advocacy and mediation to achieve improved health outcomes.
- Build institutional capacity and skills that enable the implementation of Health in All Policies and provide evidence on the determinants of health and inequity and on effective responses.
- Adopt transparent audit and accountability mechanisms for health and equity impacts that build trust across government and between governments and their people.
- Establish conflict of interest measures that include effective safeguards to protect policies from distortion by commercial and vested interests and influence.
- Include communities, social movements and civil society in the development, implementation and monitoring of Health in All Policies, building health literacy in the population.

The Helsinki Statement wrests the major responsibility of mainstreaming health in all policy to WHO, where major role is to:

- Support Member States to put Health in All Policies into practice.
- Strengthen its own capacity in Health in All Policies.
- Use the Health in All Policies approach in working with United Nations agencies and other partners on the unfinished Millennium Development Goals agenda and the post-2015 Development Agenda.
- Urge the United Nations family, other international organizations, multilateral development banks and development agencies to achieve coherence and synergy in their work with Member States to enable implementation of Health in All Policies.

Health Promotion through school settings

Schools have direct contact with students for approximately 6 hours each day and for up to 13 critical years of their social, psychological, physical, and intellectual development **(US 2010)**. The health of students is strongly linked to their academic success, and the academic success of students is strongly linked with their health. Therefore, helping students stay healthy is a fundamental part of the mission of schools **(Dewey *1999,* Dunkle and 1991, Mandell et al 2002, Shephard 1996)**. School health programs and policies might be one of the most efficient means to prevent or reduce risk behaviors, prevent serious health problems among students, and help close the educational achievement gap **(Kolbe 2002, Allensworth et al 1997)**. Schools offer an ideal setting for delivering health promotion strategies that provide opportunities for students to learn about and practice healthy behaviors. Schools, across all regional, demographic, and income categories, share the responsibility with families and communities to provide students with healthy environments that foster regular opportunities for healthy eating and physical activity. Healthy eating and physical activity also play a significant role in students' academic performance (CDC 2011).

The importance of healthy eating, including eating breakfast, for the overall health and well-being of school-aged children cannot be understated. Most research on healthy eating and academic performance has focused on the negative effects of hunger and food insufficiency (Alaimo et al 2001) and the importance of eating breakfast (Murphy *et al 1998,* Kleinman *et al 2002,* Widenhorn-Muller *et al 2008.* Recent reviews of breakfast and cognition in students (Taras *2005,* Rampersaud et al 2005, Hoyland et al 2009) report that eating a healthy breakfast might :

- Enhance cognitive function (especially memory),
- Increase attendance rates,
- Reduce absenteeism, and
- Improve psychosocial function and mood.

Certain improvements in academic performance such as improved math scores also were noted (Murphy et al 1998, Kleinman et al 2002).

A growing body of research focuses on the association between school-based physical activity, including physical education, and academic performance among school-aged children and adolescents. A comprehensive CDC literature review that included 50 studies synthesized the scientific literature on the association between school-based physical activity, including physical education, and academic performance, including indicators of cognitive skills and attitudes, academic behaviors (e.g., concentration, attentiveness, and time on task), and academic achievement (e.g., grade point average and test scores). The review identified a total of 251 associations between school-based physical activity and academic performance. Of all the associations examined, 51% were positive, 48% were not significant, and 2% were negative. Therefore, the evidence suggests that:

- Substantial evidence indicates that physical activity can help improve academic achievement, including grades and standardized test scores;
- Physical activity can affect cognitive skills and attitudes and academic behavior (including enhanced concentration, attention, and improved classroom behavior); and
- Increasing or maintaining time dedicated to physical education might help and does not appear to adversely affect academic performance **(CDC 2010)**.

Coordinated school health approach

Schools can promote the acquisition of lifelong healthy eating and physical activity behaviors through strategies that provide opportunities to practice and reinforce these behaviors. School efforts to promote healthy eating and physical activity should be part of a coordinated school health framework, which provides an integrated set of planned, sequential, and school-affiliated strategies, activities, and services designed to promote the optimal physical, emotional, social, and educational development of students. A coordinated school health framework involves families and is based on school and community needs, resources, and standards. The framework is coordinated by a multidisciplinary team such as a school health council and is accounTable to the school and community for program quality and effectiveness (Allensworth et al 1997).

School personnel, students, families, community organizations and agencies, and businesses can collaborate to successfully implement the coordinated school health approach and develop, implement, and evaluate healthy eating and physical activity efforts. Ideally, a coordinated school health framework integrates the efforts of eight components of the school environment (i.e., comprehensive health education, physical education, and health services: mental health and social services, school nutrition services, healthy and safe school environment, school employee wellness, and family and community involvement) that influence student health (Marx et al 1998). The following guidelines reflect the coordinated school health approach and include additional areas deemed to be important contributors to school health: policy development and implementation and professional development for program staff.

Evaluation of school environment and ethos

School Health Index (SHI)

As is clear from the above discussion, school ethos and environment have a vital role to play in developing heath behaviours among children. For this, the School Health Index (SHI) can be used to determine state of school health policies and its environment. It is a self-assessment and planning guide that enables a school:

- To identify the strengths and weaknesses of its policies and programs for promoting health and safety.
- Develop an action plan for improving student health and safety, and
- Involve teachers, parents, students, and the community in improving school health
- Policies, programs, and services

The *School Health Index* has hence been designed by CDC to help schools involve teachers, parents, students, and the community in identifying the strengths and weaknesses of their school's health policies and programs, and then in developing an action plan to improve these (CDC, 2006).

Health Topics Addressed Via Modules

The SHI is structured around CDC's eight-component model of a coordinated school health program (CSHP). This model highlights the importance of involving all eight components (modules), which can have a profound influence on the development of risk behaviours in students. The eight modules are:

1. School Health and Safety Policies and Environment
2. Health Education
3. Physical Education and Other Physical Activity Programs
4. Nutrition Services
5. Health Services
6. Counselling, Psychological & Social Services
7. Health Promotion for Staff

8. Family and Community Involvement

The latest edition of the School Health Index focuses on how schools can address the following health topics in the 8 modules.

- Physical activity and physical education,
- Nutrition,
- Tobacco use prevention,
- Asthma, and
- Unintentional injury and violence prevention (safety)

SHI has been available for years but still little is known about it and its use in India is nonexistent. As reported by CDC (2004) it's being used in used in 46 schools of America plus Canada where its efficacy has been well established. Outcome data of a study conducted in 102 elementary schools of Rhode Island using SHI showed that all schools developed at least one policy or environmental strategy to create a healthy school environment (Dowling et al, 2005). SHI could hence be used as a tool to introduce public health technical expertise to schools as they develop school wellness policies and programs (Austin et al 2006).

Implementation

Implementation of SHI can be done in a way that suits a particular school set up. The only thing to remember is that the aim of SHI is to involve the whole school community in evaluating the school health policies and give recommendations for improvement. The most feasible approach hence is formation of a team which is representative of administrators, teachers, students and parents. This would further include selecting a coordinator of the team who can plan the whole process (CDC, 2006). Austin et al (2006) in their qualitative study on 6 schools from 3 states of New England using SHI recommended an outside facilitator for enhancing schools' efforts to work with SHI and better implementation of health initiatives. In addition, the involvement of an outside facilitator was also reported to support schools in undertaking more complex tasks with a greater degree of collaboration across the school and local communities in order to achieve goals.

Process of implementation

- Review the eight modules
- Assemble the School Health Index team
- Identify a coordinator for the School Health Index team
- Site coordinator assigns modules.
- Team answers Discussion Questions from 8 modules, then develop and rate recommended actions.
- Make each member fill the given/ required modules
- Score each module
- Score the over all index
- Review recommendations,
- Select a manageable number of top priority actions,
- Complete the School Health Improvement Plan.

However, it may not be possible to implement all the modules together in an academic session. Therefore, it appears more practical to focus on or two modules in a year and introduce the other modules in subsequent years. Nevertheless, "school health promotion" needs to be tested for its efficacy in an Indian setting.

Thus it can be concluded from the review of literature that:

- Adolescents are an age group requiring attention and concern by all stakeholders including government, school administration, parents etc.
- Schools in a backdrop setting are an ideal setting to target programmes and interventions needed to promote health.
- Creation of an enabling environment in schools by involving school community, parents and adolescents for promotion of health is thus, a feasible approach.

Nine School Health Guidelines to Promote Healthy Eating and Physical Activity

There are nine general guidelines for school health programs to promote healthy eating and physical activity in USA. Each guideline is followed by a series of strategies for implementing them. Since each guideline is important to school health, there is no priority order. Guidelines presented first focus on the importance of a coor-

dinated approach for nutrition and physical activity policies and practices within a health-promoting school environment. Then, guidelines pertaining to nutrition services and physical education are provided, followed by guidelines for health education, health, mental health and social services, family and community involvement, staff wellness, and professional development for staff.

Although the ultimate goal is to implement all guidelines recommended, not every guideline and its corresponding strategies will be feasible for every school to implement. Due to resource limitations, some schools might need to implement the guidelines incrementally. Therefore, the recommendation is for schools to identify which guidelines are feasible to implement, based on the top health needs and priorities of the school and available resources. Families, school personnel, health-care providers, businesses, the media, religious organizations, community organizations that serve children and adolescents, and the students themselves also should be systematically involved in implementing the guidelines to optimize a coordinated approach to healthy eating and regular physical activity among school-aged children and adolescents.

However, these guidelines not clinical guidelines; hence, compliance is neither mandatory nor tracked by CDC. However, CDC monitors the status of student health behaviors and school health policies and practices nationwide through three surveillance systems, which are:

i. Youth Risk Behavior Surveillance System (YRBSS)
ii. School Health Policies and Practices Study (SHPPS)
iii. School Health Profiles (SHP)

These systems provide information about the degree to which students are participating in healthy behaviors and schools are developing and implementing the policies and practices recommended in the guidelines.

Youth Risk Behavior Surveillance System (YRBSS)

The Youth Risk Behavior Surveillance System (YRBSS) monitors priority health-risk behaviors (e.g., unhealthy dietary behaviors and physical inactivity) and the prevalence of obesity and asthma among high school students. YRBSS includes a

national, school-based survey conducted by CDC and state, territorial, tribal, and district surveys conducted by state, territorial, and local education and health agencies and tribal governments. YRBSS data are used to:

a. Measure progress toward achieving national health objectives for *Healthy People 2020* and other program and policy indicators,
b. Assess trends in priority health-risk behaviors among adolescents and young adults, and
c. Evaluate the effect of broad school and community interventions at the national, state, and local levels.

In addition, state, territorial, and local agencies and nongovernmental organizations use YRBSS data to set and track progress toward meeting school health and health promotion program goals, support modification of school health curricula or other programs, support new legislation and policies that promote health, and seek funding and other support for new initiatives.

School Health Policies and Practices Study (SHPPS)

The CDC School Health Policies and Practices Study (SHPPS) is a national survey conducted periodically to assess school health policies and practices at the state, district, school, and classroom levels. SHPPS data are used to:

a. Identify the characteristics of each school health program component (e.g., physical education and activity and nutrition services) at the state, district, school, and classroom (where applicable) levels across elementary, middle, and high schools;
b. Identify persons responsible for coordinating and delivering each school health program component and their qualifications and educational background;
c. Identify collaborations that occur among staff members from each school health program component and with staff members from outside agencies and organizations; and
d. Describe changes in key policies and practices over time.

School Health Profiles (SHP)

The School Health Profiles, SHP (i.e., Profiles) is a system of surveys assessing school health policies and practices in states, large urban school districts, territories, and tribal governments. State, local, and territorial education and health officials use Profiles data to:

a. Describe school health policies and practices and compare them across jurisdictions,
b. Identify professional development needs,
c. Plan and monitor programs,
d. Support health-related policies and legislation,
e. Seek funding, and
f. Garner support for future surveys.

The nine guidelines along with their strategies to promote healthy eating and physical activity in a school setting are as follows:

Guideline 1

Use a Coordinated Approach to Develop, Implement, and Evaluate Healthy Eating and Physical Activity Policies and Practices

- Coordinate Healthy Eating and Physical Activity Policies and Practices Through a School Health Council and School Health Coordinator
  - Establish a school health council and designate a school health coordinator at the district level.
  - Establish a school health team and designate a school health coordinator at the school level.
- Assess Healthy Eating and Physical Activity Policies and Practices
- Use a Systematic Approach To Develop, Implement, and Monitor Healthy Eating and Physical Activity Policies
  - Identify and involve key stakeholders from the beginning of the policy process.
  - Draft the policy language
  - Adopt, implement, and monitor healthy eating and physical activity policies
- Evaluate Healthy Eating and Physical Activity Policies and Practices

- Conduct process evaluation of nutrition and physical activity policies and practices
- Conduct outcome evaluation of healthy eating and physical activity policies, programs, and practices

Guideline 2.

Establish School Environments that Support Healthy Eating and Physical Activity

- Provide Access to Healthy Foods and Physical Activity Opportunities and to Safe Spaces, Facilities, and Equipment for Healthy Eating and Physical Activity
  - Provide adequate and safe spaces and facilities for healthy eating.
  - Ensure that spaces and facilities for physical activity meet or exceed recommended safety standards.
  - Develop, teach, implement, and enforce safety rules
  - Maintain high levels of supervision during structured and unstructured physical activity programs.
  - Increase community access to school physical activity facilities
- Establish a Climate that Encourages and Does Not Stigmatize Healthy Eating and Physical Activity
  - Adopt marketing techniques to promote healthy dietary choices.
  - Use student rewards that support health
  - Do not use physical activity as punishment
- Create a School Environment that Encourages a Healthy Body Image, Shape, and Size Among All Students and Staff Members, Is Accepting of Diverse Abilities, and Does Not Tolerate Weight-Based Teasing

Guideline 3.

Provide a Quality School Meal Program and Ensure that Students Have Only Appealing, Healthy Food and Beverage Choices Offered Outside of the School Meal Program

- Promote Access to and Participation in School Meals
  - Encourage participation in school meal programs among all students
- Provide Nutritious and Appealing School Meals that Comply with the *Dietary Guidelines for Americans*

  - Ensure that meals meet federally defined nutrition standards.
  - Ensure that schools have kitchen facilities and equipment needed to cook quality, appealing meals.
  - Use healthy food preparation methods and purchasing techniques.
- Ensure that all Foods and Beverages Sold or Served Outside of School Meal Programs Are Nutritious and Appealing
  - Establish strong nutrition standards for competitive foods consistent with the IOM Nutrition Standards for Foods in Schools.
  - Use the contracting process to improve the nutritional quality of competitive foods and beverages
  - Market healthier foods and beverages
  - Use fundraising activities and student rewards that support health.

Guideline 4.

Implement a Comprehensive Physical Activity Program with Quality Physical Education as the Cornerstone

- Require Students in Grades K–12 To Participate in Daily Physical Education that Uses a Planned and Sequential Curriculum and Instructional Practices that Are Consistent with National or State Standards for Physical Education
  - Require daily physical education for students in grades K–12.
  - Implement physical education curricula consistent with national or state physical education standards
  - Include protocols for student assessment in physical education.
- Provide a Substantial Percentage of Each Student's Recommended Daily Amount of Physical Activity in Physical Education Class
  - Implement curricular and instructional practices to increase student physical activity during physical education.
- Use Instructional Strategies in Physical Education that Enhance Students' Behavioral Skills, Confidence in Their Abilities, and Desire To Adopt and Maintain a Physically Active Lifestyle
  - Incorporate instructional strategies to improve students' behavioral skills in physical education and physical activity programs.

  - Incorporate instructional strategies in physical education to improve students' confidence in their ability to be physically active and maintain physical activity behaviors
  - Incorporate instructional strategies in physical education and physical activity programs that lead to positive attitudes and perceptions toward physical activity
- Provide Ample Opportunities for All Students To Engage in Physical Activity Outside of Physical Education Class
  - Require daily recess
  - Provide physical activity breaks during the school day.
  - Offer students opportunities to participate in intramural physical activity programs during after-school hours
  - Offer interscholastic sports
  - Implement and promote walk- and bicycle-to-school programs
- Ensure that Physical Education and Other Physical Activity Programs Meet the Needs and Interests of All Students
  - Promote and ensure inclusion of all students.

Guideline 5.

Implement Health Education that Provides Students with the Knowledge, Attitudes, Skills, and Experiences Needed for Healthy Eating and Physical Activity

- Require Health Education from Prekindergarten Through Grade 12
- Implement a Planned and Sequential Health Education Curriculum that Is Culturally and Developmentally Appropriate, Addresses a Clear Set of Behavioral Outcomes that Promote Healthy Eating and Physical Activity, and Is Based on National Standards
  - Implement a planned and sequential curriculum that is culturally and developmentally appropriate
  - Implement a curriculum that addresses a clear set of behavioral outcomes that promote healthy eating and physical activity.
  - Implement health education curricula that are consistent with the National Health Education Standards

- Use Curricula that Are Consistent with Scientific Evidence of Effectiveness in Helping Students Improve Healthy Eating and Physical Activity Behaviors
- Use Classroom Instructional Methods and Strategies that Are Interactive, Engage All Students, and Are Relevant to Their Daily Lives and Experiences
  - Use interactive learning strategies
  - Use methods and strategies that are developmentally appropriate
  - Integrate computer-based instruction into health education

Guideline 6.

Provide Students with Health, Mental Health, and Social Services to Address Healthy Eating, Physical Activity, and Related Chronic Disease Prevention

- Assess Student Needs Related to Physical Activity, Nutrition, and Obesity, and Provide Counseling and Other Services To Meet Those Needs
  - Assess eating and physical activity behaviors of students
  - Schools initiating BMI measurement programs should implement safeguards
  - Counsel students on how to achieve healthy eating and physical activity recommendations
  - Manage the physical activity and nutritional needs of students with chronic health conditions
- Ensure Students Have Access to Needed Health, Mental Health, and Social Services
  - Refer students to community-based health-care providers and healthy eating and physical activity services
- Provide Leadership in Advocacy and Coordination of Effective School Physical Activity and Nutrition Policies and Practices
  - Advocate on behalf of students to create a healthy, safe, and supportive school environment that allows students to make healthy dietary and physical activity choices both in and out of school.

Guideline 7.

Partner with Families and Community Members in the Development and Implementation of Healthy Eating and Physical Activity Policies, Practices, and Programs

- Encourage Communication Among Schools, Families, and Community Members to Promote Adoption of Healthy Eating and Physical Activity Behaviors Among Students
  - Communicate frequently and use various dissemination methods.
- Involve Families and Community Members on the School Health Council
  - The school health council should identify strategies for establishing partnerships with families and community members.
- Develop and Implement Strategies for Motivating Families To Participate in School-Based Programs and Activities that Promote Healthy Eating and Physical Activity
  - Provide various formats for involving families and offer frequent opportunities for participation.
- Access Community Resources To Help Provide Healthy Eating and Physical Activity Opportunities for Students
  - Involve staff members from universities, hospitals, health centers, and other health organizations in school initiatives on healthy eating and physical activity
  - Recruit parent, family, and community volunteers to assist with healthy eating and physical activity initiatives.
  - Link to out-of-school programs that promote healthy eating and physical activity.
- Demonstrate Cultural Awareness in Healthy Eating and Physical Activity Practices Throughout the School
  - Customize activities and communication to reflect the culture of the community

Guideline 8.

Provide a School Employee Wellness Program that Includes Healthy Eating and Physical Activity Services for All School Staff Members

- Gather Data and Information To Determine the Nutrition and Physical Activity Needs of School Staff Members and Assess the Availability of Existing School Employee Wellness Activities and Resources
  - Determine employee health-related costs

  - Assess the status of school employee wellness activities, and identify the nutrition and physical activity interests and needs of school employees
- Encourage Administrative Support for and Staff Involvement in School Employee Wellness
  - Obtain administrative support for school employee wellness programs that include healthy eating and physical activity.
  - Establish a school employee wellness committee, and identify a leader for the committee
- Develop, Implement, and Evaluate Healthy Eating and Physical Activity Programs for All School Employees
  - Establish broad goals and specific objectives for healthy eating and physical activity programs for school employees
  - Implement activities to promote healthy eating and physical activity that emphasize informational, behavioral skill, and policy and environmental approaches
  - Evaluate and adapt the school employee wellness program

Guideline 9.

Employ Qualified Persons, and Provide Professional Development Opportunities for Physical Education, Health Education, Nutrition Services, and Health, Mental Health, and Social Services Staff Members, as well as Staff Members Who Supervise Recess, Cafeteria Time, and Out-Of-School–Time Programs

- Require the Hiring of Physical Education Teachers, Health Education Teachers, and Nutrition Services Staff Members Who Are Certified and Appropriately Prepared To Deliver Quality Instruction, Programs, and Practices
  - Require the hiring of certified physical education teachers to teach physical education in grades K–12
  - Require the hiring of certified health education teachers to teach health education in grades K–12
  - Require the hiring of qualified nutrition service directors, managers, and staff.
- Provide School Staff Members with Annual Professional Development Opportunities To Deliver Quality Physical Education, Health Education, and Nutrition Services

  - Provide annual professional development opportunities for physical education teachers
  - Provide annual professional development opportunities for health education teachers
  - Provide annual professional development opportunities for nutrition services staff members
- Provide Annual Professional Development Opportunities for School Health, Mental Health, and Social Services Staff Members and Staff Members Who Lead or Supervise Out-Of-School–Time Programs, Recess, and Cafeteria Time
  - Provide annual professional development opportunities to school health, mental health, and social services staff members.

2.7.3 School based Intervention studies that are effective:

Based on the above nine guidelines, high intensity school based programs that focus on diet and physical activity, are comprehensive and multi component, which includes:

- Curriculum on diet and physical activity taught by trained teachers (Simon et al 2006, Lytle et al 2006, Engels et al 2005, Anderson et al 2005, Bayne-Smith et al 2004, Simon et al 2004, Lytle et al 2004, Williams et al 2004, Kain et al 2004, Trevino et al 2004, Hoelscher et al 2004,).
- supportive school environment/policies (Bartholomew et al 2006, Paradis et al 2005, French et al 2004, Perry et al 2004, Jimenez et al 2003)
- a physical activity programme (Naylor et al 2006, Simon et al 2006, Simon et al 2004)
- a parental/family component (Lytle et al 2006, Simon et al 2006, Engels et al 2005, Saksvig et al 2005, Anderson et al 2005, Simon et al 2004,)
- healthy food options available through school food services: cafeteria, vending machines, etc. (Lytle et al 2006, French et al 2005, Saksvig et al 2005, Prell et al 2005, Lytle et al 2004, French et al 2004, Kain et al 2004, Hoelscher et al 2004, Perry et al 2004, Rinderknecht and Smith 2004,)

Few benchmark school nutrition health promotions

- CATCH, a three-year programme from grade 3 through to grade 5 in the United States of America (Hoelscher et al 2004, Hoelscher et al 2003, Kelder et al 2005, McKenzie et al 2001),
- Pathways, a three year intervention targeting 8 to 11-year-old indigenous American children (Caballero et al 2003, Davis et al 2001, Gittelsohn et al 2003, Going et al 2003, Steckler et al 2003, Stevens et al 2003), and
- Know Your Body, a six-year programme targeting pupils in grades 1 to 6 in Crete (Manios et al 2002) are all example interventions that are comprehensive, multicomponent, school-based, and focus on diet and physical activity.

All were grounded on constructs from social learning theory with Pathways placing a strong emphasis on cultural identity. The programmes included curricula offered by trained teachers, a physical activity component and healthier meals offered in the school canteen (CATCH and Pathways). There was also a strong parental focus. The fact that teachers implemented the intervention made it sustainable and cost-effective. Of the family based components, events at school were the most successful. These programmes demonstrated significant improvements in knowledge and food choices. Children in the Know Your Body programme demonstrated substantive reductions in intake of dietary fat, particularly saturated fat, and four- to five-fold increases in self-reported leisure-time activity.

Pathways' process evaluation found that the intervention was successfully implemented with good reach, and high coverage and intervention fidelity. These programmes demonstrated the importance of community-based participatory research, and that a careful process of formative assessment is key to effectiveness and long-term success.

School Health Promotion Program in India

School Health program is a program for school health service under National Rural Health Mission, which has been necessitated and launched in fulfilling the vision of NRHM to provide effective health care to population throughout the country It also focuses on effective integration of health concerns through decentralized management

at district with determinant of health like sanitation, hygiene, nutrition, safe drinking water, gender and social concern.

The School Health Programme intends to cover 12,88,750 Government and private aided schools covering around 22 Crore students all over India.

This School health programme is the only public sector programme specifically focused on school age children. Its main focus is to address the health needs of children, both physical and mental, and in addition, it provides for nutrition interventions, yoga facilities and counseling. It responds to an increased need, increases the efficacy of other investments in child development, ensures good current and future health, better educational outcomes and improves social equity and all the services are provided for in a cost effective manner.

Components of School Health Program in India:

Health service provision:

- Screening, health care and referral:
  - Screening of general health, assessment of Anaemia/Nutritional status, visual acuity, hearng problems, dental check up, common skin conditions,
  - Heart defects, physical disabilities, learning disorders, behavior problems, etc.

- Basic medicine kit will be provided to take care of common ailments prevalent among young school going children.
  - Referral Cards for priority services at District / Sub-District hospitals.

    Immunisation:
  - As per national schedule
  - Fixed day activity
  - Coupled with education about the issue
- Micronutrient (Vitamin A & IFA) management:
  - Weekly supervised distribution of Iron-Folate Tablets coupled with education about the issue
  - Administration of Vitamin-A in needy cases.
- De-worming
  - As per national guidelines
  - Biannually supervised schedule

  - Prior IEC
  - Siblings of students also to be covered
- Health Promoting Schools
  - Counseling services
  - Regular practice of Yoga, Physical education, health education
  - Peer leaders as health educators.
- Adolescent health education-existing in few places
  - Linkages with the out of school children
  - Health clubs, Health cabinets
  - First Aid room/corners or clinics.
- Capacity building
- Monitoring & Evaluation
- Mid Day Meal

Therefore, the present school health program in India needs to integrate the nine guideline with respect to nutrition health promotion program in government as well as in non government aided schools. As school based interventions show consistent improvements in knowledge and attitudes, behaviour and, when tested, physical and clinical outcomes. There is strong evidence to show that schools should include a diet and physical activity component in the curriculum taught by trained teachers; ensure parental involvement; provide asupportive environment; include a food service with healthy choices; and offer a physical activity programme. However there is lack of cost-effectiveness research in this area.

The present study was conducted in two middle to high income schools, involving the study subjects aged 10-13 years from Vth, VIth & VIIth classes. The study aimed to assess the nutritional status (overweight, obesity, under weight and normal weight), biochemical profile (lipid and glucose profile) only for overweight and obese, and biophysical parameter (blood pressure) of the study subjects whose parents gave consent for their children to participate in the study. The present study also looked into the dietary and lifestyle pattern of the study subjects outside school hours and on the school campus. Based on the formative research, a nutrition health promotion program was planned to improve the dietary and lifestyle behaviors of the study subjects by providing them enabling environment in the school and conducting awareness and capacity building sessions for them, teachers as well as for their parents.

Therefore, a prospective study was undertaken after the ethical approval from the Department of Foods and Nutrition ethical committee prior to the commencement of the research study (Ethical committee no. F.C.Sc./FND/ME/80). The two schools (experimental and control) with comparable fee structure were randomly selected and the permission to conduct the study in the respective schools was taken from the principal. The fee structure of the experimental and control school for the classes Vth, VIth & VIIth was in the range between 12,000/ to 13,000/- per annum respectively.

The interventions in the form of nutrition health promotion were done in the experimental school while control school was only used to compare the nutritional status (overweight, obesity, underweight normal weight), biophysical parameter (blood pressure) and dietary and lifestyle behaviors at baseline and after intervention. The study was conducted only in classes V-VII, with the study subjects aged 10-13 years. The consent forms, explaining the purpose and methodology of data collection, were distributed to all the study subjects by the researcher (Annexure 1). The consent form was returned back to the researcher after the signature of parents who agreed for their child's participation in the study. The same consent form was also signed by the study subjects who participated in the study. There was no specific inclusion criteria as all the students from classes Vth – VIIth were enrolled in the study whose parents and themselves consented for the participation. The exclusion criteria was that the child should not be suffering from any disease.

The whole study was divided into 3 phases, namely:

PHASE I: Situational analysis in terms of nutrition health content in school curriculum, school ethos and environment of the two selected schools and assessment of the burden of malnutrition among the study subjects from the two schools.

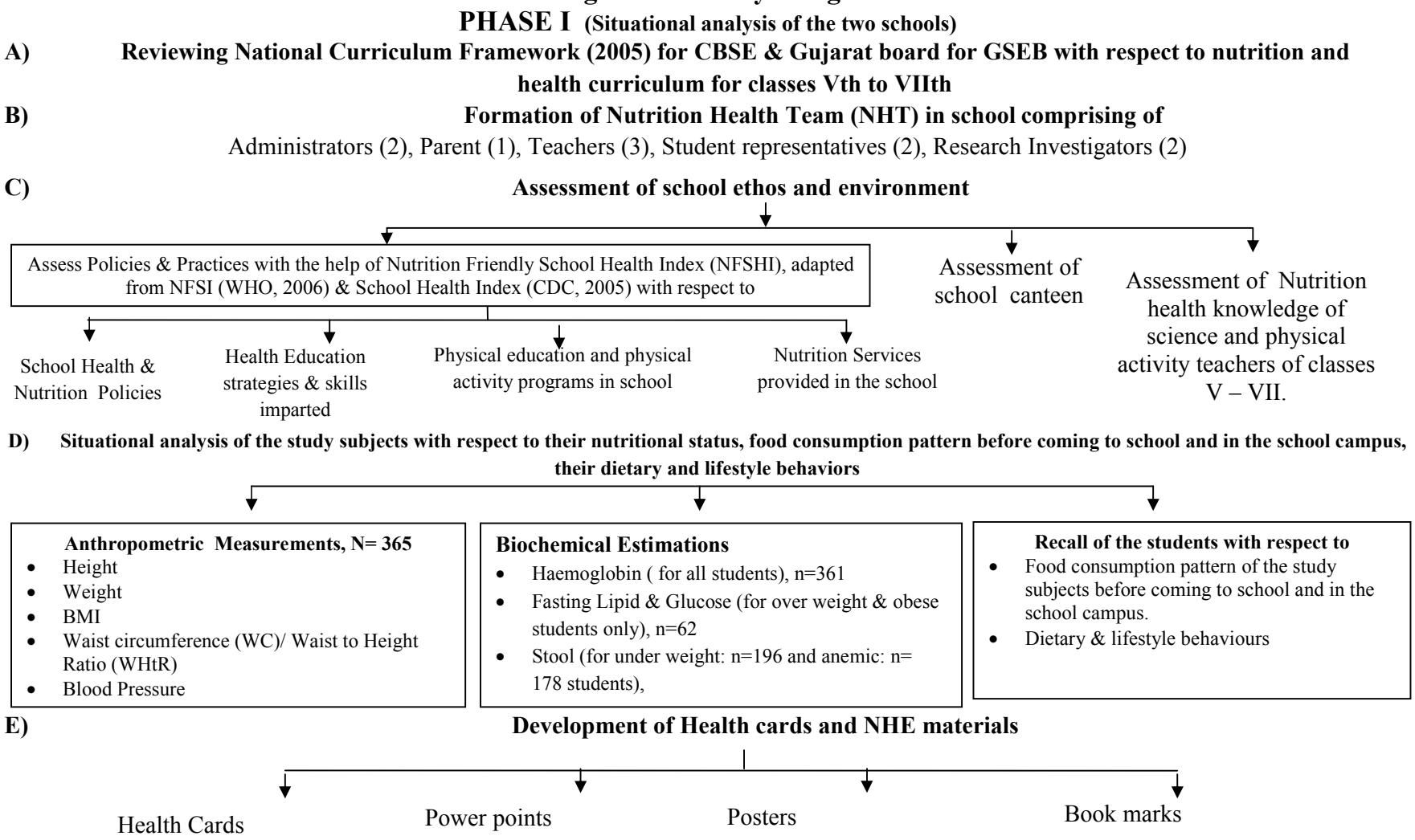
PHASE II: Interventions for creating enabling environment in the experimental school.

PHASE III: Interventions for the students from experimental school & Post intervention data collection from experimental and control school to assess the impact of one and a half years nutrition and health promotion program in a school setting

All these 3 phases were carried out during 1 ½ years school academic calendar, including months when no activities could be carried out due to examinations, annual functions and holidays. The study design, shows the various steps (20 in number) undertaken in the 3 phases. The study did not progress according to the 3 phases one after the other, a need based program was evolved step by step. These steps could be from different phases carried out simultaneously in a given time period. Hence, the time framework details out the continuous implementation of these 20 steps (as seen form the study design) during a given time period. Few steps were carried out simultaneously, though belonging to different phases.

The complete study design and step by step time framework of the study is described below:

Figure 3.1: Study Design



PHASE II

(Intervention for creating enabling environment in the experimental school)

(A) **Orientation meeting with NHT members along with parents with respect to**

- Discussing the results of NFSHI & baseline data
- Feasibility of different programs to be under taken
- Capacity building of NHT members
- Support to be given by NHT to implement Nutrition & Health promotion program

Support given by NHT members to implement the nutrition health promotion program by making a plan for

- Organizing parents- teacher meeting
- Organizing awareness and capacity building sessions with students in the physical activity, drawing & free classes.
- Organizing awareness and capacity building sessions with parents.

(B) **Capacity building of class teachers regarding**

- Awareness for healthy dietary & lifestyle behaviours
- Tiffin auditing with checklist provided

(C) **Planning for a healthy canteen in school by**

- Organizing a meeting with principal, vice principal with canteen contractor for initiating healthy snacks, milk beverages and fruit juices in the canteen.
- Identifying few healthy beverages for replacing unhealthy ones with similar costs.
- 5 Days pilot trial to study the acceptability of providing healthy beverages.
- Availability of the selected healthy beverages in the canteen on regular basis.

(D)

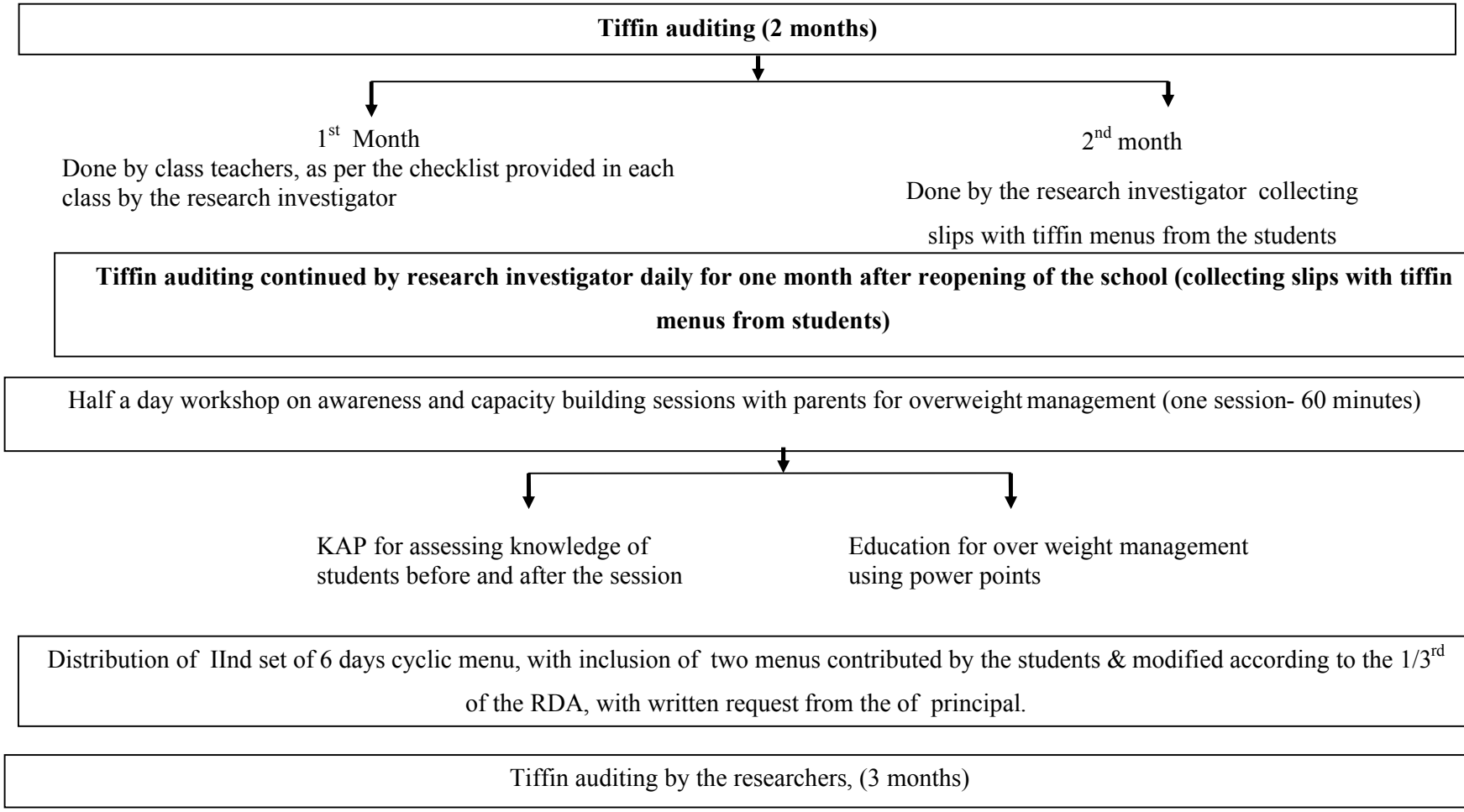
Creating enabling environment in the school by initiating parent's engagement in the nutrition and health promotion program in the school

At baseline, tiffin auditing by research investigator daily for two months (collecting slips with tiffin menus from students)

Half day workshop on awareness and capacity building sessions with parents for underweight management (one session- 2 hours)

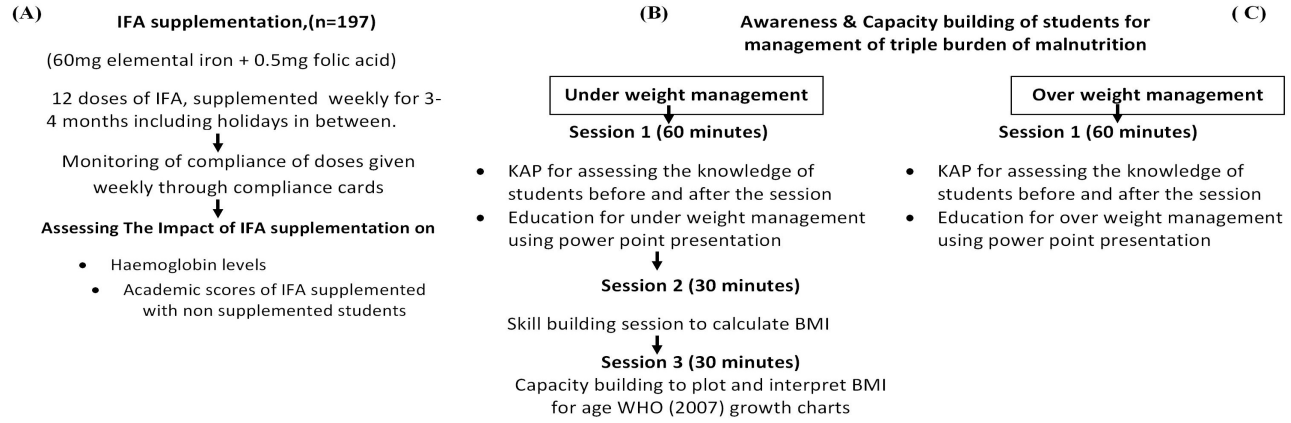
- KAP for assessing knowledge of students before and after the session
- Education for under weight management using power points
- Calculation of BMI
- Plotting of BMI for age WHO (2007) growth chart
- Interpretation of BMI for age WHO (2007) growth charts

Distribution of Ist set of 6 days cyclic menus for tiffins meeting 1/3rd of the RDAs of all nutrients, especially iron, with written request of principal on the need to provide similar type of menus in school tiffins.


Tiffin auditing (2 months)
1st Month
Done by class teachers, as per the checklist provided in each class by the research investigator
2nd month
Done by the research investigator collecting slips with tiffin menus from the students
Tiffin auditing continued by research investigator daily for one month after reopening of the school (collecting slips with tiffin menus from students)
Half a day workshop on awareness and capacity building sessions with parents for overweight management (one session- 60 minutes)
KAP for assessing knowledge of students before and after the session
Education for over weight management using power points
Distribution of IInd set of 6 days cyclic menu, with inclusion of two menus contributed by the students & modified according to the 1/3rd of the RDA, with written request from the of principal.
Tiffin auditing by the researchers, (3 months)

PHASE III

(Interventions for the students from experimental school & Post intervention data collection from experimental and control school to assess the impact of one and a half years nutrition and health promotion program)



D) Post intervention data collection from experimental and control school to assess the impact of one and a half years nutrition and health promotion program in a school setting

(Classes V- VII, with 2 sections each from experimental school and classes V-VII with one section each from control school)

Anthropometric Measurements

*(E: N= 273, C: N=92),

- Height, Weight, BMI for age
- Waist circumference (WC)/ Waist to height ratio (WHtR)
- Blood Pressure

Biochemical Estimations

- Haemoglobin (for all students),* E:N=270, C: N=91
- Fasting Lipid & Glucose (for over weight & obese students only), *E: n=45, C: n= 2

Recall of the students with respect to

- Dietary & lifestyle behaviours

*** E: Experimental school; C: Control school**

Table 3.1: Time frame of the study

Period	Number of months	Steps	Phases being conducted	Activities done	In which schools*	Number of Months/ session required to conduct the activities	Duration of sessions
Jan to March 2008	3	**1**	**Phase I** (Situational analysis)	**A)** Reviewing NCF (2005) & Gujarat Board curriculum for CBSE & GSEB respectively for nutrition and health curriculum for classes Vth to VIIth	School 1& 2		
		2		**B)** Formation of NHT	School 1& 2		
		3		**C)** Assessing school ethos and environment Policies & practices of school related to nutrition & health Assessment of the school canteen Assessment of the nutrition & health knowledge of science and physical activity teachers	School 1& 2		
		4		**D)** Baseline data collection of Anthropometric data Biophysical parameter (Blood pressure) Food pattern just before coming to school and on the school campus Dietary and lifestyle behaviours	School 1& 2		
		5		**E)** Development of Health Cards and IEC materials Health Cards Posters Book marks			

April 2008: exam period; May 2008: Summer vacation; June 2008: School reopens							
July to Dec 2008 (including deepawali holidays). Jan to Feb 2009			**Phase II** (Intervention for creating enabling environment in the intervention school)	**Distribution of health cards**			
July to Dec 2008 (including deepawali holidays). Jan to Feb 2009		**6**	**Phase II** (Intervention for creating enabling environment in the intervention school)	**Orientation meeting with school administration, NHT members and parents with respect to:** • Discussing the results of NFSHI and baseline data • Discussing with NHT & parents about feasibility of different programs to be conducted in the experimental school • Capacity building of NHT members • Support given by NHT to implement Nutrition & health promotion program	School 1	Session 1	2 hours
	6+2	**7**	**Phase III** (Intervention for students)	IFA Supplementation	School 1	3 months	
	6+2	**8**	**Phase II** (Intervention to initiate parent's engagement)	Baseline tiffin auditing by the researcher.	School 1	2 months	
	6+2	**9**	**Phase II** (Intervention for creating enabling environment in the intervention school)	Capacity building of class teachers for tiffin auditing	School 1	Session 1	60 minutes
	6+2	**10**	**Phase II** (Intervention for creating enabling environment in the experimental school)	Awareness and capacity building session for parents for under weight management	School 1	Session 1	2 hours

	6+2	**11**	**Phase II** (Intervention for creating enabling environment in the experimentalschool)	Distribution of planned Ist set of 6 days cyclic menus to parents			
		12	**Phase II** (Intervention for creating enabling environment in the experimentalschool)	Tiffin auditing by teachers	School 1	1 month	
				Tiffin auditing by researcher	School 1	1 month	
	6+2	**13**	**Phase II** (Intervention for creating enabling environment in the experimentalschool)	**Planning for a healthy canteen in school** **13.1:** Meeting with the school administration and canteen person to initiate/identify healthy snacks, milk beverages and fruit juices to be sold in the canteen **13.2:** 5 day pilot trial with heathy milk beverages and fruit juices. **13.3:** Availability of the milk beverages and fruit juices in the canteen.	School 1		
	6+2	**14**	**Phase III** (Intervention for students)	**Under weight management for the students** **14.1:** KAP & Nutrition health education (NHE) session **14.2:** Skill building session for students to assess their own nutritional status	School 1	Session 1 Session 2& 3	60 minutes 30 minutes each

March &April 2009: exam period; May 2009: Summer vacation; June 2009: School reopens							
July to December 2009 (including deepawali vacations)	6	**15**	**Phase II** (Intervention for creating enabling environment in the experimental school)	Tiffin auditing continued by the researcher after summer vacation	School 1	1 month	
	6		**Phase II** (Intervention for creating enabling environment in the experimental school)	Reinforcement of messages through posters	School 1		
	6	**16**	**Phase II** (Intervention for creating enabling environment in the experimentalschool)	Over weight management – KAP & NHE session for parents	School 1	Session 1	60 minutes
	6	**17**	**Phase II** (Intervention for creating enabling environment in the experimental school)	Distribution of IInd set of 6 days cyclic menus			

	6	**18**	**Phase II** (Intervention for creating enabling environment in the experimental school)	Tiffin auditing by the researcher	School 1	3 months	
	6	**19**	**Phase III** (Intervention for students)	Over weight management sessions – KAP & NHE sessions	School 1	Session 1	60 minutes
Jan 2010	1	**20**	**PHASE III (**Post intervention data collection	Post intervention data collection of • Anthropometric data • Dietary and lifestyle behaviours	School 1 & 2	1 month	

*School 1= Experiemntal school

School2= Control school

STEP 1 (Jan to march 2008)

Reviewing National Curriculum Framework (2005) for CBSE and Gujarat board for GSEB for classes Vth to VIIth (Jan to March 2008)

The National Curriculum Framework (NCF 2005) is a framework provided by the National Council of Educational Research and Training (NCERT) in India. The document provides the guidelines for making syllabii, textbooks and teaching practices within the school education programs in India (NCF 2005)

At state level, Gujarat Secondary & Higher Secondary Education Board (GSEB) is responsible for determining the policy- related, administrative, cognitive, and intellectual directions in school education. The main responsibility of the state board includes: academics, conducting examinations, and research & development (GSEB 2008).

The main academic task of GSEB is the preparation of syllabus for secondary schools and also the recommendation of text books to be taught in state government schools.

Hence, the whole document of NCF 2005, and the text books authorized by NCERT and GSEB for classes Vth to VIIth were downloaded for free, and reviewed by the researcher for essential topics covered for nutrition and health education in the curriculum.

STEP 2 (Jan to March 2008)

Formation of Nutrition Health Team (NHT)

A nutrition health team comprises of members from the school community (administration, teachers and students) and family members. It can be created new, use an existing team, if it is there, or create a new subcommittee of the school management council. Hence a new NHT was developed in both the schools having representatives from the school community (administration-2, teacher-1, and students-2), and family (1) along with the researcher.

STEP 3 (Jan to March 2008)

Assessing school ethos and environment

- **Policies & practices of school related to nutrition and health**

The schools health ethos and environment were assessed by the NHT members with the help of pretested nutrition friendly school health index (NFSHI) adapted from self appraisal tool (SAT) of nutrition friendly school initiative framework by WHO **(WHO 2006)**, and school health index (SHI) by Centre for Disease Control **(CDC 2005)**.

The NFSI developed by WHO, is an initiative to tackle the double burden of malnutrition in the school setting. While, SHI, is structured around CDC's model of Coordinated School Health Program (CSHP), highlighting the importance of involving and coordinating the efforts of all 8 interactive components to maintain the well being of young people. The eight components are: health education, physical education, health services, nutrition services, counseling, psychological and social services, healthy school environment, health promotion for staff, and family/community involvement.

Hence, NFSHI, was developed to assess the policies and practices of the schools with the help of adapting the selected four modules of SHI **(Annexure 2).** They were:
MODULE 1: School Health Environment,
MODULE 2: Health Education & Skills imparted,
MODULE 3: Physical Education and Physical Activity Program in the school, and
MODULE 4: Nutrition Services provided in the school.

Responses of each NHT member were ranked as per the guidelines given in NFSHI to conclude their assessment of the policy or the practices as per following classifications:

- Not in place,
- Underdevelopment,
- Partially in place, and
- Fully in place.

In case of disparity in the results obtained from the responses, the results were substantiated by the observations of the research investigators in school.

The components of the four adapted modules are as follows:

MODULE 1: SCHOOL HEALTH POLICIES

Module 1 activity was taken up by the principal and the vice principal of the schools only. With the help of this module, polices and practices of the schools related to nutrition and health were evaluated based on presence or absence of the following:

- *Representative school health committee:*

Representative means that it includes school administrators, health education teachers, physical education teachers, mental health or social services staff members, nutrition services staff members, health services staff members, maintenance and transportation staff members, students, parents, community members, local health departments or organizations, faith-based organizations, businesses, and local government representatives.

- *Written school health policies*
- *Connectedness of the students and staff to the school*

Connectedness is the degree to which students and families feel part of the school community. Students and families feel more connected when they perceive that faculty and staff care about them and when they share responsibility for how well the school functions.

- *Methods to overcome barriers of learning*

Barriers to learning include deficiencies in basic living resources and opportunities for development, psychosocial issues, physical health issues, general stressors, crises and emergencies, difficult transitions associated with stages of schooling. Services to address barriers to learning include mental health, special education, nursing, psychological, and social services; counseling; mentoring; tutoring; assistance in the classroom; orientation for new students; and English language acquisition.

- *Enrichment experiences*

Examples of enrichment experiences include athletics, drama, art, music, vocational education, technology training, student clubs, field trips, student advocacy, and community services. These can take place before, during, and after school hours.

- *Access to physical activity (PA) facilities outside school hours*

Outside school hours means after school, and during evenings, weekends, and school vacations.

- *Prohibition of using PA as punishment and providing food as a reward*

An example of using physical activity as punishment in making students run laps or do push ups as a consequence of inappropriate behavior.

- *Fundraising efforts supportive of healthy eating*
- *Restricting access to foods of minimal nutritional value*

Foods of minimal nutritional value include carbonated soft drinks, chewing gum, water ices, and certain candies such as hard candy, licorice, jelly beans, and gum drops. The U.S Department of Agriculture has defined these foods as providing less than 5% of the U.S. Department of Agriculture recommended daily allowance per serving for protein, vitamin A, vitamin C, niacin, riboflavin, thiamin, calcium, and iron. U.S. Department of Agriculture regulations prohibit the sale of these foods in food service areas during meal times.

MODULE 2: HEALTH EDUCATION

Module 2 activity was taken up by the Vice-Principal, the counselor, student representatives and the parent representative. It was evaluated based on the presence and absence of the following activities:

- *Required health education course*
- *Health education grading*
- *Sequential health education curriculum consistent with standards*

Sequential means a curriculum that builds on concepts taught in preceding years.
Consistent means that the curriculum addresses the key learning objectives identified by the standards.

- *Active learning methodologies used for teaching*

Active learning strategies include interactive teaching methods to encourage student involvement rather than relying solely on a lecture format. Active learning strategies include:

- ✓ supervised practice
- ✓ discussion

- ✓ cooperative learning
- ✓ simulations and learning games
- ✓ teacher and peer modeling
- ✓ role playing
- ✓ goal-setting
- ✓ rehearsal
- ✓ visualization

- *Opportunities to practice skills needed to adopt healthy lifestyles*

Examples of skills needed to adopt healthy lifestyles include:

- ✓ Reading food labels
- ✓ Planning healthy meals
- ✓ Developing a safe, individualized physical activity plan

- *Assignments which encourage student interaction with family and community*

Examples of ways to interact with family members include:

- ✓ Doing homework assignments with parents, guardians, or other family members
- ✓ Conducting surveys of family members
- ✓ Sharing information with family members
- ✓ Exhibiting student projects at school for family viewing
- ✓ Participating in fun family activities related to safe physical activity and healthy eating

Examples of ways to interact with community organizations include:

- ✓ Gathering information about existing community – based services
- ✓ Having students volunteer to help deliver services through community based organizations
- ✓ Participating in community based special events and attending community based organizations after school

- *Credentialed health education teachers*

Credentialed means teachers who have been awarded a credential, by the state, permitting them to teach health education.

- *Professional development in health education*

Professional development means on-site (e.g., school, district) and off-site (e.g., city, state, national) training opportunities.

- *Professional development in delivering curriculum*

It includes topics such as:

✓ Discussion of the curriculum's underlying theory and conceptual framework
✓ Demonstration of the program activities by a skilled trainer
✓ Opportunities to practice curricular activities during training

- *Essential topics on healthy eating*

It includes topics such as:

✓ The relationship between healthy eating and personal health and disease prevention
✓ Food guidance from MyPlate or MyPyramid
✓ Reading and using food labels
✓ Eating a variety of foods every day
✓ Balancing food intake and physical activity
✓ Eating more fruits, vegetables and whole grain products
✓ Choosing foods that are low in fat, saturated fat, and cholesterol and do not contain transfat
✓ Choosing foods and beverages with little added sugars
✓ Eating more calcium-rich foods
✓ Preparing healthy meals and snacks
✓ Risks of unhealthy weight control practices
✓ Accepting body size differences
✓ Food safety
✓ Importance of water consumption
✓ Importance of eating breakfast
✓ Making healthy choices when eating at restaurants
✓ Eating disorders
✓ The Dietary Guidelines for Americans
✓ Reducing sodium intake
✓ How to find valid information or services related to nutrition and dietary behavior
✓ How to develop a plan and track progress toward achieving a personal goal to eat healthfully

- *Essential topics of Physical activity*

It includes topics such as:

- ✓ The physical, psychological, or social benefits of physical activity
- ✓ How physical activity can contribute to a healthy weight
- ✓ How physical activity can contribute to the academic learning process
- ✓ How an inactive lifestyle contributes to chronic disease
- ✓ Health-related fitness, that is, cardiovascular endurance, muscular endurance, muscular strength, flexibility, and body composition
- ✓ Differences between physical activity, exercise, and fitness
- ✓ Phases of an exercise session, that is, warm up, workout, and cool down
- ✓ Overcoming barriers to physical activity
- ✓ Decreasing sedentary activities, such as TV watching
- ✓ Opportunities for physical activity in the community
- ✓ How much physical activity is enough, that is, determining frequency, intensity, time, and type of physical activity
- ✓ Developing an individualized physical activity and fitness plan
- ✓ Monitoring progress toward reaching goals in an individualized physical activity plan
- ✓ How to find valid information or services related to physical activity and fitness
- ✓ How to influence, support, or advocate for others to engage in physical

MODULE 3: PHYSICAL EDUCATION AND PHYSICAL ACTIVITY PROGRAM

Module 3 on Physical Education and Physical Activity Program was administered to The vice Principal, the counselor, student representatives and the parent representative. It was evaluated based on presence and absence of the following:

- *225 minutes of physical education per week*

Physical education means structured physical education classes or lessons, not physical activity breaks or recess and not substitution of participation in a sport team, marching band, etc., for physical education course credit. Physical education is provided by qualified trained teachers.

Physical education classes should be spread over at least three days per week, with daily physical education preferable.

- *Adequate teacher/student ratio*

It means approximately the same number of students per teacher as in other classes.

- *Students active for at least 50% of class time*

At least 50% of the time means at least half of the total time scheduled for a physical education class session.

- *Physical education is enjoyable*
- *Prohibit substitution for physical education*
- *Promote community physical activities*

Examples of community physical activity options include club, teams, recreational classes, special events such as community fun runs, and use of playgrounds, parks, and bike paths.

- *Participation in extracurricular physical activity programs*

Extracurricular physical activity programs include intramural activities, physical activity clubs (e.g., dance, hiking, karate) and interscholastic sports.

- *Physical education grading.*
- *Sequential physical education curriculum consistent with standards*

Sequential means a curriculum that builds on concepts taught in preceding years.

Consistent means that the curriculum addresses the key learning objectives identified by the standards.

- *Individualized physical activity/ fitness plans*

Individualized physical activity and fitness plan means a written plan that contains:

- ✓ Assessment of fitness level (before beginning a new physical activity and fitness plan, individuals should assess their current level of fitness to help avoid injury)
- ✓ Long-term and short-term personal goals for participating regularly in physical activity and maintaining or improving health-related fitness
- ✓ Specific actions to achieve those goals
- ✓ Timeline for taking specific actions, assessing progress, and achieving goals
- ✓ Methods that will be used to record actions taken and assess progress
- ✓ Rewards for achieving goals

MODULE 4: NUTRITION SERVICES IN THE SCHOOL

Module 4 of the School Health Index (SHI) evaluates the existing Nutrition services in the school which was administered to whole NHT (Principal, Vice-Principal, Counselor, student representatives and to the parent representative). The nutrition services were evaluated with respect to the following facilities:

- *Breakfast and lunch services*

Nutritious breakfast and lunch programs means school- sponsored or district – sponsored programs that are designed to meet the U. S. Department of Agriculture School Meal Nutrition Standards

- *Variety of foods in school meals*

Do school meals include a variety of foods that meet the following criteria?

- ✓ Go beyond the National School Lunch Program requirements to offer one additional serving per week from any of the 3 vegetable subgroups (dark green, red and orange, dry beans and peas)
- ✓ Offer a different fruit every day of the week during lunch (100% fruit juice can be counted as a fruit only once per week)
- ✓ Serve fresh fruit at least 1 day/week
- ✓ Ensure that at least two-thirds of grains offered each week are whole grain rich
- ✓ Offer at least 3 different types of whole grain-rich foods each week
- ✓ Offer only nonfat (flavored or unflavored) and low-fat (unflavored) fluid milk each day

<u>Breakfast</u>

- ✓ Offer at least 3 different fruits and vegetables each week
- ✓ Serve fresh at least 1 fruit per week
- ✓ Ensure that at least 50% of grains offered per week are whole grain rich
- ✓ Offer only nonfat (flavored or unflavored) and low-fat (unflavored) fluid milk each day

NOTE: A school meal is a set of foods that meets school meal program regulations. This does not include à la carte offerings.

- *Low fat meals*

Low fat means either ½ % or 1% fat.

- *Food purchasing and preparation practices to minimize fat includes:*

✓ Spoon solid fat from chilled meat and poultry broth before use

✓ Use specifications requiring lower fat content in ordering prepared foods such as hamburgers, pizza, chicken nuggets, etc.

✓ Rinse browned meat with hot water to remove grease before adding to other ingredients

✓ Remove skin from poultry before or after cooking

✓ Roast, bake, or broil meat rather than fry it

✓ Roast meat and poultry on rack so fat will drain

✓ Use low-fat or reduced-fat cheese on pizza

✓ Prepare vegetables using little or no fat

✓ Cook with nonstick spray or pan liners rather than with grease or oil

✓ Offer low-fat salad dressings

✓ Use frozen vegetables or low-sodium canned vegetables, instead of regular canned vegetables

✓ Use standardized recipes that are low in fats, oils, salt and sugars

✓ Use other seasonings in place of salt

- *Promote healthy food and beverage choices, like*

✓ Place in more prominent positions than less nutritious choices

✓ Offer at competitive prices compared with less nutritious choices

✓ Display nutritional information about available foods

✓ Display promotional materials such as posters

✓ Highlight healthy cafeteria selections in menus that are distributed or posted

✓ Offer taste-testing opportunities

✓ Make school-wide audio or video announcements

✓ Have contests (e.g., recipe competitions)

✓ Engaging students in deciding what foods and beverages are offered

- *Adequate time to eat meals*

It means at least 10 minutes to eat breakfast and at least 20 minutes to eat lunch.

- *Collaboration between service staff and teachers, means*
  - ✓ Participate in design and implementation of nutrition education programs
  - ✓ Display educational and informational materials that reinforce classroom lessons
  - ✓ Provide food for use in classroom nutrition education lessons
  - ✓ Provide ideas for classroom nutrition education lessons
  - ✓ Teach lessons or give presentations to students
  - ✓ Provide cafeteria tours for classes

- *Clean and safe canteen, means*
  - ✓ Physical structure (e.g., walls, floor covering) does not need repairs
  - ✓ Tables and chairs are not damaged and are of appropriate size for all students
  - ✓ Seating is not overcrowded (i.e., never more than 100% of capacity)
  - ✓ Rules for safe behavior (e.g., no running, no throwing food or utensils) are enforced
  - ✓ Tables and floors are cleaned between lunch periods or shifts
  - ✓ Age-appropriate decorations are used
  - ✓ Appropriate practices are used to prevent excessive noise levels (e.g., no whistles)
  - ✓ Smells are pleasant and not offensive
  - ✓ Appropriate eating devices are available when needed for students with special health care needs

- *Preparedness for food emergencies, for*
  - ✓ Choking
  - ✓ Natural disasters (e.g., electrical outages affecting refrigeration)
  - ✓ Medical emergencies (e.g., severe food allergy reactions, diabetic reactions)
  - ✓ Attempts to introduce biological or other hazards into the food supply
  - ✓ Situations that require students or others to shelter in the school

The SHI is a school's self-assessment tool. It is not meant to be used to compare schools. The results of the entire NHT were then compiled using score cards (Annexure 3). Responses for each component, which were greater than 75% of the

responses, were considered as strengths while less than 75% were considered as weaknesses.

Hence, after analyzing the responses of the four modules for all the respondents, the strengths and weaknesses of the schools were identified. In the experimental school, the weaknesses identified were discussed with the school administration and parents to plan a nutrition and health promotion program in the school.

- **Assessment of canteen services in the school campus**

School canteen was evaluated for the type and quality of food served using a structured pretested questionnaire (Annexure 4). The questionnaire was targeted at obtaining information regarding sales trend of popular food items and beverages in the school. Cleanliness and hygiene practices were also observed by the research investigators by a checklist developed for the purpose.

- **Assessment of nutrition health knowledge of science and physical activity teachers of classes V – VII**

For assessing the Knowledge, Attitude and Practices of teachers for healthy dietary and lifestyle behaviors, a structured pretested questionnaire (Annexure 5) was used which aimed at obtaining information pertaining to the five study behaviors in the study subjects namely, consuming carbonated (sweetened) beverages less than 3 days per week, having fast food outside home for less than 3 days per week, consuming fruits and vegetable more than 400gm per day, performing physical activity for 60 minutes, limiting television viewing to 2 hours per day. For this purpose, Science, physical activity (PA) teachers, and the school counselor were purposively selected as these teachers were most likely to discuss topics of nutrition and health with the students.

STEP 4 (Jan to March 2008)

Situational analysis of the nutritional status, food consumption pattern before coming to school and in the school campus, their dietary and lifestyle behaviors of the study subjects

Nutritional Status

Anthropometric measurements of all the study subjects were taken in the class only, in their free classes. The measurements included height, weight, and waist circumference (WC), which were recorded using standard procedures, as describes below:

- ***Height***

A flat floor against a perpendicular wall was identified in a hall and it was marked using fibre tape to an accuracy of 0.1 cms. The study subjects were asked to stand bare feet on a flat floor against a perpendicular wall with feet parallel and with heels, buttocks, shoulders and back of the head touching the wall. The head was held comfortably erect and marked for measuring height with a flat scale touching the top of the head horizontally and its vertical edge flat against the wall.

- ***Weight***

A standardized bathroom scale was used for recording the weight of the study subjects. The equipment was checked for its sensitivity with known weights. The weight was taken in school uniform without shoes, jumpers, sweaters etc. The study subjects were asked to stand on a scale with weight evenly balanced on both the feet and the feet about 25-30 cm apart.

- ***Body Mass Index (BMI)***

BMI was calculated using the following formula: BMI = Weight (kg) / Height (m^2). Classification of the study subjects as overweight (including obesity), underweight and normal weight were done based on their BMI for age classification (Annexure 5) according to WHO 2007 references (De Onis et al 2007).

- ***Central Obesity***

Central obesity was identified by two indicators, namely waist circumference and waist to height ratio (WHtR).

- ***Waist Circumference (WC)***

The measurements were done midway between the lower rib margin and iliac crest i.e measurement of waist at its narrowest point, with help of a fibre glass tape. The study subjects were asked to remove their sweaters and belts and then waist circumference

was measured. High WC was classified using IDF classification (Fernandez et al 2004) as given in (Annexure 6).

- ***Waist to height Ratio (WHtR)***

It was calculated with the help of the following formula : WHtR = Waist circumference (cm) / Height (mt) and high WHtR was identified using ≥ 0.5 cut off **(McCarthy and Ashwell 2006)**.

- ***Blood Pressure (BP)***

Blood Pressure was taken after obtaining 15 days training from university chief medical officer (CMO), who certified the researcher's ability to take apt B.P readings (Annexure7). The Blood pressure measurement was done by the sphygmomanometer, after resting the study subjects for 10 minutes. Two consecutive readings after an interval of 5 minutes were taken in sitting position and then averaged. Since the measurements were done in school setting, it was not possible to take three separate readings due to school permissions and restricted time available. The fourth report on diagnosis, evaluation, and treatment of high blood pressure in children and adolescents (NIH 2005) was used to classify pre hypertension & hypertension amongst the study subjects (Annexure 6).

Biochemical Estimation

- ***Haemoglobin Estimations***

Haemoglobin estimation was carried out on all the study subjects to map the prevalence of anaemia by a reputed laboratory (Thyrocare) in Vadodara, by Cyanmethaemoglobin method.

Principle: Potassium ferricyanide oxidises haemoglobin (Fe^{++}) to methaemoglobin (Fe^{+++}) and cyanide ion reacts with oxidised form to yield cyanmethaemoglobin. This absorbs at 540 nm and is very stable.

Procedure: The subject was instructed to close her finger tightly, a tourniquet was applied, the appropriate vein was selected and after cleaning the area with spirit, venous blood was collected in 2ml syringe and transferred into vials containing 10% EDTA. Cotton swab with spirit was given to the subject for applying on venous puncture site for a few minutes. A micro pipette was used to pippet out 0.02ml of

blood transferred into the test tube containing 5ml of Drabkin reagent and haemoglobin was estimated for each sample at 540 nm. Haemoglobin was calculated in g/l using the following formula:

$$\text{Hb (g/l)} = \frac{A^{540} \text{ of test sample}}{A^{540} \text{ of standard}} \times \frac{\text{Concentration of standard (mg/l)}}{1000} \times \text{Dilution factor}$$

Cut off used:

The study subjects were classified according to their haemoglobin status as anemics or non anemics and according to their severity of anemia based on the cut off (Annexure 6) given by WHO (WHO 2007) .

- ***Lipid Profile***

After classifying the study subjects into their nutritional categories of overweight, obese, normal and underweight, Lipid profile estimations were carried out only on overweight and obese subjects to map the prevalence of dyslipidaemia as they are predisposed to a higher risk. For withdrawal of blood for lipid estimations, parental consent was again obtained (Annexure 8). Lipid profile was carried out only on those study subjects whose parent's consented for the estimation. Also parents were requested to be present with their children at the time of withdrawal of blood.

The study subjects taking the test were instructed to undertake 12 hours fasting. Fasting venous blood samples of the study subjects were collected by a trained technician of a reputed laboratory (Thyrocare) using disposable needles and syringes. After the withdrawal of the blood, immediately the subjects were given one banana and flavoured milk. Serum was used to estimate the following biochemical parameters:

Estimation of Triglyceride

Principle: The estimation of serum triglycerides was done using GPO method Triglycerides are hydrolyzed by lipase to glycerol and free fatty acids. Glycerol is phosphorylated by ATP in the presence of glycerol kinase (GK) to Glycerol 3-Phosphatic Oxidase which is oxidized by the enzyme, Glycerol -3 Phosphatic Oxidase producing Hydrogen Peroxidise which reacts with 4-Amino Antipyrine and 3,5 Dichloride 2 Hydroxy Benzene Sulphonic Acid (DHBS) in the presence of enzyme

Peroxidase (POD) to produce red quinoneimine dye. The intensity of the color developed is proportional to the triglyceride concentration in the sample which is read at 546 nm.

Triglyceride + H_2o $\xrightarrow{\text{Lipoprotein Lipase}}$ Glycerol + Fatty Acid

Glycerol + ATP $\xrightarrow{\text{Gk}}$ Glycerol-3-P + Adp Mg +2

Glycerol 3-Phosphate + O_2 $\xrightarrow{\text{GPO}}$ Dihydroxy Acetone + H_2o

H_2O_2 + Aminoanitipyrine + DHBS $\xrightarrow{\text{POD}}$ Quinoneimine + H_2O

Total cholesterol

Principle: Cholesterol esterase hydrolyses cholesterol esters. Free cholesterol is oxidized by Cholesterol Oxidase (CO) to cholest-4-en-3-one and hydrogen peroxide. Hydrogen peroxide produced, couples with 4-amino antipyrine and phenol in the presence of peroxidase to form a pink coloured quinoneimine dye. The intensity of the color developed is proportional to the triglyceride concentration in the sample which is read at 505 nm.

Cholesterol ester + H_2O $\xrightarrow{\text{CE}}$ Cholesterol +Fatty Acid

Cholesterol+ O_2 $\xrightarrow{\text{CO}}$ Cholesterol 4-en3-one +H_2O

$2H_2O_2$+ 4-aminoantipyrine + Phenol $\xrightarrow{\text{POD}}$ Quinoneimine dye + $4H_2O$

High Density Lipoprotein Cholesterol (HDL-C)

High-density lipoprotein cholesterol (HDLC) was estimated after binding anti-human β lipoprotein antibody to (apolipoprotein-B containing) lipoproteins (LDL, VLDL and chylomicrons) other than HDL. This was followed by reaction by cholesterol esterase yielding free cholesterol. Cholesterol oxidase coupled with free cholesterol yields Cholesterol 4-en3-one which is made to react with 4-aminoantipyrine + Phenol in presence peroxidase to form a pink coloured quinoneimine dye. The intensity of the color developed is proportional to the triglyceride concentration in the sample which is read at 505 nm.

Very Low Density Lipoprotein Cholesterol (VLDL-C)

It was calculated by difference VLDL-C = TG/5

Low Density Lipoprotein Cholesterol (LDL-C)

It was calculated by Friedlewald's formula LDL-C in mg% = TC-HDL-TG/5

- ***Fasting Blood Glucose***

Blood glucose estimations were done on whole capillary blood samples obtained by finger pricking using Thyrocare's Blood Glucose Test Strips. Each strip is sensitive to only D-glucose and is coated with 20 units of Glucose Oxidase and 0.12 mg of potassium ferricynide. The range for measuring blood glucose lies between 20-600 mg/dl with a sensitivity of 1 mg/dl and testing time of 15 seconds.

Principle: Glucose in the blood mixes with the chemicals coated on the strip and produces a small electronic current. The amount of current produced is specific to the amount of Glucose present in the blood. The glucose meter measures the current and displays it on the digital screen.

Cut offs used

Abnormal lipid profile was identified using ATP III and AHA classification (NIH 2005), while glucose intolerance was identified using International Diabetes Association classification (IDF 2007). The cut off values are given in (Annexure 6).

- ***Stool Examination***

Stool examination was done for only underweight (n=196) and anemic (n=178) study subjects to identify any parasitic infections, which could help in identifying the need, if any, of giving antihelminthic treatment before starting IFA supplementation.

Food consumption pattern before coming to school and in the school campus, dietary and lifestyle behaviors of the study subjects

A semi structured pretested questionnaire (Annexure 9) adapted from WHO's Global School Health Survey (GSHS) was used to elicit information from the study subjects regarding their food consumption pattern before coming to the school and in the school campus (tiffin/ canteen), and their dietary & lifestyle behaviours (WHO 2009).

STEP 5 (Jan to March 2008)

Development of Health cards and NHE materials

Based on the results of the formative research, Health card **(Annexure 10)** was developed to inform parents and the study subjects also about their nutritional status. The content of the health card was same, however, to recognize normal weight, under weight, over weight and obese subjects, front side different colored strips were used. They were:

1. Green: belonged to normal weight category of the study subjects
2. Red: belonged to underweight category of the study subjects
3. Yellow: Overweight and obese subjects

After, completing all the health cards with the students' information pertaining to nutritional status, they were duly signed by the principal of the schools and then distributed among the study subjects. They were asked to get the health cards signed by their parents and then return them back to the researcher for further entries.

NHE materials

Later, power point presentations pertaining to malnutrition (underweight, overweight including obesity, and anemia) management were prepared for the students and parents (Annexure 11, 12). To reinforce the messages, posters and book marks were made with key messages (Annexure 13). Posters were put up on the notice board, while book marks were distributed to all the students of the class irrespective of the enrollment of the study subjects.

STEP 6 (July to December 2008)

Orientation meeting with NHT members along with parents

- **Discussing the results of NFSHI & baseline data**

An orientation meeting, of 2 hours was conducted for NHT and parents to discuss the results of the NFSHI, in terms of weaknesses of the school and the baseline data of the students. The discussions concentrated on the role and responsibilities of NHT and parents in school health promotion program. It also helped the researcher to identify

the various components of the promotion program which could be feasible to conduct on the school campus with the help of school community (teachers and canteen staff)

The orientation session also discussed the following issues:

- Magnitude, causes & consequences of double burden of malnutrition among the students
- Importance of initiating a healthy meal programme in school
- Need to change canteen menus
- Importance of participation of parents in school nutrition health programme
- Importance of IFA Supplementation

In the meeting, all the suggestions to improve the nutritional status of the students were agreed by both parents and the administration. However, the administration was hesitant to initiate a completely new programme of healthy school meals due to administrative difficulties. Looking at the parent's interest in the programme, administration suggested an alternative strategy where parents could take initiative. Hence, healthy tiffin menus (Annexure 14), as suggested by the researcher was initiated. The suggestion of healthy tiffin menus, was unanimously accepted by the parents in the meeting and planned 6 days cyclic menus (fulfilling 1/3rd of the RDA for all the nutrients, especially for iron) were provided to mothers, with an appeal to follow it as far as possible.

After the meeting, to obtain parents' written consent for various programs as discussed in the meeting, letters were sent to parents through the students and then collected back (Annexure 15). The tiffin menus were also sent to parents along with a set of 6 days cyclic menus (Annexure 16).

Planning meetings with support from NHT members to implement the nutrition promotion program.

After the orientation session of the NHT members and parents, NHT helped to organize and implement the nutrition and health program to control the triple burden of malnutrition among students and improve the environment of the school. They also helped in conducting awareness sessions for parents and students during free classes.

The day, time and venue for the above mentioned activities was first discussed with the NHT members and then organized.

STEP 7 (July to December 2008)

Iron folic acid (IFA) supplementation

Results from the formative research showed widespread prevalence of anemia, hence, weekly Iron Folic Acid (IFA) tablets (60 mg elemental iron+ 0.5 mg folic acid) for 3 to 4 months was given to all the students irrespective of their nutritional status, after obtaining a written consent from their parents (Annexure 17).

Monitoring the compliance of IFA tablets

Ingestion of the tablet was supervised by the researchers and the data was recorded in the IFA supplementation compliance checklist against each study subject's name to assess the effective number of days each study subject received and consumed the tablets. In order to determine the compliance of the IFA tablets amongst the study subjects, the criteria given in the table 3.2 was used.

Table 3.2: Criteria to classify the compliance of IFA supplementation

Compliance	No. of tablets
Very good	11
Good	9-10
Average	8
Poor	<8

Assessing the impact of IFA supplementation

The impact of IFA supplementation after 3 to 4 months was assessed with respect to the following parameters:

- On haemoglobin status, and
- On academic performance.

STEP 8 (July to December 2008)

Conducting baseline tiffin auditing by the researcher

Tiffin auditing was done to know the pattern of food brought by the study subjects given by their mothers. It was done by categorizing the tiffin menus as healthy (cooked: paratha sabji, thepla, sabudana khichdi etc or uncooked: bread jam, bread butter, cheese sandwhich, khakra etc) and unhealthy (cooked: maggi, noodles, franky, veg roll, muthia etc or uncooked: mamra, fryms, biscuits etc). For this, the researchers collected slips from the students, which mentioned the content of their tiffin. This was done everyday for 2 months.

The results were calculated as: Number of observations X number of days of observations.

STEP 9 (July to December 2008)

Capacity building of (class) teachers. (one session for 60 minutes)

As one of the strategies discussed in the orientation meeting was, involving parents also in the promotion program, it was identified that their participation could be assessed by auditing tiffin menus in the school. Therefore, the capacities of the class teachers were built to monitor the tiffins brought by the study subjects in the class. Separate files with the checklist (Annexure 18) comprising names of all the students from each class were made. The checklist was made according to the food groups to be brought daily. Every morning after taking the attendance of the class, teachers were expected to monitor the tiffins of each study subject with the help of the provided checklist.

One disadvantage of the method was that, teachers found this activity very time consuming which compromised on their teaching. This activity could take place just for a month and later the class teachers were apprehensive to monitor the tiffins.

STEP 10 (July to December 2008. Jan to Feb 2009)

Half day workshop on awareness and capacity building sessions with parents for underweight management

Parents of all the adolescents were contacted and counseling session was conducted with those who came for the session. That is, for the first session only 60 parents (both father and mother) came for the counseling.

Capacity building sessions were organized for parents who were present, with the help of a power point presentation **(Annexure 19)** to build their capacities to manage their children's under nutrition. For this workshop, the letters of invitation was sent two days before the session **(Annexure 20)**.

Before starting the session, their knowledge was assessed by a semi structured pretested KAP questionnaire (Annexure 21). The education session comprised of the following:

- What is adolescent age?
- Why adolescent period is important.
- Consequences of malnutrition (under nutrition & over nutrition)
- Why nutrition is important for adolescents
- Causes and consequences of under weight and anemia
- Preventive measures (dietary and lifestyle) for under nutrition
- Sources of iron and vitamin C rich foods
- Preparation of healthy meals.

Their capacities were also built for assessing their children's nutritional status by teaching them how to calculate BMI, plot on BMI for age (WHO 2007) growth charts, and finally interpret the results.

STEP 11 (July to December 2008. Jan to Feb 2009)

Distribution of planned (1st set) 6 days cyclic menus for tiffins meeting 1/3rd of the RDAs of all nutrients, especially iron.

Efforts were initially made to start a healthy school meal program and for this a parent teachers meeting was organized. However, after the deliberations of the meeting, consensus was reached with parents and school authorities to distribute planned 6 days cyclic menus to parents who will ensure that the meal brought from home by the students was healthy and as per the guidelines suggested in the menus. These six menus **(**Annexure 14) were planned to fulfill 1/3rd of the RDA of the adolescents with special emphasis to make the menus iron rich. To make the menus iron rich, 5 gram of gardencress seed powder (roasted and grinded) was sprinkled in all the menus while cooking. Hence, the planned 1st set of 6 days cyclic menus were:

1. Rajmah chawal & one fruit (seasonal)
2. Pau bhaji & fruit (seasonal)
3. Mixed veg pulao, curd & fruit (seasonal)
4. Four puris, channa, curd & fruit (seasonal)
5. Veg upma and fruit (seasonal)
6. Stuffed paratha with curd & fruit (seasonal)

STEP 12 (July to December 2008, Jan to Feb 2009)

Tiffin auditing

After distributing the Ist set of 6 days cyclic tiffin menus, the auditing was carried out by teachers, who were trained to do tiffin auditing with the help of checklist (Annexure 18). This activity could not be sustained as teachers found it difficult to take up tiffin auditing on regular basis due to pressures of finishing their course. However, the teachers could do it only for a month, and later, it was taken up by the researchers who again collected slips (having details of the tiffin menus) from the study subjects.

STEP 13 (July to December 2008. Jan to Feb 2009)

Planning for a healthy canteen

The school canteen was also evaluated on the type and sales trend of the quality of food served in the canteen. An effort was made to introduce healthy low fat milk beverages (butter milk, flavoured milk and sweetened butter milk) along with juices in the canteen. For this a meeting with the principal, vice principal and the canteen contractor was organized for initiating healthy snacks, milk beverages and fruit juices in the canteen. After an hour long discussion, few healthy beverages with similar costs to the existing unhealthy beverages were identified for replacement in the canteen. The acceptability of the identified healthy beverages to be replaced in the canteen was assessed by a 5 day pilot trial.

This five day pilot trial was under taken with healthy beverages like – Butter milk, flavoured milk, lassi, fruit juices, which was made available to all the students by the researchers in the recess.

STEP 14 (July to December 2008. Jan to Feb 2009)

Under weight management programme for the study subjects

Three capacity building sessions for each class, in the period of two months could be conducted. The duration and the content of the above sessions are as under:

Session I: The study subjects and teachers of all the sections of V - VII (6 sections) were given 60 minutes interactive session each with the help of power point presentation on under nutrition management. The sessions were conducted according to the availability of the study subjects in their free periods. A semi structured questionnaire was used before and after the session to assess the impact of interactive session on their knowledge level (Annexure 22).

Key messages of the interactive session for under nutrition management were:

- What is adolescent age?
- Why adolescent period is important.
- Consequences of malnutrition (under nutrition & over nutrition)
- Why nutrition is important for adolescents
- Causes and consequences of under weight and anemia
- Preventive measures (dietary and lifestyle) for under nutrition
- Sources of iron and vitamin C rich foods

After a gap of one or two days the sessions II & III consisted of practice/ skill building sessions for the study subjects to identify their own nutritional status.

Session II: Another 30 minutes interactive session was conducted which concentrated on building the capacities of the study subjects to calculate the BMI from the weight and height information. The study subjects , who were aware of their weight and height, calculated their own BMI. The calculations done by them were checked by the investigator.

Session III: Another 30 minutes interactive session was conducted to build their capacities to plot BMI for age on the provided BMI for age, WHO 2007 percentile graphs). This session was conducted immediately after the second session.

Hence, session I (60 minutes) was conducted separately, while sessions II & III (30 + 30 minutes) were conducted together.

To reinforce the messages, IEC materials (posters and bookmarks) were made (Annexure 13). Book marks with key messages on healthy dietary and lifestyle behaviours to be followed were distributed to all the study subjects at the end of capacity building sessions. Similarly, the 8 posters made were put up on the notice board. They are as follows:

1. Adolescents and malnutrition
2. Balanced diet and five food groups
3. Cereals and whole grains
4. Whole pulses and legumes
5. Milk and milk products, fruits and vegetables
6. Why salt should be avoided
7. Why sugar and fat should be avoided
8. Benefits of physical activity

STEP 15 (July to December 2009)

Continuation of tiffin auditing by the researcher at the beginning of new academic session

In the beginning of the next new academic session, after a break of 4 months due to exams and summer vacation, efforts were made to assess the quality of meals brought to school by auditing tiffins for 1 month by the researcher. The same procedure was followed as earlier (collecting slips with tiffin menus from each student).

STEP 16 (July to December 2009)

Half a day workshop on awareness sessions with parents for overweight and obesity management

In this session also the letters of invitation were sent two days before the session (Annexure 23). This second nutrition and health education was organized for the parents to build their capacities to manage their children's over weight and obesity. Before starting the session, their knowledge was assessed by a semi structured pretested KAP questionnaire (Annexure 24). The education session comprised of the following:

- Causes and consequences of over nutrition (over weight & obese)

- What is a balanced diet
- What are the five food groups to be included in the diet daily
- What is a healthy food pyramid
- Preventive measures (dietary and lifestyle) for over nutrition management.

A training module was developed for weight management for parents **(Annexure 25)**.

STEP 17 (July to December 2009)

Distribution of IInd set of 6 days cyclic tiffin menu

After analyzing the results of step 15, a second set of 6 days cyclic tiffin menus was distributed, having two recipes contributed by the parents of the students **(annexure 26)**. These two recipes were, first- beet theple with curd and seasonal fruit and second- veg sevai and a seasonal fruit. After the recipe was obtained from the mothers, the recipe which was easy to cook was again modified by the researcher to meet 1/3rd of the RDA and iron requirement. The IInd set of cyclic menus were sent to mothers along with a request letter signed by the principal urging the mothers to send school tiffin based on the planned menus sent to them.

1. Rajmah chawal & one fruit (seasonal)
1. Pau bhaji & fruit (seasonal)
2. Mixed veg pulao, curd & fruit (seasonal)
3. Beet thepla with curd & fruit (seasonal)
4. Veg sevai and fruit (seasonal)
5. Stuffed paratha with curd & fruit (seasonal)

STEP 18 (July to December 2009)

After the distribution of IInd set of 6 days cyclic menus, the tiffin auditing was done for 3 months to monitor the trend of tiffin menus. It was carried out by the researcher only (following the same procedure by collecting the slips).

STEP 19 (July to December 2009)

Over weight and obesity management programme for the students

The study subjects of sections of VI - VIII (the same student from V to VII were followed up in the new school session) were given 60 minutes interactive session each with the help of power point presentation on over weight and obesity management. A

semi structured questionnaire was used before and after the session to assess the impact of interactive session on their knowledge level (Annexure 27).

Key messages of the interactive session for over weight and obesity management were:

- Causes and consequences of over nutrition (over weight & obese)
- What is a balanced diet
- What are the five food groups to be included in the diet daily
- What is a healthy food pyramid
- Preventive measures (dietary and lifestyle) for over nutrition management.

STEP 20 (Jan 2010)

Post intervention data collection from experimental and control school

The complete data on anthropometric measurements, biochemical parameters and dietary and lifestyle behaviours of the study subjects, was collected post intervention to assess the impact of nutrition and health promotion program in a school setting.

Statistical analysis

Data was entered in Microsoft Office Excel Worksheet (2003). Means, standard deviations, percentages were calculated. Relationships and comparison of groups were done by applying certain tests (Chi square, Fischer Test, Mcnemar Test). Complete analysis was done by SPSS 16.0 package. Levels of significance selected were * $P \leq 0.05$, ** $P \leq 0.01$ and *** $P \leq 0.001$.

This chapter presents the results of the following study conducted in two schools with the study subjects belonging to middle to high economic strata (MHSES). The study involved adolescents aged 10-12 years, the last window of opportunity to attain growth and development and influence healthy dietary and lifestyle behaviours in school setting where teachers and parents can play a significant role. Hence, the study was conducted in Three phases. The first phase included situational analysis in terms of reviewing national and state school curriculum related to nutrition and health education, understanding school ethos and environment of the selected schools and screening of the study subjects from classes Vth to VIIth, to assess the burden of malnutrition (under weight, over weight and anemia). Then based on the results of the prevalence of malnutrition among the study subjects of the selected schools, nutrition health promotion program was planned in the next three phases, to be implemented in the school setting, where all the study subjects could be targeted at one time. The intervention aimed at creating enabling environment in the school using various approaches (capacity building of teachers & parents and efforts to improve canteen services) and improving student's knowledge, attitude and practices by various forms of Nutrition Health Education (NHE) materials (health cards, power points, posters, and book marks), and IFA supplementation.

Therefore, the three phases of the study were:

PHASE I: Situational analysis in terms of school curriculum, school ethos and environment of the two selected schools and assessment of the burden of malnutrition among the study subjects from the selected two schools.

PHASE II: Interventions for creating enabling environment in the experimental school

PHASE III: Interventions for the students from experimental school & Post intervention data collection from experimental and control school to assess the impact of one and a half years nutrition and health promotion program in a school setting

The two study schools were co-educational. The experimental school, had both English and Gujarati as teaching medium, however, the subjects belonging to only English medium were enrolled in the study. While the control school had only English as teaching medium, hence all the subjects from class Vth – VIIth were included in

the study. The total number of subjects from the experimental school enrolled in the study were 273, while from the control school were 92. Both the schools were under Gujarat Secondary & Higher Secondary Education Board (GSEB) and therefore the GSEB curriculum was also reviewed and compared with the topics covered in Central Board of Secondary Education (CBSE). Also efforts were made to review guidelines given by center for disease control Atlanta USA to compare it with International standards.

Before elaborating the results of the above mentioned three phases, table 4.1.1 describes the profile of the study subjects from the two selected schools. The table clearly shows that majority (94.8%) of the study subjects from both the schools were in their pre adolescent phase (10-13 years). In the experimental and control school 95.6% and 92.4% of the study subjects respectively, were in the age group of 10-13 years, the pre adolescent years.

Looking into the gender distribution of the study subjects (table 4.1.1), boys were almost double (66.3%) in proportion than girls (33.7%) in both the schools. The same trend of boys being more than girls, was observed in the experimental school (68.9% vs 31.1%) and control school (58.7% vs 41.3%) also. The overall distribution of the study subjects, with respect to religion showed (table 4.1.1), three quarters (75.9%) of the subjects belonged to Hindu religion, while 15.3% and 8.2% belonged to Christian and Muslim religions respectively.

The results of the following phases are as follows:

Table 4.1.1: Age, gender and religion profile of the study subjects from the selected two schools

Variables	Experimental School (N=273)	Control School (N=92)	Total (N=365)
	% (n)	% (n)	% (n)
AGE (years)			
< 10	2.2 (6)	0 (0)	1.6 (6)
10 – 13	95.6 (261)	92,4 (85)	94.8 (34.6)
14 - 16	2.2 (6)	7.6 (7)	3.6 (13)
GENDER			
Girls	31.1 (85)	41.3 (38)	33.7 (123)
Boys	68.9 (188)	58.7 (54)	66.3 (242)
RELIGION			
Hindu	68.9 (188)	96.7 (89)	75.9 (277)
Muslim	10.6 (29)	1.1 (1)	8.2 (30)
Christian	19.8 (54)	2.2 (2)	15.3 (56)
Sikh	0.7 (2)	-	0.5 (2)

PHASE I

SITUATIONAL ANALYSIS

4.1.1Reviewing National Curriculum Framework (NCF, 2005) for CBSE and State Board Curriculum for GSEB

National Curriculum Framework (2005) is the latest curriculum framework for making syllabi, textbooks and teaching practices within the school education programs in India. It is framed and implemented by National Council of Educational Research and Training (NCERT), by the Government of India (GOI), to assist and advise the central and state governments on academic matters related to school education. NCERT publishes textbooks, for classes 1 to XII, used by government and private schools across India following Central Board of Secondary Education (CBSE) board.

Understanding the importance of health education in schools, CBSE launched its Comprehensive School Health Programme (CSHP) in 1940s, which advocated that schools become Health Promoting Schools displaying and supporting the commitment to enhance the emotional, social, physical and moral well being of the school community (principal, teachers, students and family). National Curriculum Framework (2005) also categorically states that health is a critical input for the overall development of the child and it influences significantly student enrolment, retention and completion of school.

The CSHP of India is similar to Comprehensive School Health Program (CSHP) of America which was initiated in late 1980s, later changed to "Coordinated School Health Program" (CSHP) in 2007, to better describe the inter disciplinary and interagency collaboration required between the eight components, namely: health education, physical education, health services, nutrition services, counseling psychology & social services, staff health promotion, family& community involvement and healthy environment. Thus, a collaborative effort of CBSE with WHO was initiated in 2007 with an overall goal to strengthen the CSHP of India more effectively by delivering it's interventions in the form of recommending:

- Four comprehensive school health manuals
- Promotion of school health and wellness clubs

4.1.1a Comprehensive school health manuals

Till recent years aspect of school health was somehow relegated to sporadic health checkups or in some cases a few hours of health instructions in the curriculum. However, the four manuals, developed by CBSE in collaboration with WHO in 2007 addresses this gap in schooling, where it aims to view health holistically, utilize all the educational opportunities for health promotion including formal and informal approaches in curricular pedagogy. The four modules developed were:

- Volume I: Addressed to all stakeholders concerned with school health.
- Volume II: Teachers activity manual for Primary Level (classes I to V)
- Volume III: Teachers activity manual for Upper Primary Level (classes VI to VIII)
- Volume IV: Teachers activity manual for Secondary and Higher Secondary Level (classes IX to XII)

The activities to be conducted by the teachers revolve around six different themes. They are:

1. Knowing your body
2. Foods and Nutrition
3. Personal, environmental hygiene and sanitation
4. Physical fitness
5. Being safe and responsible
6. Behaviour and life skills

As can be seen from tables 4.1.2 and 4.1.3, the topics in national (CBSE) Teachers Training manuals were reviewed and they revealed that 81.8% of the essential topics on healthy eating and 87.5% on physical activity respectively were covered, as described by Center for Disease Control (CDC) curriculum, however, the state (GSEB) board being currently followed in the selected schools, did not have any teachers training module at all.

Looking at the important topics recommended by CDC & its relevance in our context as well, the national (NCERT) curriculum had certain gaps which were as under:

Table 4.1.2: Comparison of essential topics to be addressed for healthy eating curriculum in national and state

S. No.	Essential topics for healthy eating recommended by CDC	Whether or not covered by NCERT					Whether or not covered by GSBST
		Teacher's training manuals- Vol II (classes I - V)		Teacher's training manuals- Vol III (VI - VIII)		Text Books (V to VIIth)	
		2007	2010	2007	2010		
1	Benefits of healthy eating	√	√	√	√	√	√
2	Importance of eating a healthy breakfast	**X**	**X**	**X**	**X**	**X**	**X**
3	Importance of making healthy choices when eating out	√	√	√	√	**X**	**X**
4	Importance of making healthy choices when snacking	√	√	√	√	**X**	**X**
5	The relationship of unhealthy eating to chronic diseases such as heart disease, cancer, diabetes, hypertension, and osteoporosis	-	-	√	√	**X**	**X**
6	The Dietary Guidelines for Indians	-	-	√	√	**X**	**X**
7	The Food Guide Pyramid and nutritious choices for each group	√	√	√	√	**X**	**X**
8	Using food labels	-	-	√	√	√	**X**
9	Importance of moderation in a person's eating habits	-	-	√	√	**X**	**X**
10	Identifying key nutrients (e.g., water, vitamins, minerals, protein, carbohydrates, and fiber) and major food sources of each	√	√	√	√	√	√
11	Identifying foods that are low in fat, saturated fat, cholesterol, sodium, and added sugars	-	-	**X**	**X**	**X**	**X**
12	Preparing a variety of healthy meals and snacks	-	-	√	√	**X**	**X**
13	Influence of personal preferences, family, peers, culture, and media on dietary behavior	-	-	√	√	**X**	**X**
14	Finding valid information and services related to healthy eating	-	-	√	√	**X**	**X**
15	Goal-setting and decision-making skills for healthy eating	√	√	√	√	**X**	**X**
16	How students can influence and support others to engage in healthy eating	-	-	√	√	**X**	**X**
17	Balancing food intake and physical activity	**X**	**X**	√	√	**X**	**X**
18	Healthy weight management	-	-	√	√	**X**	**X**
19	Accepting body size differences	-	-	√	√	**X**	**X**
20	Risks of unhealthy weight control practices, such as crash or fad diets, purging, diet pills, and tobacco use	-	-	**X**	**X**	**X**	**X**
21	Eating disorders (e.g., anorexia, bulimia)	**X**	**X**	**X**	**X**	**X**	**X**
22	Food safety, including handwashing and safe food purchasing, preparation, and storage	√	√	√	√	**X**	**X**

- Topics not for the respective age group

Table 4.1.3: Comparison of essential topics of to be addressed for physical activity curriculum in national and state

S. No.	Essential topics for physical activity recommended by CDC	Whether or not covered by NCERT					Whether or not covered by GSBST
		Teacher's training manuals (Vol II)		Teacher's training manuals (Vol III)		Text Books (V to VIIth)	
		2007	2010	2007	2010		
1	Meaning of physical activity, exercise, and health-related fitness sunburn, heat stroke, and hypothermia	√	√	√	√	√	**X**
2	Physical, mental, and social benefits of physical activity	√	√	√	√	√	**X**
3	Role of physical activity in controlling body weight	√	√	√	√	√	√
4	Recommended amounts and types of physical activity for adolescents and adults	-	-	√	√	√	√ (but not correct)
5	Role of a sedentary lifestyle in development of chronic diseases	**X**	**X**	√	√	√	√
6	Ways to increase daily physical activity	√	√	√	√	√	**X**
7	Physical activities that contribute to maintaining or improving the components of health related fitness	√	√	√	√	**X**	**X**
8	Influence of culture and media on physical activity	-	-	√	√	**X**	**X**
9	Finding valid information and services related to physical activity and fitness	-	-	**X**	**X**	**X**	**X**
10	Interpersonal communication skills related to physical activity	√	√	√	√	**X**	**X**
11	Behavioral skills related to physical activity (e.g., goal-setting, decision-making, self monitoring)	√	√	√	√	**X**	**X**
12	Planning a personal physical activity program	√	√	√	√	**X**	**X**
13	Methods for avoiding and responding to physical conditions such as physical exhaustion,	√	√	√	√	**X**	**X**
14	Proper wear and use of safety equipment for specific physical activities	√	√	√	√	**X**	**X**
15	Importance of hydration in physical activity	√	√	√	√	**X**	**X**
16	Effects of and legal issues related to using performance-enhancing drugs	**X**	**X**	-	-	**X**	**X**

1. Dietary guidelines were given only for energy and not for other nutrients like protein or fats or essential vitamins and minerals.
2. Children were taught to identify healthy (fruits & vegetables and home cooked foods) and unhealthy (processed foods from market) foods without mentioning the exact reason for them being healthy or unhealthy.
3. BMI calculation and WHO 2007 growth charts were not introduced to enable students to calculate their own nutritional status.

There were few topics (recommended by CDC) which were not at all discussed, namely:

- Identifying foods that are low in fat, saturated fat, cholesterol, sodium, and added sugars
- Risks of unhealthy weight control practices, such as crash or fad diets, purging, diet pills, and tobacco use.
- Eating disorders (e.g., anorexia, bulimia)
- Recommended duration of physical activity according to age.

4.1.1b Course text books

The chapters pertaining to nutrition and health were also reviewed of national (CBSE) and state (GSEB) board compared with CDC recommended essential topics to be covered in the curriculum for healthy eating and physical activity. The results are presented in table 4.1.2 and 4.1.3. Out of 22 essential topics for healthy eating, only 3 topics (13.6%) were covered in the text books of national (CBSE), while only 2 topics (9.1%) were covered in the state (GSEB) board text books.

Regarding essential topics for physical activity (table 4.1.3), 6 topics (37.5%) were covered in national (CBSE) books, while only 3 topics (18.8%) were covered by the state (GSEB) books.

It was also observed that the Gujarat (GSEB) board text books had information on RDAs (table 4.1.4) and exchange list (table 4.1.5). On reviewing the information from table 4.1.4, it clearly showed that the information provided in the text books appeared to be incorrect or incomplete as compared to National Institute of Nutrition (NIN) RDA applicable in 2005 and revised RDAs for Indians in 2010 **(NIN 2011).** The

exchange list (table 4.1.5) in the text book was also inappropriate and not very clear in terms of the portion sizes commonly consumed by the populations.

Table 4.1.4: Comparison of the Recommended Dietary Allowances (RDA) given in state curriculum (GSEB) books and National standards given by National Institute of Nutrition (NIN) for Indians

RDA as in Gujarat board (GSEB) text books		Standard RDA as recommended by National Institute of Nutrition for Indians *					
Individual	Daily Requirement (calories)	Group	Category/ age (in years)	2005		2010	
				Net energy (kcal)	Protein (g/d)	Net energy (kcal)	Protein (g/d)
10-12 years old child	2000	Boys Girls	10-12 10-12	2190 1970	54 57	2190 2010	39.9 40.4
12-14 years old boy	2200	Boys	13-15	2450	70	2750	54.3
14-16 years old girl	2600	Girls Boys	13- 15 16-17	2060 2640	65 78	2330 3010	51.9 61.9
15-18 years old girl	2600	Girls	16-17	2060	63	2440	55.5
15-18 years old youth	3000						
Labourer	2500-4000	Man	Sedentary Moderate Heavy	2425 2875 3800	60.0	2320 2730 3490	60.0
		Woman	Sedentary Moderate Heavy	1875 2225 2925	50	1900 2230 2850	55.0

Reference: * National Institute of Nutrition (2004), Hyderabad

Table 4.1.5: Review of the exchange list given in state text books (GSEB)

Food	Amount	Calorie available	Review Comments
Chapati	One	150	Serving size of chapatti not mentioned
Bread	One big slice	70	
Apple	One big piece	100	Amount of serving not mentioned
Rice	100 gms	500-600	Cooked or raw not mentioned. 100 gms of raw rice gives 350 kcal, hence cooked will give lesser calories
Butter	1 spoonfull	100	Tea spoon (tsp)or table spoon (tbsp), not mentioned. 1 tsp= 5gms & tbsp= 15 gms.1 tsp gives 45 kcal, 1 tbsp gives 135kcal
Milk	1 cup	150	Skimmed or full fat not mentioned. Measurement of the cup also not mentioned.
Mutton	50 gms	100	1 piece of mutton or two not mentioned. 2 pieces are 40 gms and provides 70 kcal.
Egg	1 big	100	Average egg in market weight between 60-80 gms-
Spinach	100	26	Raw or cooked – not mentioned
Banana	1 banana (Big)	104	Big= 100gms, medium= 80 gms or small= < 80 gms.
Grapes	100gms	17	100 gms of grapes (pale green variety) provide 71 kcal.

For example, in table 4.1.5, it is given that one chapati gives 150 kcals. However, when comparing with the standard exchange list, one exchange of cereal is 20 gms which provides 70 kcal of energy. Therefore, from the table 4.1.5, it is not clear that one chapatti is how many grams of wheat flour, and the amount of energy provided by one exchange thus cannot be calculated. Likewise, the information provided for other foods in the table 4.1.5, was incomplete in terms of amounts or calories, when details about the amounts taken to derive at the values was not given.

4.1.1c School health and wellness clubs

At National level (NCERT) institutionalization of School health wellness clubs in all the schools as an integral part of comprehensive school health promotion was recommended because they can act:

- As organizer of all the health relevant activities (at least 8-10 activities in the year at each level)
- Resource center for the overall well being of the students.
- Screen, diagnose and impart health counseling services to the students.

They have the following objectives:

- To create health cards for each student.
- To create a health newspaper at least twice a year/ poster competition related to health issues.
- To conduct surveys on health related concerns.
- To organize health walks as part of social campaigns.
- To organize health fairs and immunization projects.
- To tap the local resources in the community to arrange health talks.
- To render service in any area affected by a disaster or a calamity.
- To create health help- line within the school to de-stress, cope with emotional and social behaviours and to clarify misconceptions regarding sexual and reproductive health.
- To teach the students techniques of yoga and meditation from an early age.
- To inculcate in the students healthy and positive way of living.
- To teach health songs on various health topics.
- Celebration of important days (World Health Day- April 7).
- Creating awareness regarding World No Tobacco Day (May 31), World AIDS day (December 1), etc.

These activities were further classified to be carried class wise (1-V, VI-VIII, and IX-XII), under the six areas (knowing your body, food and nutrition, personal, environmental hygiene and sanitation, physical fitness, being responsible and safe, and behavior and life skills).

In view of the rising trend of over weight/ obesity among adolescents and its risks of developing high blood pressure, dyslipidemia, poor school performance with problems of undernutrition and anemia still affecting large sections of the population, it is imperative that the monitoring of these indicators become a part of school health

assessment. Keeping these points in mind the health cards given by national curriculum (NCERT) were reviewed and the following gaps were noted:

- Biochemical estimations (haemoglobin level, fasting glucose and lipid profiles) were not included.
- The school health card I (health history) did not have any information on haemoglobin levels, fasting and lipid profiles.
- School health card II (results of the examinations done in the wellness clubs) did not include weight information (classification based on different categories of Body Mass Index) and biochemical profile (stool examination, haemoglobin levels and glucose and lipid profile).
- The health card II, also did not have the WHO 2007 growth charts (different for girls and boys) so that the growth of the child could be monitored regularly in the wellness clubs.
- Blood pressure measurement was also not incorporated in school health card II, indicating that no provision is made to measure blood pressure of children's in the wellness clubs.

Highlights:

- The NCF 2005, framed by NCERT for CBSE affiliated schools, updated its Comprehensive School Health Program in collaboration with WHO in 2007 to include formal and informal approaches in the curricular pedagogy by developing teacher's training module and establishment of school wellness clubs. However, many gaps were observed in the module and services provided by the school wellness clubs when compared to CDC recommendations.
- The state board (GSEB) however, did not have any such recommendations regarding setting up of school health & wellness clubs.
- The text books of national (CBSE) and state board (GSEB), covered very few essential topics on healthy eating (NCERT: 13.6% vs GSEB: 9.1%) and physical activity (NCERT: 37.5% vs GSEB: 18.8%) when compared to CDC recommendations. The National Curriculum was slightly better than the state (Gujarat) Curriculum, though both need improvement.

4.1.2 Assessment of school ethos and environment

Center for Disease Control (CDC), recommends that schools should take up self assessment activities to understand their strengths and weaknesses in terms of policies and practices to improve their nutrition and health services. Therefore, to conduct this activity a representative team of school community (administrators, students, teachers) and parents is required. However, both the experimental as well as the control schools did not have any such team, hence, a Nutrition Health Team (NHT) was formed, comprising of 2 administrators (principal and vice principal), 1 teacher, 2 students, and 1 parent who volunteered to be a part of the NHT and nutrition health promotion program to be implemented in the school.

4.1.2b Assessing School Policies and Practices

School Health Index (SHI) of CDC (CDC 2005) and Nutrition Friendly School Initiative (NFSI) of WHO (WHO 2006) was used to develop framework to assess the strengths and weaknesses of the study schools with respect to various components of Coordinated School Health Program (CSHP), namely, health education, physical education, health services, nutrition services, counseling, psychological & social services, healthy school environment, health promotion for staff, family & community involvement. All these components of CSHP, are important for the holistic development of the students in a school setting. Therefore, Nutrition Friendly School Health Index (NFSHI) adapted from SHI (CDC) and NFSI (WHO), was used to assess strengths and weaknesses of the two selected schools with the help of only four modules pertaining to health and nutrition policies and practices (school health policies, health education, physical education & physical activity program and nutrition services).

The strengths and weaknesses of the respective schools are shown in Table 4.1.6, four modules pertaining to health and nutrition were assessed. These results were the responses of the NHT members (principal, vice principal, teachers, counselor, student representatives, and one parent representative).

Table 4.1.6: Strengths and weaknesses of the selected two schools with respect to health and nutrition policies and practices as assessed by NFSHI

MODULES	STRENGTHS		WEAKNESSES		PARTIALLY IN PLACE	
	Experimental School	**Control School**	**Experimental School**	**Control School**	**Experimental School**	**Control School**
Module 1: **School Health Policies**	Access to physical activity facilities outside school hours Overcoming barriers to learning Enrichment experiences Adequate physical activity facilities		No representative school health committee No written school health policies Complete access to foods of minimal nutritional value No communication of school health policies to Students, parents, staff, and visitors	Access to physical activity facilities outside school hours Overcoming barriers to learning Adequate physical activity facilities No representative school health committee No written school health policies No communication of school health policies to Students, parents, staff, and visitors	Connectedness to school	Enrichment experiences Complete access to foods of minimal nutritional value
MODULE 2: Health Education	• Nil	Nil	Nil	Nil	Active learning strategies	Active learning strategies
MODULE 3: Physical Education and Physical Activity program	225 minutes of physical education per week Students active for at least 50% of class time Physical education is enjoyable Participation in extracurricular physical activity programs	225 minutes of physical education per week Students active for at least 50% of class time Participation in extracurricular physical activity programs	Sequential physical education curriculum consistent with standards Physical education grading Promote community physical activities *(class room discussions and assignments)* Prohibit substitution for physical education Adequate teacher/student ratio (ratio similar to other subject taught)	Physical education is enjoyable Sequential physical education curriculum consistent with standards Physical education grading Promote community physical activities *(class room discussions and assignments)* Prohibit substitution for physical education Adequate teacher/student ratio (ratio similar to other subject taught)	Individualized physical activity/ fitness plans	
MODULE 4: Nutrition Services	• Nil		Nil		Nil	Promote healthy food and beverage choices

Looking at the results of the module 1, which is related to school's policies, for the experimental school, out of the points considered to assess policies of the schools, strengths and weaknesses were found to be in the same proportion (44.4%) while only one point (11.1%) was considered to be partially in place, i.e., connectedness to school. However, no strengths were observed in the control school regarding policies and 66.7% of the considered points were taken as weaknesses and 33.3% were partially in place. Therefore, the results indicate that school administration needs to be sensitized on the importance of incorporating health and nutrition policies along with policies related to other issues.

The results of module 2, related to health education imparted in the schools, showed similar results for both the experimental and control schools. No strengths and weaknesses were found in terms of health education, while only active learning strategies were found to be partially in place in both the schools. Hence, as observed before also, the whole education curriculum of the state (Gujarat) board needs revision based on the national standards (CBSE), if not international standards (CDC).

Module 3, based on physical education and physical activity program also shows, similar results for both the selected schools. More weaknesses (experimental: 50% vs control: 70%) were observed than the strengths (experimental: 40% vs control: 30%) in both the schools. The results show that, though children were active for the recommended time (1 hour per day), other aspects (student teacher ratio, education curriculum, prohibit substitution for physical activity, etc) need to be considered to improve physical activity and education in the schools. Lastly, module 4, pertaining to nutrition services showed no policies in place for both the schools. However, only in the control school, sale of unhealthy snacks and beverages was prohibited, though it was not included in the school policy.

4.1.2c Assessing Canteen services

Canteen is a place where children access food in the school campus. Hence, it is an important aspect of the nutrition service for the students in the school. Therefore, the canteen of the two selected schools was assessed for their services. In both the schools, canteen was the only source of food besides their tiffin during the schools hours. Further results revealed that the experimental school, offered precooked and pre packed snacks, high in trans fats, and sugars. The study of sales trends of these

snacks showed high sales of unhealthy, high calorie, trans-fat containing snack items such as puff, samosa and vegetable roll (figure 4.1.1) as well as sweetened beverages such as pepsi, fruity and appy fizz (figure 4.1.2). School authorities had no role in planning canteen menu (or other foods available in the canteen) and the nutritional aspect of the foods being sold on the school campus was not taken into consideration.

In the control school, permanent canteen did not exist. Two volunteer mothers of the students were given the contract to provide the snack items. The recipes (ragda patties, vada pau, vegetable rice, poha etc) were decided by the volunteer mothers themselves. The food was cooked at home, and provided to students in the recess time only. Before and after the recess, no snack or any other item was available to the students in the control school. However, sale of unhealthy snacks (puff, frankys, samosas etc) and carbonated beverages was prohibited in the school campus, although no written policy was in place for the same.

Figure 4.1.1: Sales trend of popular snacks (average pieces/day) at baseline in experimental school

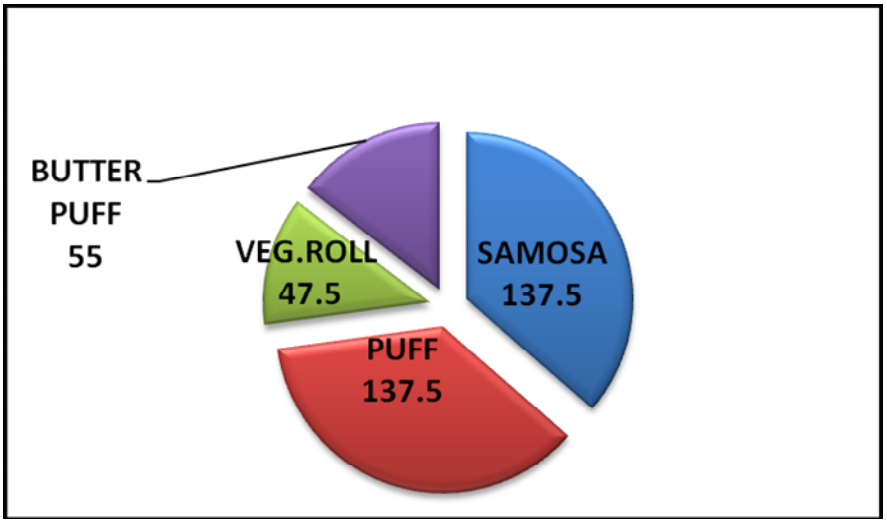
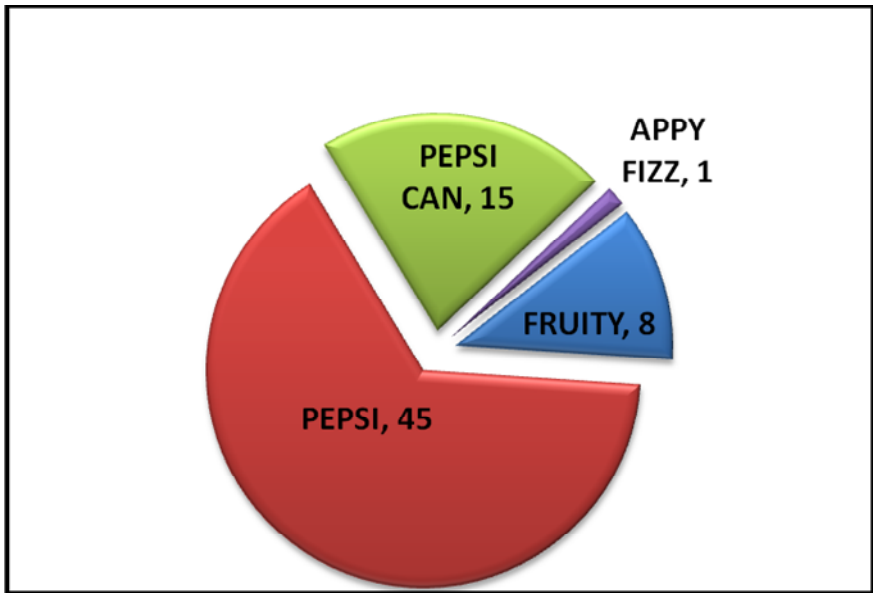


Figure 4.1.2: Daily sales trend of beverages (glasses or tetra packs) at baseline in experimental school



4.1.2d Assessing Nutrition Health knowledge of science and physical activity teachers of classes V-VII

Knowledge of teachers, from the two schools pertaining to 'healthy diet' was found to be in appropriate. They could correctly identify faulty behavior patterns leading to malnutrition in children and also supported teaching about these in school, their outlook regarding the same was however limited. Their main concern was on scholastic performance of children with no thought about the health consequences. It was also found that in spite of teachers being able to distinguish unhealthy behaviors from healthy ones, they depicted insufficient knowledge about their reasons. For example, though all the teachers agreed that sweetened carbonated beverages did not impart any health benefit, none were able to give an explanation for the same other than suggest that, they were 'chemicals' and 'toxins'. It was also found that experimental school did not have any technically qualified physical activity teachers, while the control school had one.

Highlights:

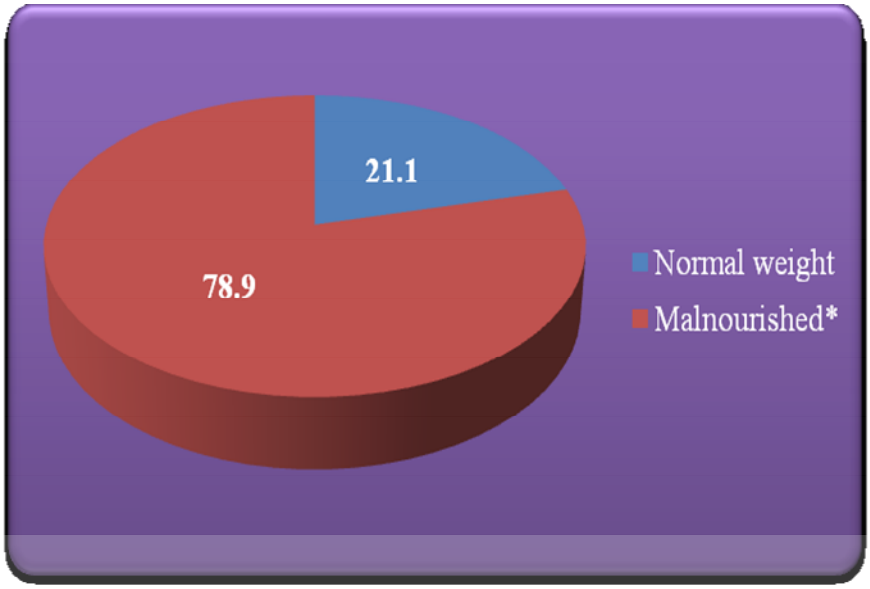
- No representative school health committee was in place to review the policies and practices related to health and nutrition in both the schools.
- According to SHI, module 1 pertaining to school health policies, no written policies related to nutrition and health were found in both the schools. However, in both the schools, various related activities were being followed (access to physical activity facilities was better in the experimental school than in the control school while better enabling environment in terms of selling of nutritious food was found in the control school than in the experimental school).
- According to module 3 (physical education and physical activity program), more weaknesses (experimental: 50% vs control: 70%) were observed than the strengths (experimental: 40% vs control: 30%) in both the schools.
- According to module 2 (health education imparted) and module 4 (nutrition services) showed no policies in place for both the schools.
- The canteen services were not nutrition friendly. The canteen service providers had no knowledge about nutrition aspect. Also the menus of the canteens were not nutritionally planned.
- Teachers teaching science and physical activity did not have technical knowledge about nutrition and physical activity.

4.1.3 Assessment of anthropometric (nutritional status, central obesity), sub optimal blood pressure, biochemical (haemoglobin, lipid and glucose) parameters and dietary and lifestyle behaviors of the study subjects from the selected two schools catering to Middle to High socio economic strata (MHSES)

According to figure 4.1.3, more than three quarters (78.9%) of the study subjects from MHSES were malnourished (overweight including obese, and underweight), while only 21.1% were having normal weight, as indicated by BMI for age WHO 2007 growth standards. Furthermore, from figure 4.1.4, it was very surprising to note that more than half (53.7%) of the study subjects from MHSES, were identified as underweight, while a quarter (25.2%) of them were overweight (including obesity). The prevalence of anemia, was 49.3% in the study subjects. Hence, prevalence of

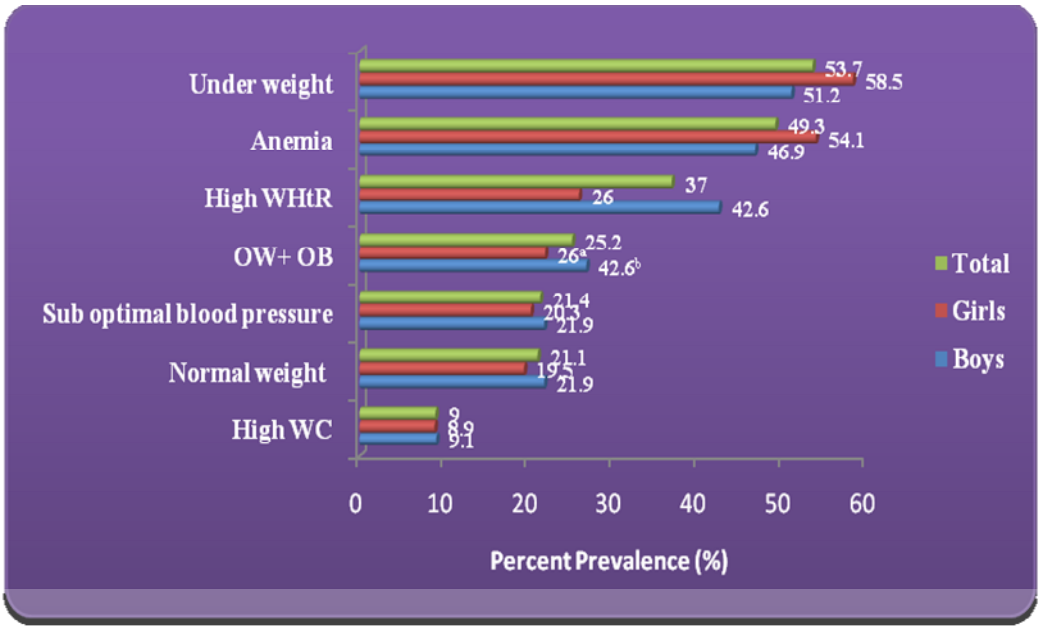
overweight (including obese), underweight along with anemia indicated the presence of triple burden of malnutrition among this age group from MHSES also. Central obesity measurements as seen from figure 4.1.4, also revealed that 1/3rd (37.0%) of the study subjects had central obesity when measured by high WHtR, while 9% subjects could be classified as centrally obese by taking the criteria of high waist circumference. Similarly, about 1/5th (21.4%) of the study subjects had suboptimal blood pressures (Figure 4.1.4).

Figure 4.1.3: Percent prevalence of nutritional status of the study subjects from the selected two schools



Malnourished (overweight including obese and under weight)

Figure 4.1.4: Prevalence of anemia, malnutrition, sub optimal blood pressure and central obesity among the study subjects from the selected two schools



Nutritional status according to WHO 2007 (de Onis et al. (2007)**:** Normal weight: (-1 to +1 z score), Over weight: (> + 2 to +3 z score), Obese: (> +3 z score), MIUW: (< -1 to – 2 z score), MOUW: (< -2 to -3 z score), SUW: (< - 3 z score).

Central Obesity (Ferna´ndez et al.2004, McCarthy and Ashwell. 2006)**:** Waist Circumference (WC): High WC: ≥ 90th percentile; Waist to Height Ratio (WHtR): High WHtR: (Normal: < 0.5, High: ≥ 0.5)

Hypertension (NIH 2005)**:** Normal: <90th percentile, Pre hypertension: ≥ 90th to <95th percentile, Stage I: ≥95th to 99th percentile, Stage II: >99th percentile

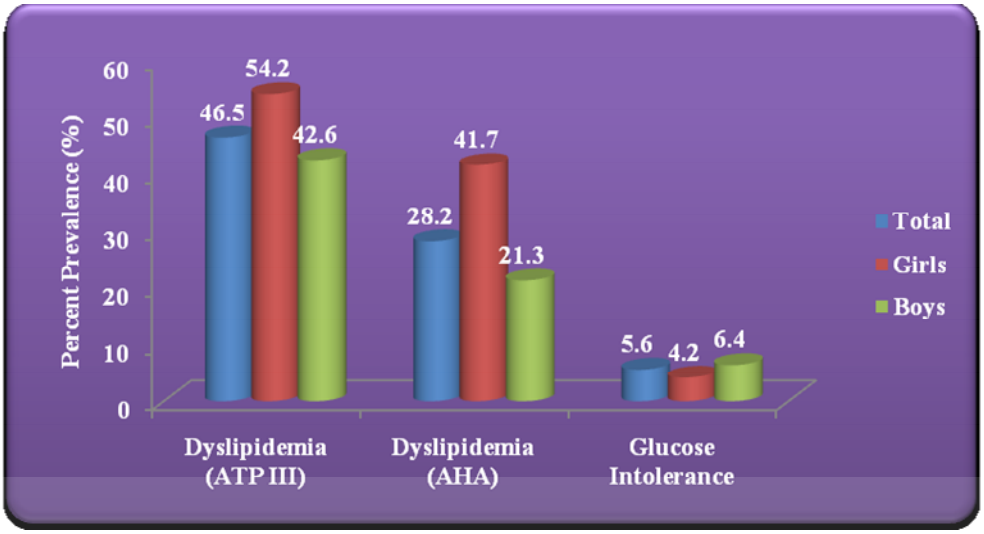
Anemia status (age wise classification, WHO 2007)**:** 5-11 years: >11.0g/dl, 12-14 Years: ≥ 11.5 g/dl, Boys (15 or above): ≥ 12.0 g/dl; Girls (15 or above): ≥ 13.0 g/dl

a vs b***

The biochemical parameters of only overweight (including obese) subjects, showed that (figure 4.1.5), dyslipidemia was present in 46.5% and 28.2% of the study subjects according to ATP III and AHA classifications respectively. Glucose intolerance was observed in 5.6% of overweight and obese subjects.

Looking into the dietary and lifestyle behaviors of the study subjects, figure 4.1.6 indicated that more than half (56.7%) of the study subjects did not fulfill their daily recommended intake of fruits and vegetables (≥ 400 grams), which was followed by 41.4% of the study subjects watching TV/ playing on computer for more than two hours a day. Having fast food, 2 or more than 2 days was practiced by 36.7% of the study subjects. Moreover, 31.8% of the study subjects were physically inactive, and high intake of carbonated beverages (≥ 2 days / week) was reported by 15.3% of the subjects.

Figure 4.1.5: Percent prevalence of Dyslipidemia (ATP III & AHA classifications) and Glucose Intolerance (IDF Classifications) in over weight and obese subjects from the selected two schools



ATP III: Adult Treatment Panel, AHA: American Heart Association, IDF: International Diabetes Federation

Cut off for Lipid profiles,:

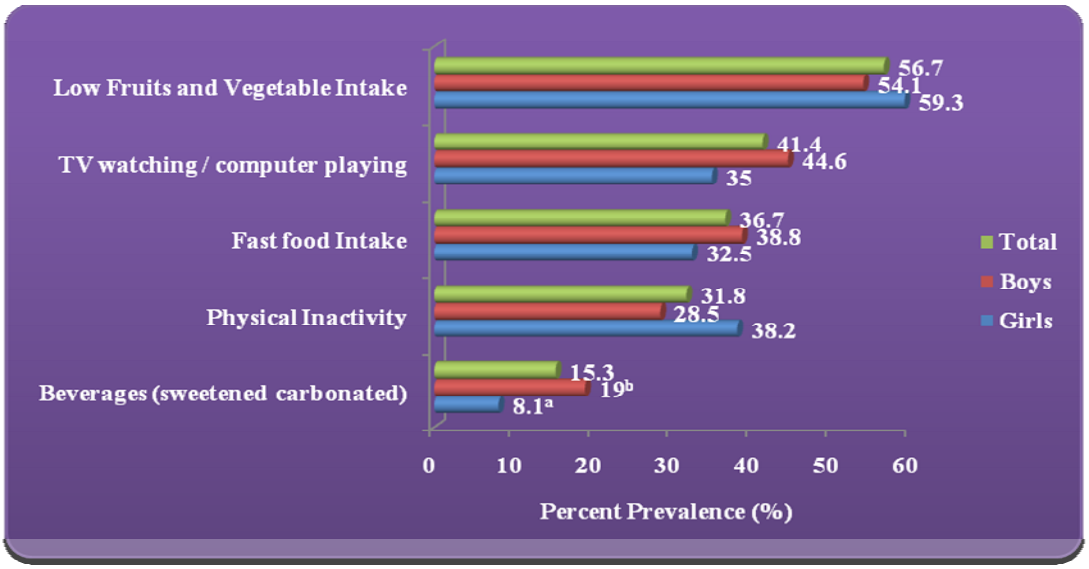
ATP III Classification (NIH 2002): TC:> 200gm/dl
LDL: >100 gm/dl
TG: >150 gm/dl
HDL: < 40 gm/dl

AHA Classification: TC: > 200gm/dl
LDL: > 130 gm/dl
TG: ≥ 150 gm/dl
HDL: ≤ 35 gm/dl

Cut off for glucose profiles :

IDF guidelines (IDF 2007): < 100gm/dl

Figure 4.1.6: Percent prevalence of modifiable risk factors among the study subjects from the selected two schools



a vs b **: X^2= 7.43, p= 0.006

The breakfast patterns of the study subjects (Table 4.1.7) revealed that most (65.8%) of the study subjects consumed breakfast regularly while about a quarter (26.0%) of them were not regular breakfast eaters. Table 4.1.8, shows the reasons, given by the study subjects for their irregularity in having breakfast. The results revealed that, most (32.9%) of them mentioned other reasons (completing homework in the morning, do not feel hungry in the morning, tuitions early in the morning) for not being able to take breakfast, besides not having enough time (26.6%) and not able to eat early in the morning (8.8%). Regarding the breakfast pattern of the study subjects, table 4.1.9, revealed that most (82.7%) of the subjects were having unhealthy breakfast at home.

Table 4.1.10, showed that most (89.9%) of the study subjects brought their lunch boxes to school, and about half (48.8%) of the study subjects consumed the food from their lunch box only in the school campus while another half (44.9%) of the study subjects had their lunch box as well as bought snacks from the canteen also (Table 4.1.11).

Table 4.1.7: Breakfast consumption pattern in terms of number of days consumed by the study subjects from the selected two schools

		Girls (n=123)	**Boys (n=242)**	**Total (N=365)**
		% (n)	**% (n)**	**% (n)**
Breakfast pattern	**Regular (> 3 days / week)**	52.8 (65)	72.3 (175)	65.8 (240)
	Irregular (≤ 3 days / week)	36.6 (45)	20.7 (50)	26.0 (95)
	No breakfast	10.6 (13)	7.0 (17)	8.2 (30)

X^2= 13.89***

Table 4.1.8: Reasons for skipping breakfast in the morning before coming to school as given by the study subjects from the selected two schools

	Responses	Girls (n=123)	Boys (n=242)	Total (N=365)
		% (n)	% (n)	% (n)
Reasons for not having breakfast	No response	26.8 (33)	34.3 (83)	31.8 (116)
	Do not have time	35.0 (43)	22.3 (54)	26.6 (97)
	Cannot eat early in the morning	15.4 (19)	5.4 (13)	8.8 (32)
	Other reasons	22.8 (28)	38.0 (92)	32.9 (120)

X^2= 21.551***

Table 4.1.9: Breakfast pattern of the study subjects from the selected two schools

		Girls (n=123)	Boys (n=242)	Total (N=365)
		% (n)	% (n)	% (n)
Breakfast pattern	Unhealthy breakfast	81.3 (100)	83.5 (202)	82.7 (302)
	Healthy breakfast	12.2 (15)	12.0 (29)	12.1 (44)
	Nothing	6.5 (8)	4.5 (11)	5.2 (19)

Table 4.1.10: Percentage of the study subjects from the selected two schools bringing lunch box to the school

Responses	Girls (n=123)	Boys (n=242)	Total (N=365)
	% (n)	% (n)	% (n)
Yes	95.1 (117)	87.2 (211)	89.9 (328)
No	4.9 (6)	12.8 (31)	10.1 (37)

X^2= 5.632*

Gender wise distribution

While assessing the association between the various indicators (malnutrition, central obesity, suboptimal blood pressure, anemia, dyslipidemia and glucose intolerance) and gender, no significant associations were found (Figure 4.1.4, Figure 4.1.5). However, more girls were found to be under weight (58.5% vs 51.2%) and anemic (54.1% vs 46.9%) as compared to boys , while boys were found to be more over weight and obese than girls (26.9% vs 22.0%). A highly significant association ($p<0.01$) was observed between high WHtR and gender, with boys having more high WHtR than girls (42.6% vs 26.0%). The prevalence of sub optimal blood pressure between the two genders was found to be almost similar (21.9% vs 20.3%). Central obesity as indicated by high WC was almost same in both the genders (9.1% vs 8.9%).

According to figure 4.1.5, no significant gender difference existed in the prevalence of dyslipidemia and glucose intolerance in overweight and obese subjects between the genders. However, girls were found to be more dyslipidemic than boys (ATP III: 54.2% vs 42.6%, AHA: 41.7% vs 21.3%), while boys had higher levels of glucose intolerance (6.4% vs 4.2%).

Also no significant gender differences were observed between the gender and unhealthy behaviors, except for consumption of carbonated beverages, which was consumed more by boys (19.0%) than girls (8.1%), and the difference was highly significant ($p=0.002^{**}$). However, looking into the gender differences for other behaviors, more girls (59.3% vs 54.1%) were found to consume less fruits and vegetables (< 400gm), than boys. Girls were also found to be more (38.2%) physically inactive than boys (28.5%). While, boys were found to be involved more in watching TV/ playing on computer more than 2 hours a day (44.6% vs 35.0%), consuming fast food, 2 or more than 2 days (38.8% vs 32.5%).

Table 4.1.7, showed that there is a highly significant association between the breakfast pattern and gender ($p=001^{**}$). It shows that more proportion of girls (36.6%) were irregular (≤ 3days/week) in their consumption of breakfast than boys (26.0%), indicating highly significant difference between the genders ($p\leq 0.01^{**}$). Also very highly significant association between reasons and the gender was seen

(table 4.1.8). More proportion of the girls as compared to boys (35.0% vs 22.3%) reported that they did not have time followed by expressing their inability to have breakfast in the morning (15.4% vs 5.4). However, more proportion of boys were found to give no response (34.3% vs 26.8%) and giving other reasons (38.0% vs 22.8%) for not consuming breakfast.

From table 4.1.10, demonstrated an association between bringing lunch box to school and gender, with significantly higher (p=0.018*) proportion of boys not bringing lunch box than girls (12.8% vs 4.9%).

Similarly, from table 4.1.11, an association was also observed between eating pattern of the study subjects in the recess and gender. High significant difference ($p \leq 0.01$**) was observed between the genders, with more girls (56.9%) eating only the food brought in their lunch box than boys (44.6%), while more proportion of boys (8.7%) were found to be using only canteen in the recess than girls (1.6%).

Table 4.1.12, shows the relation of sub optimal blood pressure with different parameters (nutritional status and central obesity). No association was found between the sub optimal blood pressure levels of the subjects and nutritional status as measured by BMI. However, an association was found between suboptimal blood pressure and central obesity. There was very highly significant difference in the prevalence of sub optimal blood pressure between the subjects with high waist circumference as compared to subjects with normal waist circumference (57.6% vs 17.8%). Similarly, 49.4% of the study subjects with high WHtR had sub optimal blood pressures, than the study subjects having normal WHtR (13.6%), showing very highly significant association . The result also indicated that the subjects with high WC (OR: 6.28) and high WHtR (OR: 6.18) were six times at risk of developing sub optimal blood pressures.

Table 4.1.11: Eating pattern of the study subjects from the selected two schools during the recess time

Responses	Girls (n=123)	Boys (n=242)	Total (N=365)
	% (n)	% (n)	% (n)
Eat the food only from the lunch box	56.9 (70)	44.6 (108)	48.8 (178)
Buy from the canteen	1.6 (2)	8.7 (21)	6.3 (23)
Both	41.5 (51)	46.7 (113)	44.9 (164)

X^2= 9.455**

Table 4.1.12 Relationship of sub optimal blood pressure with nutritional status and central obesity of the study subjects from the selected two schools

	Normotensives	Sub optimal blood pressure
	% (n)	% (n)
Normal weight (n=77)	83.1 (64)	16.9 (13)
Malnutrition (n= 288)	77.4 (223)	22.6 (65)
Normal WC (n=332)	82.2 (273)	17.8 (59)[a]
High WC (n= 33)	42.4 (14)	57.6 (19)[b]
Normal WHtR (n=286)	86.4 (247)	13.6 (39)[c]
High WHtR (79)	50.6 (40)	49.4 (39)[d]

a VS b*** (OR: 6.28); c VS d*** (OR: 6.18)

Highlights:

- Presence of triple burden of malnutrition in the present study subjects from MHSES (under weight: 53.7%, overweight including obesity: 25.2% and anemia: 46.3%) is alarmimg.
- Only 21.1% of the study subjects from middle to high income schools were having normal BMI for age.
- Central obesity as indicated by high WHtR and High WC was present in 37.0% and 9.0% of the study subjects respectively.
- Sub optimal high blood pressure was present in 21.4% of the study subjects.
- In overweight and obese subjects, 46.5% and 28.2% were identified to be dyslipidemics according to ATP III and AHA classifications respectively.
- In overweight and obese subjects, 5.6% were identified as having Glucose intolerance.
- Among five dietary and lifestyle behaviors, low intake of fruits and vegetable (≤ 400 gm/day) was observed in more than half (56.7%) of the study subjects.
- More boys (42.6%) had central obesity than girls (26.0%) as indicated by high WHtR, with the difference being highly significant ($p \leq 0.01$**).
- More girls (36.6%) were irregular than boys (20.7%) in consuming breakfast, with the difference being highly significant ($p \leq 0.01$**).
- More proportion of boys (19.0%) consumed carbonated beverages than girls (8.1%), indicating highly significant difference ($p \leq 0.01$**).
- Regarding breakfast pattern, more girls (36.6%) were irregular in having breakfast than boys (20.7%), indicating high significant difference (($p \leq 0.01$**) between the two genders.
- The study subjects having high WC and high WHtR were six times at risk of developing sub optimal blood pressures.

Discussion

Adolescents form the largest cohort of young population worldwide, i.e., 1.8 billion, of which 1.5 billion live in developing countries. According to Lancet series on adolescents in 2012, young people are referred to people aged between 10-24 years (Patton et al 2012). They are often thought of as a healthy group and hence are the

neglected ones. Also this age group is considered the last window of opportunity to set the stage for a healthy and productive adulthood (WHO 2012).

Therefore, with the rising epidemic of childhood obesity (Wang and Lobstein, 2006), all the countries started mapping the prevalence of obesity among the school going children and adolescents from MHSES groups, worldwide (Jazayeri 2005, Lobstein et al 2004, Hedley et al 2004,) as well as in India ((Marwah et al 2012, Aggarwal et al 2008, Sharma et al 2007, Kumar et al 2007, Sidhu et al 2005, Sharma et al 2004, Bhave et al 2004, Sethi & Kapoor 2003, Kapil et al 2002, Ramchandran et al 2002) to control the expanding prevalence of overweight and obesity in school going children and adolescents (6-18 years), to prevent the rising burden of adulthood NCDs. But, the prevalence of under nutrition in the aforesaid population is not well known, as it was considered to be the problem of under privileged segments of the society. Further departmental studies also depicted similar scenario of estimating only over weight and obesity among children and adolescents in urban Vadodara. Studies carried out over the years by Akolkar, Shah, Gandhi and Munshi in 2003, 2004, 2005, 2012 respectively reported the prevalence of overweight and obesity in young children and adolescents (6-18 years) ranging from 7- 25.0%, irrespective of the standards used.

It has recently been estimated that adolescent obesity prevalence is increasing in the developing countries also where under nutrition used to be the major nutritional disorder (Poskitt 2009, Önera et al 2004). Hence the present study was undertaken to assess the nutritional status of adolescents, aged 10- 13 years from MHSES, and their dietary and lifestyle behaviors in the school campus and outside school hours. The data showed that more than half of the study subjects were under weight (53.7%), a quarter (25.2%) were overweight and obese, while 46.3% of the study subjects were found to be anemic. This indicated the presence of triple burden of malnutrition in the adolescents from MHSES. However, no study could be retrieved worldwide or in India which reported the presence of triple burden of malnutrition among the same adolescent population in MHSES.

Very few studies from developing countries facing double burden of malnutrition due to nutritional transition have reported an increasing incidence of overweight and obesity along with under nutrition (Özgüven et al 2010, Opara et al 2010, Aboshkair et al 2009, Montazerifar et al 2009, Tang et al 2007, Thiam *et al* 2006, Gales-Camus et al 2006, Eggal and Lopriore 2006, Shrimpton 2006, Bener and Abdulbari 2006,

WHO 2004, Önera et al 2004, Hooshyar et al 2001). In India also, two review studies for the school going children and adolescents from MHSES of different regions reported coexistence of over nutrition (over weight and obesity) and under nutrition (under weight) in this age group of 6 - 19 years (Srihari et al 2007, Jeemon et al 2009). While two studies from Gujarat, conducted on the same study subjects (adolescents aged 12-14 years) indicated coexistence of double burden of malnutrition (Iyer et al 2011, Shah et al 2008).

The prevalence of overweight and obesity reported by the current study as 25.2%, which is much higher than the reported prevalence world wide, i.e., 11.1% in Nigeria, 9.1% in Vietnam, and 10.1% in Baluchistan (Opara et al 2010, Montazerifar et al 2009, Tang et al 2007), while it is similar to 25.6% and 24.0% reported in urban Turkey and Malaysia respectively (Aboshkair et al 2011, Önera et al 2004). In India also, the reported prevalence (25.2%) was much higher than 13.4% reported in a study conducted for school going children and adolescents of MHSES workers of industries from 10 cities (Jeemone et al 2009) and 14.8% to 17.5% reported in two cities of Gujarat (Iyer et al 2011, Shah et al 2008). All the above studies referred, reported over nutrition and under nutrition in the same study population.

The present study also reported a high prevalence of underweight (53.7%) in the study subjects from MHSES, which was found to be higher than the estimated prevalence of underweight worldwide between 9.4% to 27.3% (Aboshkair et al 2011, Opara et al 2010, Montazerifar et al 2009, Tang et al 2007, Önera et al 2004) while it was within the estimated range in India, between 36.3% to 70.4%, indicating a rising trend of underweight among the school going children and adolescents from MHESE (Iyer et al 2011, Jeemone et al 2009, Shah et al 2008).

The present study also reported 46.3% of the study subjects from MHSES, to be anemic. It was very surprising to note that no study was done in the developed countries or in developing countries to estimate the prevalence of anemia among school going children and adolescents from MHSES. However, in India, few studies estimated the prevalence of anemia between the range of 14% to 88% in the school going children and adolescents (6-18 years) from MHSES indicating that besides under privileged children and adolescents being anemic, the MHSES children and adolescents are also vulnerable to iron deficiency anemia (Srihari et al 2007).

Addressing central obesity issues to prevent the occurrence of NCD risk factors so early in life is also extremely important as, it was present in 9.0 % to 37.0% of the study subjects as indicated by WC and WHtR respectively in the present study. A high central obesity in school children has earlier been reported (7.1%) by Mishra, 2011.

A very high percentage of sub optimal high blood pressure (21.4%) in the study subjects as shown in the present study is disheartening, although bigger trials on assessing the burden of sub optimal blood pressure in school children, especially adolescents is required. However, high burden of sub optimal blood pressure in the adolescent subjects has been reported earlier though at lower levels (3-10%) than in the present study (Narayanappa et al 2012, Verma and Singh 2012, Durrani and Wasim 2011, Khan et al 2010).

Developing countries are undergoing nutrition transition due to increased economic development and market globalization leading to rapid changes in lifestyle and dietary habits. Poor dietary and lifestyle behaviours have led to an increase in overweight and obesity among adults and children. Hence, besides the double burden of underweight and micronutrient deficiencies (folate, vitamin D, calcium, magnesium and vitamin E), the developing countries are also facing triple burden of malnutrition (under weight, micronutrient deficiencies and overweight and obesity) in MHSES as indicated by data of the the review of studies (Jeemone et al 2009, Li et al 2005, Gills 2005, Elmadfa and Weichselbaum 2004, De Benoist et al 2004, Nead et al 2004, WHO 2003, Thane et al 2003, Pinhas-Hamiel et al 2003, Halterman et al 2001, Schaff et al 2000,).

This trend of triple burden of malnutrition among children and adolescents is of great concern as unhealthy children and adolescents are likely to become unhealthy adults and develop non communicable diseases (NCDs), like type II diabetes, hypertension and cardiovascular diseases (Field 2006, Nader et al 2006, Whitaker et al 2006, Monteiro et al 2003). Also under nutrition adversely influence growth and development, cognitive performance and increase susceptibility to infections (Srihari et al 2007). Hence, according to 2008- 2013 action plan for the global strategy for the prevention and control of NCDs, targeting children in the school has been identified as the best buys for the prevention of childhood malnutrition (WHO 2008).

Preventing unhealthy behaviors during childhood and adolescents is easier and more effective than trying to change unhealthy behaviors during adulthood. As schools have direct contact with the nation's young people aged 5–17 years, for about six hours a day, and for up to 13 years of their social, psychological, physical, and intellectual development, schools play a critical role in promoting the health and safety of young people and helping them establish lifelong healthy behavior patterns (CDC 2012).

Therefore the National Health Education Standards (NHES) of America are developed to establish, promote and support health-enhancing behaviors for students in all grade levels—from pre-Kindergarten through grade 12. The NHES provide a framework for teachers, administrators, and policy makers in designing or selecting curricula, allocating instructional resources, and assessing student achievement and progress. Importantly, the standards provide students, families and communities with concrete expectations for health education (CDC 2013a).

Hence, according to CDC, health education curriculum should emphasize on:

- Teaching functional health information (essential knowledge)
- Shaping personal values and beliefs that support healthy behaviors
- Shaping group norms that value a healthy lifestyle
- Developing the essential health skills necessary to adopt, practice, and maintain health-enhancing behaviors.

Likewise NCF 2005, in India provides a framework for all CBSE affiliated schools, the framework for making syllabi, textbooks and teaching materials for all the grades (pre Kindergarten through 12) within the school education programs. CBSE in collaboration with WHO, made an effort to make teaching and learning more participatory for both teachers and students, by developing skill based training modules and introducing school wellness clubs in the schools.

It is very surprising to note that, the review of literature on this aspect did not reveal any reported studies in India till now. Therefore the results of the present study could not be compared with reported literature which looks into the national recommended standards for education.

As can be seen from tables 4.1.2 and 4.1.3, the topics in NCERT Teachers Training manuals were elaborated and covered 81.8% of the essential topics on healthy eating and 87.5% of physical activity respectively, as described Center for Disease Control (CDC) curriculum, however, GSEB board being currently followed in the selected schools did not have any teachers training module or did not sufficiently cover essential topics for nutrition health promotion.

The results of this study showed that the chapters from the text books of NCERT & GSEB covered very few essential topics on healthy eating (NCERT: 13.6% vs GSEB: 9.1%) and physical activity (NCERT: 37.5% vs GSEB: 18.8%).

Thus it can be concluded that nutrition and health focus to prevent malnutrition in all its forms is missing in both National as well as Gujarat state curriculum, though National curriculum was better than state curriculum. Therefore, it is a need to improve school curriculum if we want to seriously curb the rising burden of NCDs and promote health amongst adolescents.

Hence, more studies need to be conducted to evaluate the existing school curriculum to improve them or incorporate the required curriculum in school based intervention programs which addresses the problem of childhood and adolescent malnutrition.

The observations made in the present study showed that, the school authorities did not have a say in the canteen menu, resulting in rampant and unchecked consumption of unhealthy, high energy dense foods and beverages as corroborated by the sales trend data in results section of the school canteen. Consumption of unhealthy, energy dense foods by the school children on the school campus was also reported by various studies (Marwah et al 2012, Laxmaiah et al 2007). Considering that a school canteen is one of the first places outside home which largely influences a child's food choices, a healthier approach here might become a primary step towards eliminating the danger of children getting used to high trans-fat, sugary and pre packed foods – the main pre disposers to malnutrition in this age group. Also since teachers and peers can influence adolescent food choices, probably a planned nutritious school meal program may help adolescents to follow healthy food choices.

Teachers remain the primary providers of information to children who can effectively impart nutritional education. In the present study, knowledge of teachers, pertaining to "healthy diet" particularly, was found to be inadequate and hence they were likely to

pass-on incorrect information or model unhealthy dietary behaviours probably unintentionally. However, since their own knowledge about healthy dietary and lifestyle behaviours is limited, it will be prudent to build the capacity of teachers in these areas or have these included in the science curriculum for them to become role model for students (Evans, et.al., 2005). However, since their own knowledge about healthy dietary and lifestyle behaviours was very limited, it will be necessary to build capacity of both teachers and parents in the area of prevention and control of malnutrition or have them included in the science curriculum.

It is an alarm bell for school authorities and parents as unhealthy diets and stress of achieving high grades probably take a toll on young minds who find it difficult to cope up with school pressure, parental & teacher expectations etc. Also the study showed that overweight and obesity was a significant risk factor for developing sub optimal high blood pressures, it is important that low salt and higher intake of fruits and vegetables with promotion of physical activity is promoted in all settings including schools and has been recommended by WHO 2012 for controlling NCD in populations (Mehan, et.al., 2012). The role of teachers and parents in shaping healthy behaviours in their children especially adolescents can not be undermined, their sensitization and modeling of healthy behaviours is also necessary. For this it is important to initiate media programs and probably include health and nutrition guidelines in all teaching curriculums of schools and universities as it is important to make our population as a whole nutrition & health literate, if we want to tackle the huge burden of non communicable diseases affecting our nation.

PHASE II

INTERVENTIONS FOR CREATING ENABLING ENVIRONMENT IN THE EXPERIMENTAL SCHOOL

In order to create enabling environment in the experimental school, interventions like understanding school ethos and environment, nutrition health promotion in the form of nutrition health education of school teachers, parents and finally students was done. Also efforts were made to improve the quality of meals students brought to school, and improve the existing food services (canteen menus) in the school campus.

4.2.1 Planning nutrition health promotion program in school with participation of teachers, parents, and researcher

4.2.1a Orientation meeting with NHT members along with parents

In order to make the nutrition health promotion program participatory and sustainable, as a first step nutrition health team consisting of teachers/ students/ administrators and parents was made. An orientation meeting was organized for the NHT members along with parents. The meeting aimed to discuss the results of the NFSHI and the triple burden of malnutrition among the study subjects from phase I, and plan a nutrition health promotion program in consultation with the NHT members and parents. Roles and responsibilities of NHT, teachers and parents were also discussed. However, the participation of the parents in the first meeting was disheartening as out of the parents of 273 study subjects, only 12 (0.04%) came for the meeting.

Looking at the very poor response of the parent's participation in the first orientation meeting, an alternative methodology was adopted to involve parents in planning the intervention program. The letters duly signed by the principal through the study subjects (students) were sent to all parents, where parents had to tick on the programs they felt should be initiated in the school from the various given options for the programs (table 4.2.1). However, only 47.3% of the parents responded. The results of parent's response from table 4.2.1, showed that most (82.2%) of the parents of those who responded, wanted a change in the canteen menus to restrict the sale of unhealthy food items, followed by many (71.3%) wanting a school feeding program. It can be thus understood that only 47.3% of the parents were willing to get involved in a

nutrition health promotion program. However, the school authorities were hesitant to initiate any new program, thus alternatively parents were urged to take initiative in providing healthy tiffin to their children. Hence, an effort was made to provide a 6 days cyclic menus to the parents (of all the children irrespective of their participation in the program) and introduce healthy menus in the canteen, with the aim of helping all school children to have an enabling environment in the school campus with respect to healthy eating.

Table 4.2.1: Responses of parents to the components of the nutrition health promotion program to be initiated in the experimental school

Components of nutrition and health promotion program	TOTAL (n=129) % (n)
Starting a "School Feeding Programme"	71.3 (92)
In the Canteen: Restricting the sale of unhealthy food items and providing healthy snacks and milk beverages.	82.2 (106)
Iron Folic Acid Supplementation for all.	57.4 (74)
Presentations on how family members can influence the development of healthy dietary and lifestyle practices of children.	62.8 (81)
Demonstrations of healthy menus.	66.7 (86)
Talks by eminent personalities to build the capacities of the family members.	41.9 (54)

4.2.1b Support given by NHT members to implement the nutrition health promotion program

As the NHT consisted of the representatives from administration, children and parents, it facilitated the planning of the capacity building sessions and nutrition health education sessions for teachers, parents and students. The planning schedules included, deciding the dates, periods that could be engaged for nutrition health education for students and parents who consented for their participation in the school program.

4.2.1c Awareness and Capacity building of Class teachers

The awareness of the class teachers regarding nutrition and health issues was assessed along with the sessions conducted for the study subjects (students). No separate session was conducted for the teachers due to unavailability of all the teachers at one time.

Since, six days cyclic menus were distributed, a 60 minutes capacity building session was conducted for teachers to train them for tiffin auditing with the help of a check list both at baseline (before giving menus) and 3 months after giving menus to understand if parents had improved the quality of tiffins they made for their children (Annexure 18).

4.2.2 Parent's engagement in the school nutrition health promotion program in the management of malnutrition

To make parents understand their roles and responsibilities, towards their child's nutrition and health, nutrition health education (NHE) was conducted including awareness and capacity building sessions, which were planned to make them understand the importance of adolescent age group and how to prevent and control triple burden of malnutrition (overnutrition, undernutrition and anemia) in this age group. Further, as suggested by the school authorities in the orientation meeting that parents should take initiative by providing healthy tiffin to their children, two sets of 6 days planned cyclic menus (Annexure 14 & 26), providing 1/3rd of the child's RDA and iron rich, were given to the mothers to help them plan healthy tiffin for their child (explained further). .

4.2.2a Awareness and capacity building sessions for parents

Two NHE sessions were conducted for parents separately. The first session was related to improve their knowledge regarding prevention and control of underweight and anemia among adolescents , and build capacities of parents to enable them monitor their own child's growth regularly with the help of WHO 2007 growth charts. Hence they were taught to calculate BMI, plot on growth chart and then interpret the result. The second session was conducted to improve their knowledge regarding prevention and control of overweight and obesity in adolescents.

The first session was conducted on the following topics:

- What is adolescent age?
- Why adolescent period is important.
- Consequences of malnutrition (under nutrition & over nutrition)
- Why nutrition is important for adolescents

- Causes and consequences of under weight and anemia
- Preventive measures (dietary and lifestyle) for under nutrition
- Sources of iron and vitamin C rich foods
- Planning and Preparation of healthy meals.

Table 4.2.2, presents the results of the first NHE session, in which only 22.0% of the parents participated. The results demonstrated that before the session, though more than half (55.0%) of the parents knew about the correct age to define adolescence and importance of nutrition during adolescence (81.7%), after the session the proportion of parents significantly increased who could identify correct age of adolescence (98.3%) and could understand the importance of nutrition during adolescence (100.0%). It was very surprising to note that before the session only a quarter (25.0%) of the parents were aware about the term malnutrition, while after the session 100.0% parents could understand the exact meaning of malnutrition.

Looking at the responses for the steps that should be undertaken to address the nutritional requirements of the child, At baseline 0.04 % of parents understood the importance of providing healthy meals & monitoring dietary intakes of their children, however, majority (80.0%) of the parents after the session understood the same importance of providing healthy tiffin meal and monitoring the dietary intake of the child at home (76.7%). Further, the proportion of parents before the session who agreed that addressing malnutrition during adolescence is important was very less (33.3%) which increased to 91.7% after the session.

Coming to the awareness of parents regarding the nutritional status of adolescents, none of the parents were aware about the method of assessing nutritional status and BMI before the NHE session. However, after the session, 100.0% of the parents were aware about the assessment of nutritional status of adolescents and were able to identify BMI as a method to assess the nutritional status of the adolescents.

The awareness level of parents about the causes of under nutrition at baseline was low (38.3%), While, after the session majority (71.7%) of them could identify unhealthy dietary practices followed by unhealthy home tiffin (63.3%), consumption of aerated drinks (61.7%) and skipping breakfast (55.0%) as causes of under nutrition.

The first NHE session also gave knowledge about control and prevention of anemia. Table 4.2.3, shows the improvement levels in the knowledge of parents related to key issues of anemia prevention and control. Before the session, only 13.3% were aware about anemia while after the session the percentage of parents significantly increased to 86.7% , who were able to understand anemia. While, assessing the knowledge of parents regarding sources of haem and non haem iron, it was seen from the table 4.2.3, that only 13.3% (correct: 5.0%, partially correct: 8.3%) and 30.0% (partially correct: 30.0%) of parents could identify correct sources of haem and non haem iron respectively. However, the percentage of parents significantly increased to 95.6% and 100.0%, after session who could correctly identify the sources of haem amd non haem iron respectively.

Furthermore from table 4.2.3, looking into the knowledge of parents regarding enhancers and inhibitors of iron bioavailability, before the session, only 23.3% (partially correct: 23.3%) and 15.0% (correct: 5.0%, partially correct: 10.0%) of parents were able to correctly identify enhancers and inhibitors respectively. While after the session, 100% of the parents were able to identify the enhancers (correctly 70.0%, partially correct: 30.0%) and inhibitors (correctly 80.0%, partially correct: 20.0%). Similarly, an increase in knowledge about healthy cooking practices to improve nutritional quality of meals was also observed (table 4.2.3).

Table 4.2.2: Impact of nutrition health education sessions to parents on improvement in knowledge about key issues related to under nutrition

Key issues related to under nutrition	Before the session (N=60)	After the session (N=60)
	% (n)	% (n)
Correct age of adolescence 10-19 years	55.0 (33)	98.3 (59)
Importance of nutrition during adolescence	81.7 (49)	100.0 (60)
Awareness of malnutrition	25.0 (15)	100.0 (60)
Most frequent responses for the steps that should be undertaken to address the nutritional requirements of the child • Monitoring the dietary intake of the child at home • Giving healthy tiffin meal to child • Health check ups	65.0 (39) 48.3 (29) 28.3 (17)	76.7 (46) 80 (48) 50.0 (30)
Importance of addressing malnutrition during adolescence	33.3 (20)	91.7 (55)
Method assessing the nutritional status of adolescents	0 (0)	100 (60)
Importance of assessing nutritional status regularly	80.0 (48)	100 (60)
Awareness about Body Mass Index (BMI)	0 (0)	96.7 (58)
Assessing their child's nutritional status • Yes (Once a month, Twice a year, Thrice a year) • Never	 50.0 (30) 48.3 (29)	
Causes of under nutrition • Unhealthy dietary practices • Unhealthy home tiffin • Skipping breakfast • consumption of aerated drinks Don't Know	 36.7 (22) 33.3 (20) 26.7 (16) 25.0 (15) 38.3 (23)	 71.7 (43) 63.3 (38) 55.0 (33) 61.7 (37) 0 (0)

Table 4.2.3: Impact of nutrition health education sessions to parents on improvement in knowledge about key issues related to anaemia

Key issues related to anaemia	Before the session (N=60)	After the session (N=60)
	%(n)	% (n)
Awareness about anaemia	13.3 (8)	86.7 (52)
Sources of haem iron		
• Correct answer (meat, poultry, fish)	5.0 (3)	50.0 (30)
• Partially correct	8.3 (5)	45.0 (27)
• Wrong	70.0 (42)	3.3 (2)
• Don't know	16.7 (10)	1.7 (1)
Sources of non haem iron		
• Correct answer (pulses, cereals, vegetables, legumes)	0 (0)	16.7 (10)
• Partially correct	30.0 (18)	83.3(50)
• Wrong	28.3 (17)	0 (0)
• Don't know	41.7 (25)	0 (0)
Enhancers		
• Correct answer (Vitamin C rich fruits, meat, fish and other sea foods)	0 (0)	70 (42)
• Partially correct	23.3 (14)	30.0 (18)
• Wrong	43.3 (26)	0 (0)
• Don't know	33.3 (20)	0 (0)
Inhibitors		
• Correct answer (Coffee, Tea)	5.0 (3)	80 (48)
• Partially correct	10 (6)	20 (12)
• Wrong	38.3 (23)	0 (0)
• Don't know	46.7 (28)	0 (0)
Watermelon seeds are very rich in iron	35.0 (21)	96.7 (58)
Use of boiled water of green leafy vegetables for using it in other preparations	53.3 (32)	96.7 (58)
Incorporation of green leafy vegetables to add the iron content of various food products	45.0 (27)	6.7 (58)
Usage of left over iron rich vegetables or dal to knead the flour	26.7 (16)	93.3 (56)
Cauliflower greens are rich source of iron	33.3 (20)	95.0 (57)
Preparation of iron rich snacks with lemon topping.	43.3 (26)	96.7 (58)
Preparation of fruits just before having them	43.3 (26)	96.7 (58)

The second NHE session for parents was related to management and control of over nutrition (overweight including obesity). The topics covered were:

- Importance of including five food groups for healthy diet
- Consequences of high intake of salt, sugar and saturated fats.
- Recommendations for physical activity, TV/computer playing, and fruits and vegetable intake.

Table 4.2.4, shows the results of the second NHE session on parent's knowledge before and after the session. The percentage of parents participating in the second NHE session increased from 22.0% in the first NHE session to 33.0% in the second NHE session. The table showed that before the session, more (61.1%) parents knew the cereals, bread and potatoes are the constituent of five food groups followed by very few parents identifying pulses & legumes (11.1%) and fruits & vegetables (11.1%) also to be the constituent of five food groups. None of the parents knew that milk and milk products and oil, salt & sugar also form the five food groups, before the session. However, after the session all (100.0%) could understand that all food items categorized into various groups forms the five food groups.

Regarding the adverse consequences of high salt intake, before the session, majority (83.3%) of the parents identified high blood pressure as a major health problem, while very few (16.7%) of the parents reported heart problem as major ill consequence of high salt intake. However, after the session, 100.0% of the parents were able to understand that high salt intake leads to both high blood pressure and heart problems (table 4.2.4).

From table 4.2.4, it was very clear before the session that, majority (88.9%) of the parents knew that high intake of sugar leads to diabetes, while only 11.1% of parents reported that it can lead to increased weight gain. However, after the session all the (100.0%) parents knew that besides diabetes, high sugar intake also leads to increased weight gain.

The table 4.2.4, revealed that majority (83.3%) of the parents considered heart diseases the major adverse consequence of high saturated fat intake, followed by 11.1% and 5.6% of parents identifying high blood pressure and increased blood cholesterol respectively, to be the major health risks of high saturated fat intake.

Nevertheless, after the session, all (100.0%) of the parents understood that high saturated fat intake also leads to high blood pressure and increased blood cholesterol leading to heart diseases.

It was very surprising to note that, the knowledge of parents regarding recommended levels of physical activity per day (≥ 60 minutes /day) of their children was low, as majority (74.4%) of them reported that children should be less active than the recommended hours (≥ 60 minutes /day), while only a quarter (25.6%) of parents reported that the children should be active for 60 minutes or more. However, after the NHE session, all (100.0%) parents knew about the recommended level of physical activity to be performed by their children daily.

Regarding the hours spent by the children watching TV or sitting on computer, parents themselves wanted that their children should spend less time in front of the TV or sit on computer, Therefore, before the session, majority (80.0%) of the parents surprisingly could correctly identify the recommended levels of TV watching/ computer playing. However, after the session all (100.0%) were able to identify the recommended levels of TVwatching / sitting on computer (table 4.2.4).

Regarding the recommended levels of fruits and vegetable intake (≥ 400 gm/day), table 4.2.4 revealed that 63.3% of the parents were not knowing about the correct amount of fruits and vegetable to be consumed daily (≥ 400 gm/day), while after the session the percentage of parents increased significantly to 100.0%, who knew about the recommended levels of fruits and vegetable (≥ 400 gm/day) to be consumed daily by their children.

Table 4.2.4: Impact of nutrition health education sessions to parents on improvement in knowledge about key issues related to over nutrition

Responses	Before the session (N=90)	After the session (N=90)
	% (n)	% (n)
Five food groups contain		
• Cereals, bread and potatoes	61.1 (55)	-
• Pulses and Legumes	11.1 (10)	-
• Milk and milk products	-	-
• Fruits and vegetables	11.1 (10)	-
• Oil Salt and sugar	-	-
• All of the above	16.7 (15)	100.0 (90)
High intake of salt leads to:		
• High blood pressure	83.3 (75)	-
• Heart problems	16.7 (15)	-
• Both	-	100.0 (90)
High Intake of sugar leads to		
• Diabetes	88.9 (80)	-
• Increased weight gain	11.1 (10)	-
• Both	-	100.0 (90)
High intake of saturated fat leads to		
• Increased blood cholesterol	5.6 (5)	-
• Heart diseases	83.3 (75)	-
• High blood pressure	11.1 (10)	-
• All of the above	-	100.0 (90)
How much time daily your child should be physically active vigorously?		
• Less than 60 minutes	74.4 (67)	-
• Equal to or more than 60 minutes	25.6 (23)	100.0 (90)
How long daily your child should watch T.V or sit on computer?		
• More than 2 hours	20.0 (18)	-
• Equal to or less than 2 hours	80.0 (72)	100.0 (90)
How much (in grams) your child should consume fruits and vegetables daily?	63.3 (57)	-
• Less than 400 grams	36.7 (33)	100.0 (90)
• Equal to or more than 400 grams		

4.2.3 Creating enabling environment in the school to promote healthy eating during school hours

4.2.3a Improving quality of tiffin menus brought by the study subjects to school

The baseline assessment of tiffin, was done by categorizing the tiffin menus as healthy (cooked: paratha sabji, thepla, sabudana khichdi etc or uncooked: bread jam, bread butter, cheese sandwhich, khakra etc) and unhealthy (cooked: magi, noodles, franky, veg roll, muthiaetc or uncooked: mamra, fryms, biscuits etc). Therefore, table 4.2.5, showed that almost equal percentage of the study subjects brought unhealthy (50.1%) and healthy tiffin (49.9%) whether cooked or uncooked. Hence, an effort was made to improve the tiffin menus by planning 6 days cyclic menus. These tiffin menus were then given to parents, helping them to plan healthy tiffin on their own. Two sets of 6 days cyclic menus were planned to provide 1/3rd of the RDAs with special emphasis given to make food items iron rich (Annexure 14 & 26). The items in the first set were decided after observing the maximum frequency of items (home cooked and healthy) brought by the students at the baseline. These items were then modified to provide 1/3rd of the RDA and make it iron rich. The two items in the second set of 6 days cyclic menu were replaced by the recipes provided by the student (made by their mother). Further, these two recipes were again modified to provide 1/3rd of the RDA and make it iron rich.

The acceptability of the 6 days cyclic menus (two sets) were observed by tiffin auditing done by either class teachers (for one month) or the researchers (two months for Ist set and for three months for IInd set of menus).

4.2.3b Tiffin auditing

Table 4.2.5, shows the acceptability of planned tiffin menus (providing 1/3rd of the RDA and iron rich) through tiffin auditing. The table indicates a significant increase from 49.9% to 80.3% in healthy tiffins, after the distribution of Ist set of 6 days cyclic menus. The tiffin auditing was done for 2 months. One month it was done by the teachers with the help of a checklist (Annexure 18) and the second month by the researchers again, after teachers expressed their inability to complete the checklist on time.

The tiffin auditing was discontinued for four months due to exams and summer vacation and again resumed by the researchers to observe the trend of tiffin menus after the reopening of the school for one month. The results indicated that healthy tiffins were reduced from 80.3% to 75.6%, though the decrease was not significant. After the second session of the parents again a 2nd set of tiffin menus was given to the mothers. Tiffin auditing was continued for 3 months by the researchers and now it was observed that almost all (99.5%) of the study subjects were bringing healthy tiffin (table 4.2.5).

Table 4.2.5: Change in tiffin meal pattern brought by the study subjects before and after the distribution of two sets of 6 days cyclic menus

Type of tiffin meal	Baseline (2 months) N*=1053	Tiffin meals after giving Ist set of planned 6 days tiffin menu, after the first parent's NHE session (after 2 months) N*=7564	Tiffin meals after reopening of the school (after summer vacation for 1 month) N*= 6700	Tiffin meals after giving IInd set of planned 6 days tiffin menu, after the second parent's NHE session (after 3 months) N*=20,636
	% (n)	% (n)	% (n)	% (n)
Healthy (cooked + uncooked)	49.9 (525)	80.3 (6076)	75.6 (5060)	99.5 (20525)
Unhealthy (cooked + uncooked)	50.1 (528)	15.5 (1169)	18.6 (1245)	0.1 (36)
Healthy + unhealthy (cooked+ uncooked)	-	4.2 (319)	5.9 (395)	0.4 (75)

*Number of observations made (N)= Number of days X number of students)

4.2.3c Facilitating the delivery of healthy food options in the school canteen

The baseline assessment of the canteen menus as demonstrated by figures 4.1.1 and 4.1.2, showed high sale of precooked and reheated unhealthy snacks like puff, samosa, vegetable roll, carbonated beverages which were high in saturated, trans fat and sugar. Therefore, a meeting was conducted with the principal and the canteen contractor to discuss how canteen services can be improved by changing the existing canteen menus. The healthy snacks suggested were: Methi thepla, uttapa, chilla, dhokla, sprouts bhel, ragda patties, sev usal, subudana khichdi, idli sambhar, sambhar wada, soyabean patties, etc. However, the canteen contractor showed difficulty in serving the healthy snacks, because he neither had any facility for cooking in the premises nor the expertise to cook the menus as mostly pre- packaged or out sourced snacks were sold in the premises.

Regarding serving of healthy beverages in the canteen, efforts were made by the researcher to promote only those beverages which were having a comparable cost to the beverages that were sold in the canteen (Table 4.2.6). The selected beverages were, low fat milk beverages (butter milk, flavoured milk etc.) and sweetened fruit juices, like: real nature fresh juice, frooti etc (Table 4.2.7). It was not considered feasible, to promote the consumption of unsweetened fruit juices due to higher costs (Table 4.2.8). Hence, in order to promote the sale of healthy beverages a five day pilot trial was initiated by the researchers to study the response of the study subjects.

4.2.3d Five days pilot trial to promote healthy beverages in the school canteen

In this Five Day Pilot Trial, coupons were sold to the study subjects (students) according to their preferences for the products mentioned in table 4.2.7. This trial was also undertaken to assess the acceptability of healthy beverages among the study subjects and promote the consumption of healthy beverages by making them available in the school canteen. Figure 4.2.1, showed the popularity for butter milk and flavoured milk also. On looking at the response of the pilot trial, and knowing that 82.2% of the parents (table 4.2.1) wanted a change in canteen menus, the canteen contractor made arrangements for providing the healthy beverages in the school canteen.

Table 4.2.6: Comparison between the cost of proposed healthy beverages and available beverages in the canteen

Cost of healthy milk beverages and juices proposed for the change in the canteen		**Cost of unhealthy carbonated beverages already being sold in the canteen**	
Beverages	**Cost (Rs.)**	**Cost (Rs.)**	**Beverages**
Butter milk (200 ml)	3.00	18.00	Pepsi Can
Flavoured Milk (200 ml)	7.00	5.00-10.00	Pepsi
Lassi (200 ml)	9.00	10.00	Appy fizz, etc
Frooti (200ml)	10.00		
Real Nature Fresh (200ml)	15.00		

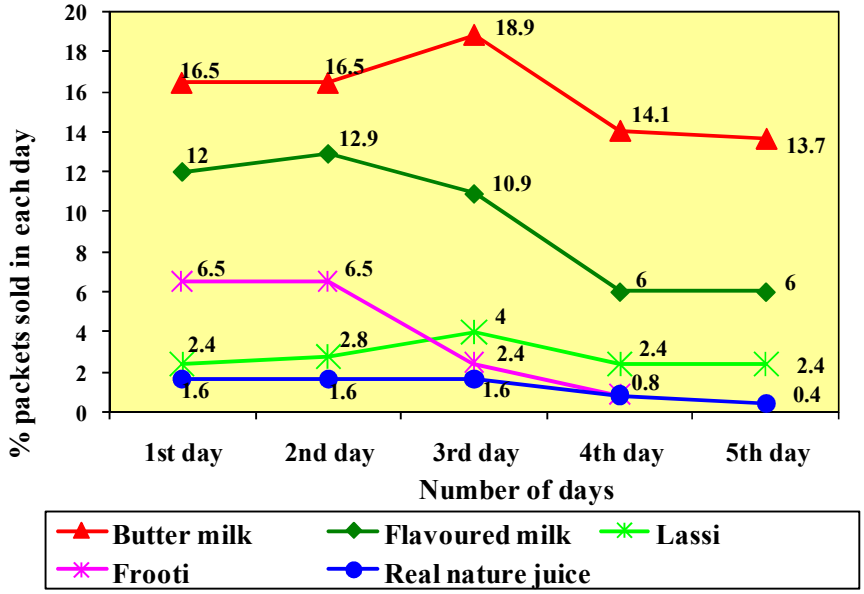
Table 4.2.7: Selected low fat milk beverages and fruit juices proposed to be sold in the school canteen

Beverages	**Cost (Rs.)**
Butter milk	@ 3.00
Flavoured milk	@ 7.00
Lassi	@ 9.00
Frooti	@ 10.00
Real nature	@ 15.00

Table 4.2.8: Cost of unsweetened fruit juices in the market which could not be proposed in the school canteen due to higher costs

Fruit juices labeled as "No added sugar"	Cost of tetra pack of 200 ml (Rs.)
Active	20.00
Ceres	25.00

Figure 4.2.1 Sale trend of proposed milk beverages and fruit juices in the five days trial period



Highlights

- High (82.2%) percentage of the parents who participated wanted a change in the existing school canteen, followed by 71.3% agreeing to initiate a school meal program.
- Parent's participation was very poor (0.04%) during the first orientation meeting which improved slightly to 22.0% in the first NHE session to 33.0% in the second session NHE session.
- The knowledge of parents who attended the NHE sessions improved significantly after the NHE session conducted to provide information about prevention and control of triple burden of malnutrition (overweight including obesity, underweight and anemia).
- The percentage of study subjects brining healthy tiffin increased from 49.9% at baseline to almost 100.0%, after the introduction of two sets of 6 days cyclic menus (providing 1/3rd of the RDA and iron rich) as an alternative to school meal program.
- Teachers were unable to audit tiffin menus of the study subjects due to due to overload of their own teaching schedule.
- Low fat milk beverages like butter milk and flavoured milk were proposed to be sold in the school canteen as they were well accepted by the study subjects, shown by A Five Day Pilot Trial.

Discussions

The second phase of the study was conducted to engage teachers and parents in the school nutrition and health promotion program. It also aimed to create enabling environment in the school by improving tiffin menus brought by the study subjects and improving the existing nutrition services in the school to offer ample opportunity for the children to adopt healthy dietary behaviors.

Since there was no school meal program in the school, an initiative was made to improve the tiffin menus of the study subjects they brought from home and had it in the school interval. Two sets of 6 days cyclic menus, providing 1/3rd of the RDA and iron rich recipes were given to mothers, helping them to plan healthy tiffin for their child. With the help of tiffin auditing (by teachers and researchers) positive change

was observed, with percentage of the study subjects bringing healthy tiffin increased from 49.9% to almost 100.0%. In the United States (U.S) school meal programs are in place, comprising school breakfast program or school lunch programs (CDC 2011). The review of literature also shows that students who participated in school meal programs consumed more milk, fruits, and vegetables and have better nutrient intake than those who do not participate (Condon and Crepinsek 2009, Gordon et al 2009). In addition, regular participation in the School Breakfast Program is associated with lower BMI, improved student functioning on a broad range of psychosocial and academic measures and significant decrease in the rates of school absence and tardiness compared with the students whose participation remained the same or decreased (Gleason and Dodd 2009, Murphy et al 2005, Murphy et al 2001, Powell et al 1998, Murphy et al 1998). However, no data on school meal program from MHSES could be retrieved from India to support our result. Thus based on experiences from USA and parents willingness to initiate nutritious meal programmes in the present study, It will be worthwhile if school authorities of private schools are given some recognition such as accreditation as nutrition friendly school or incentives such as providing kitchen space if they start a nutritious school meal programme. It is also important that school management is sensitized about the need to focus on nutrition assessment and adverse implications of micronutrient deficiencies especially anemia and malnutrition on scholastic achievements and development of non communicable diseases in future. In the present study, an effort was also made to improve the existing canteen services. According to the U. S. School Health Guidelines, foods or beverages sold or served outside of the school meal program, are the principal source of low- nutrient, energy dense foods that students consume at school **(CDC 2011)**. The most commonly available competitive foods are high in sugar, fat, and calories, including high fat salty snacks, high fat baked goods, and high calorie sweetened beverages, such as soft drinks, sports drinks, and fruit drinks (CDC 2008, O'Toole et al 2007, US GAO 2005).

While it was not feasible in the study school setting to improve canteen menus because of lack of infrastructure available to the contractor or his willingness or motivation to make a change, in the absence of school authorities having no say in the running of the canteen, therefore, a five day pilot trial conducted to promote low fat milk beverages and juices among the students proved to be quite successful as

given the choice of selecting healthy foods students were willing the change and prefer low fat and healthy alternatives such as butter milk, flavoured milk and fruit juices. This clearly demonstrates that students are willing to change their eating habits provided they get an enabling environment, therefore the onus of improving adolescent or school health lies with the school authorities and informed & supportive parents. This result was supported by Briefel et al 2009. Who showed that children attending schools without stores or snack bars that sell foods or beverages is estimated to significantly reduce sugar-sweetened beverage consumption by 22 kcal per school day for middle school students and 28 kcal per school day for high school students. In addition, restricting access to snack foods is associated with more frequent fruit and vegetable consumption (Gonzalez et al 2009). Government of India (GOI) has also recognized the importance of healthy canteens in school premises, especially banning the sale of aerated drinks, however, it needs to go further and ban all other unhealthy items such as high salt savory items, trans fat laden bakery items etc in the school premises with some monitoring mechanism in place.

Though in India, international schools are running school meal programs or restricting the sale of unhealthy snacks and beverages in their schools, no scientific data could be found to support the results of the present nutrition and health promotion program or the implementation of GOI guidelines in schools. These initiatives by the international schools are generally based on commercial gains and not nutritional considerations.

The nutrition and health promotion programs also in the present study aimed to involve parent's participation. The participation rate of parents in the present program was not very satisfactory, however, it increased from 22.0% to 33.0% from first NHE session to second NHE session. According to CDC's School health guidelines, parents contribute to the academic success of the students and are key stakeholders in healthy eating and physical activity policies and practices in schools (Epstein et al 2009, Henderson and Mara 2002, Epstein 2001). Family involvement in nutrition and health can increase children's as well as parent's knowledge and attitude about healthy lifestyle (Nader et al 1996), influence behavior change (Trevino et al 2005, McGarvey et al 2004, Beech et al 2003, Golan and Crow 2003, McLean et al 2003), and provide social support for being healthy.

Therefore it is imperative that parents involvement and sensitization is routinely done to make them aware of the healthy dietary and life style behaviours to be promoted in children, this can be effectively done by inviting experts on nutrition, health, physical activity, yoga etc in parent teachers (PTA) meeting who can guide them on healthy life style habits to be promoted in children.

Studies that have assessed strategies to prevent and treat childhood obesity or promote physical activity and healthy eating have demonstrated more success when focusing on both the family and the child rather than the child alone (Bharati et al 2008, Shah et al 2008, Golan and Crow 2004, Ransdell et al 2003). However, in Indian scenario this concept of parent's participation in nutrition and health issues has largely remained unexplored.

In the present study, parents who participated in nutrition health promotion program also wanted a change in canteen menus (82.2 %) and initiating school meal program (71.3%) in the school. Hence, the results of the present study revealed that those parents who participated were keen on initiating healthy nutrition practices, thus it is important that schools make efforts to engage parents in these activities. However, it can be hypothesized that those who participated were more aware of the nutrition health issues and thus wanted to be more informed, while those (majority) who did not participate were those who were totally unaware and thus all the more it is important that schools become a medium to sensitize and educate parents to focus on improving not only their child's scholastic performance but also immediate and future health of their children.

Teachers are also an important part of nutrition and health promotion programs in schools. In the present study, teachers showed willingness to participate in the program, however due to their own overload of teaching schedules, could not conduct the activities required by them (tiffin auditing, participation in NHE sessions etc). Hence to ensure effective implementation of nutrition and health promotion programs in school qualified professionals are required who should be employed by the school for the program only with parental financial support. The United State Department of Education has recommended that schools should develop and adopt policies that require certified physical and nutrition education teachers, rather than teachers who are certified to teach other subjects areas, to ensure that students receive quality

instructions. Certified teachers teach longer lessons, spend more time developing motor and movement skills, impart more knowledge, and provide better guidance (Davis et al 2005, McKenzie et al 2000, Sallis et al 1997, McKenzie et al 1995,). These technically qualified teachers should be aware of the recommended national standards to help school comply with the recommendations (NASPE 2009, Cater and Carr 2004, Rainville and Carr 2000). Later, these specifically qualified teachers should also be provided annual professional development opportunities (Bauer ET AL 2006, O'Toole et al 2006, Davis et al 2005, McKenzie et al 2004, Kelder et al 2003, ADA 2003, Sullivan et al 2000, McKenzie et al 1997,). Professional development can enhance teachers' instructional strategies for increasing student physical activity during physical education classes, and can help implement changes within the school meal program leading to reduction in calories from total fat, saturated fat, and sodium (Fairclough and Stratton 2005, Kelder et al 2003, McKenzie et al 2000, McKenzie et al 1997, Osganian et al 1996,). In addition, professional development also help the teachers to positively influence children's choices for healthy dietary and lifestyle behaviours (Fulkerson et al 2002).

Therefore, the second phase of the study helps us to understand the importance of participation of school community (administration, teachers and nutrition service providers) and parents, for effective implementation of nutrition and health promotion program for the growth and development of school aged children and adolescents.

PHASE III

IMPACT OF NUTRITION HEALTH PROMOTION PROGRAM (INTERVENTION) IN THE EXPERIMENTAL SCHOOL AND COMPARISION OF IMAPCT INDICATORS BETWEEN THE EXPERIMENTAL AND CONTROL SCHOOL

Before planning the nutrition health promotion program, the situational analysis of the study subjects regarding anthropometry (BMI for age, central obesity), biophysical (blood pressure), biochemical parameters (haemoglobin and lipid and glucose) and dietary and lifestyle behaviors was done in the Experimental & control schools. Since, anemia was found to be present in 49.3% of the study subjects, IFA supplementation was immediately initiated among the student as blanket cover in the Experimental school. Later depending on the availability of free classes, NHE sessions were conducted for the study subjects in the experimental school. The nutrition health promotion program besides creating enabling environment in the experimental school as described in Phase II also included:

- Weekly IFA supplementation of 60 mg elemental iron and 0.5 mg folic acid for a period of 3 to 4 months (12 doses) on the prevalence of anaemia and improvement in haemoglobin levels.
- Nutrition Health Education (NHE) and capacity building sessions with the study subjects, with the help of power point presentations were conducted for prevention and management of malnutrition (in all its forms).

Later, the impact of the nutrition health promotion program was seen on:

- The prevalence of anemia after weekly supplementation of 60 mg elemental iron and 0.5 mg folic acid for a period of 3 to 4 months (12 doses).
- The change in the knowledge, attitude and practices of study subjects after nutrition health education for the prevention and management of malnutrition (in all its forms) and capacity building for assessing their own nutritional status.
- The selected outcome indicators (BMI for age, biophysical parameter, biochemical parameters, and dietary and lifestyle behaviors), after one and half years of nutrition health promotion were compared with the subjects from the control school.

4.3.1 Impact of nutrition health promotion program including weekly supplementation of 60 mg elemental iron and 0.5 mg folic acid for a period of 3 to 4 months (12 doses) on the prevalence of anaemia

Table 4.3.1, demonstrates that there was a slight decrease (though not significantly) in the prevalence of anaemia after nutrition health promotion program (intervention) including IFA supplementation from base line (49.3% vs 48.7%). Mean haemoglobin levels also increased slightly from its respective base line values (11.61±1.9 gm/dl vs 11.66±1.0 gm/dl).

Table 4.3.2 presents overall and sex wise compliance of IFA tablets. Among the study subjects, the overall compliance was very good (38.6%) and good (30.5%) suggesting that 68.5% of the study subjects had no problems with compliance. Overall the girls had better compliance(≥9 doses) than boys (74.1% vs 65.9%) comprising of subjects who took more than 75% of the given 12 doses (Figure 4.3.1).

Initial and final prevalence and severity of anaemia between the 4 groups (groups A: 11-12 tablets, group B: 9-10 tablets, group C: 8 tablets, group D: < 8 tablets) were compared in the table 4.3.3. In order to observe the efficacy of nutrition health promotion programme including weekly IFA supplementation on anaemia control, the table reveals that 27.9% reduction in the prevalence of anaemia was seen in 'A' group (11 – 12 tablets) followed by Group 'C' (20.0%) and Group 'B' (11.4%). On the contrary, a very highly significant increase (267%) was seen in Group 'D' although their initial prevalence was lower at baseline (18.7%).

Similarly on looking at the mean haemoglobin levels with respect to compliance, table 4.3.4 demonstrates that a highly significant ($p<0.01$) increase in haemoglobin levels (11.30 ± 1.9 to 11.91 ± 1.2) was seen in the subjects who had very good compliance (11-12 tablets). Similarly in good (11.28±1.7 gm/dl to 11.49±1.0 gm/dl) and average compliance (11.59±1.6 gm/dl to 11.74±0.9 gm/dl) categories also an increase (though not significantly) in haemoglobin levels from base line was seen after nutrition health promotion program including IFA supplementation. However in subjects with poor compliance (1-7 tablets) a significant ($p \leq 0.05$) decrease in haemoglobin levels (12.97±1.7 to 11.3±0.92) was seen.

Table 4.3.5 presents a significant fall in mean haemoglobin level among non anaemic subjects from baseline to end line (13.20±1.15 Vs. 12.0±0.99) in all supplemented groups where as, a significant increase in haemoglobin levels was seen in anaemic subjects from baseline value (10.04±0.97 vs 11.29±1.04). A linear relationship in improving the anaemic status from baseline was seen with the compliance of the tablets. Those who had good and very good compliance had higher increase in haemoglobin levels (very good: 9.83 ± 0.99 to 11.34 ± 1.0; good: 10.14 ± 1.0 to 11.32 ± 1.0) as compared to poor compliers (poor: 10.05 ± 0.5 to 10.41 ± 1.06). However, no consistent trend was observed in reduction of haemoglobin levels in the non-anaemic subjects.

Table 4.3.6 presents at baseline academic scores of the supplemented subjects as compared to non-supplemented subjects. At baseline, in the supplemented subjects a significant improvement in the academic performance of the study subjects after nutrition health promotion programme (combined interventions) from the baseline (186.7 ± 46.64 Vs. 191.20 ± 45.20***, p≤ 0.001) as compared to non supplemented group (177.24 ± 48.34 Vs.169.86 ± 48.53***, p≤ 0.001) was seen. Similarly, significantly ($p<0.01$) higher improvement in the marks obtained by subjects after supplementation from baseline in anaemic subjects as compared to counter parts was observed (Table 4.3.7).

Table 4.3.1: Percent change in prevalence of anaemia and change in mean haemoglobin levels of the study subjects before and after the intervention including weekly IFA supplementation

	prevalence of anaemia (n=197)	**Mean Haemoglobin levels (gm/dl)**
	% (n)	**Mean ± S.D**
Initial	49.3 [a] (99)	11.61±1.9 [c] (197)
Final	48.7 [b] (96)	11.66±1.0 [d] (197)
p value	p = 0.09	p = -0.37

Table 4.3.2: Compliance of 12 doses of Iron Folic Acid supplementation among all (anaemic + non-anaemic) study subjects

	Girls (n=62)	**Boys (n=135)**	**Total (N=197)**
	% (n)	**% (n)**	**% (n)**
Very good compliance (11-12 tablets)	43.5 (27)	36.3 (49)	38.6 (76)
Good compliance (9-10 tablets)	30.6 (19)	29.6 (40)	30.5 (59)
Average compliance (8 tablets)	12.9 (8)	16.2 (22)	14.7 (29)
Poor compliance (1-7 tablets)	12.9 (8)	17.8 (24)	16.2 (32)

Figure 4.3.1: Compliance of IFA supplementation among study subjects (≥75%)

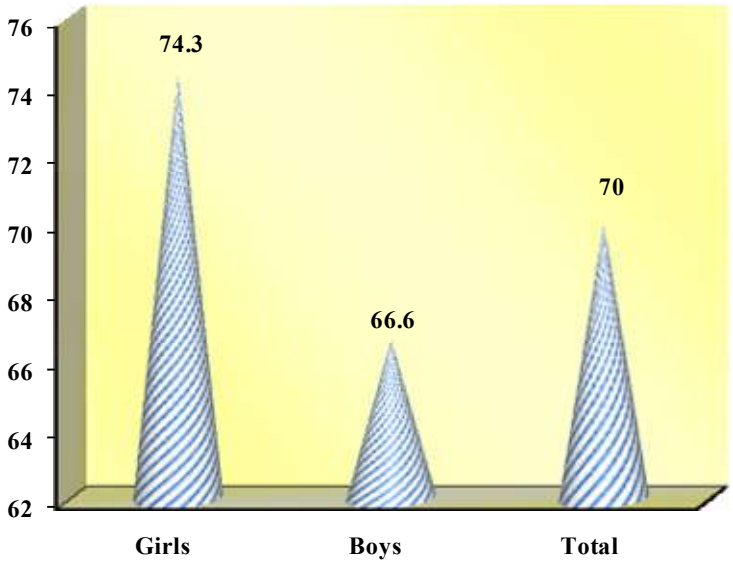


Table 4.3.3: Changes in the severity of the Anaemia among the study subjects before and after the intervention in relation to compliance

	Group A (11-12 tablets) (n= 76)		Group B (9-10 tablets) (n=59)		Group C (8 tablets) (n=30)		Group D (<8 tablets) (n=32)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Non anaemics	38.1 [a] (29)	57.8 [b] (44)	28.8 (17)	35.5 (21)	36.6 (11)	46.6 (14)	81.2[c] (26)	25.0[d] (8)
Mild anaemia 10.1 – 11.9 gm/dl	25.0 (19)	38.1 (29)	32.2 (19)	55.9 (33)	50.0 (15)	50.0 (15)	9.3 (3)	68.7 (22)
Moderate anaemia 7.1 – 10 gm/dl	36.8 (28)	3.9 (3)	38.9 (23)	8.4 (5)	13.3 (4)	3.3 (1)	9.3 (3)	6.2 (2)
Severe anaemia ≤ 7 gm/dl	-	-	-	-	-	-	-	-

a Vs. b = 5.17*
c Vs. d = 18.13 ***
*p < 0.05, *** p < 0.001

Table 4.3.4: Relations between compliance of Iron Folic Acid tablets and mean change in haemoglobin level in the study subjects

Number of doses	Changes in Haemoglobin level		Mean difference	Paired 't' test
	Base line Hb Mean±SD (gm/dl)	End line Hb Mean±SD (gm/dl)		
11-12 (n=76)	11.30±1.9	11.91±1.2	0.6±0.4	3.0 **
9-10 (n=59)	11.28±1.7	11.49±1.0	0.2±0.2	0.72
8 (n=30)	11.59±1.6	11.74±0.9	0.1±0.1	.77
<8 (n=32)	12.97±1.7	11.3±0.92	-1.66±1.1	5.6*
Total (N=197)	11.61±1.9	11.66±1.0	0.05±0.03	0.37

* p < 0.05
** p < 0.01

Table 4.3.5: Impact of IFA supplementation in relation to the compliance and anaemic status of the study subjects

	11-12 tablets		9- 10 tablets		8 tablets		<8tablets		Total	
	Non Anaemic (n=33) (gm/dl)	Anaemic (n=43) (gm/dl)	Non Anaemic (n=24) (gm/dl)	Anaemic (n=35) (gm/dl)	Non Anaemic (n=15) (gm/dl)	Anaemic (n=15) (gm/dl)	Non Anaemic (n=26) (gm/dl)	Anaemic (n=6) (gm/dl)	Non Anaemic (n=98) (gm/dl)	Anaemic (n=99) (gm/dl)
Initial	13.23±1.13	9.83±0.99	12.94±1.2	10.14±1.0	12.78±1.2	10.4±0.97	13.65±1.01	10.05±0.5	13.20±1.15	10.04±0.97
Final	12.65±1.04	11.34±1.0	11.74±0.89	11.32±1.0	12.04±0.66	11.4±1.0	11.51±0.77	10.41±1.06	12.0±0.99	11.29±1.04
Change in Hb from baseline	-0.58	1.51	-1.2	1.18	-0.73	1.0	-2.13	0.36	-1.16	1.25
Paired t test	2.35*	-7.55 ***	39.07***	-4.84***	2.92*	-2.50*	7.678***	-.788^{NS}	7.63***	-8.86***

* p < 0.05 ,** p < 0.01 , ***p<0.001, NS= Non significant

Table 4.3.6: Comparison of the mean academic scores of the supplemented Vs. non supplemented study subjects

	Scores before intervention Mean ± S.D	Scores after intervention Mean± S.D	Paired t Test
Supplemented (151)	186.7 ± 46.64	191.20 ± 45.20	-3.3***
Non-supplemented (72)	177.24 ± 48.34	169.86 ± 48.53	4.8***

*** p< 0.001

Table 4.3.7 Impact of combined intervention on the academic scores of the Study Subjects

	Scores before intervention Mean ± S.D	Scores after intervention Mean± S.D	Paired t Test
Anemic (69)	174.38 ± 45.46	179.57 ± 45.56	-2.7**
Non-anemic (82)	187.87 ± 82	190.6 ± 82	-2.0*

* p<0.05; ** p< 0.01

4.3.2: Impact of nutrition health education given to study subjects for the prevention and management of malnutrition (in all its forms) as a component of nutrition health promotion programme and their capacity building for assessing their own nutritional status on change in knowledge, attitude and practices of the study subjects.

In order to assess the impact of nutrition health education on knowledge pertaining to different aspects of adolescent health, under nutrition, anaemia and over nutrition, Nutrition health education was given to all the study subjects of class VI and VII. Two major sessions were conducted for under nutrition management and over nutrition management with the help of power point presentations. Under nutrition management session consisted of three sessions, which were as follows:

i. Session 1: Under weight management (60 minutes)
ii. Session 2: Skill building to calculate BMI (30 minutes)
iii. Session 3: Capacity building to plot and interpret BMI for age WHO (2007) growth charts (30 minutes)

Another session was conducted for over nutrition control and management for the study subjects for 60 minutes.

Hence, table 4.3.8, presents the results of NHE sessions pertaining to adolescent health and under nutrition.

The first session was conducted on the following topics:

- Age group of adolescent and importance of nutrition in these years
- Definition of Mal nutrition
- Methods of Nutritional status assessment by BMI calculation
- Causes of under nutrition etc.
- What is anaemia
- Sources of heam and non-heam iron
- Enhancers and inhibitors of iron etc.

According to Table 4.3.8, before the session, less than half (47.8%) of the study subjects knew the correct age of adolescence, which significantly increased to 98.2% after the session. Though more than half (58.2%) of the study subjects at baseline understood the importance of nutrition during adolescence, the percentage significantly increased to 100% after the session. Very few (8.0%) of the study subjects, before the session, were aware about the term malnutrition, however, after the session percentage increased to 94.7%. Less than a quarter (21.3%) of the study subjects, before the session understood that it is important to address the malnutrition during adolescence, which increased significantly to 93.8% after the session. Though before the session, 64.9% of the study subjects reported that they understand the importance of assessing the nutritional status regularly, nevertheless only 4.0% of them could mention the methods of assessing the same. However, almost all subjects (98.2%) after the session were able to understand the importance of assessing nutritional status and identifying the methods to assess the nutritional status. Before

the session, table 4.3.8, reported that 31.6% of the study subjects, were aware about their own nutritional status which increased to 86.2%. From table 4.3.8, it is very clear that none of the study subjects were aware about the term Body Mass Index (BMI), which significantly increased to 94.2% in the study subjects, after the session, who could identify BMI as a method to assess their nutritional status. Regarding the causes of under nutrition, more than half (52.9%) of the study subjects were not knowing the exact causes of under nutrition at baseline while after the session 92.0% of them could correctly identify the causes of under nutrition. The table 4.3.8, does not indicate any gender difference in the knowledge of the study subjects.

Table 4.3.9 shows the response of the study subjects related to key issues of anaemia, which shows that the percentage of the study subjects increased from 12.0% to 87.1% regarding their awareness about anemia before and after the session. Regarding the sources of haem iron only 6.7% of the study subjects before the session could identify the sources which were partially correct, however, this proportion of the study subjects increased significantly to 93.9% (Correct: 79.1%, partially correct: 14.2%) after the session. Similarly, only 11.1% of the study subjects before the session, could identify the sources of non haem iron which was partially correct, which after the session increased to 92.8% of the study subjects who correctly identified the sources (Correct: 72.4%, partially correct: 20.4%). Regarding the enhancers and inhibitors of the iron bioavailability of iron, though more than a quarter (26.3%) could identify the sources of enhancers, 19.6% of the study subjects were partially correct and only 6.7% were absolutely correct in identifying the sources of enhancers. This percentage increased significantly to 94.2%, with more (74.2%) identifying correctly all the sources of enhancers, while only 20.0% being partially correct. Regarding, identification of inhibitors, before the session, almost same percentage of the study subjects could correctly (11.6%) and partially (10.7%) identify it. However, after the session, 95.1% of the study subjects could identify the sources, of which 81.8% correctly identified while only 13.3% partially identified the sources of inhibitors.

Later, two skill building sessions were carried out for 30 minutes for each section. In this session capacity of the students were built regarding BMI calculation, BMI chart plotting and interpretation. After the capacity building session, 84.6% students were able to correctly plot and interpret the BMI chart (Figure 4.3.2).

The second NHE session conducted for students was on control and prevention of over weight and obesity. Table 4.3.10, shows the knowledge level of the students for various aspects on control and prevention of overweight and obesity before and after the NHE session. Regarding the knowledge of including five food groups for making healthy diet, as expected at baseline nobody knew the concept of five food groups, instead 74.5% of the study subjects could identify cereals, bread and potato as five food groups. However, after the NHE session, 100.0% of the subjects could identify all the five food groups. It was very surprising to note that the study subjects were unaware of the fact that high salt/ sugar/fat intake could lead to any health problems before the session, while after the session 100% could identify the respective health problems due to high intake of salt/sugar/fat intake. Regarding the recommended levels of various dietary and lifestyle behaviors, before the NHE session, 77.3% of the students correctly identified the level of physical activity they should be engaged in, with more proportion of boys (89.4%) responding correctly than girls (52.9%). However, after the session, this percentage became 100.0%. While coming to the knowledge of the students regarding duration of screen time (TV watching and sitting on computer), at baseline the knowledge was good with majority (92.2%) of the students identifying more than two hours, as the recommended level, which further improved to 100% after the session. Regarding the daily consumption of fruits and vegetables, before the session, only a quarter (25.5%) of the students reported that they should consume less than 400 gm/day fruits and vegetable, while majority (74.5%) of them reported that it should be consumed equal to or more than 400gm/day, which after the session 100.0% of the students were clear about the recommended levels of fruits and vegetable daily.

Table 4.3.8: Impact of nutrition health education sessions to students on improvement in knowledge about key issues related to under nutrition

Key issues related to Adolescent health and under nutrition	Before the session			After the session		
	Girls (n = 63)	Boys (n = 162)	Total (N=225)	Girls (n = 63)	Boys (n = 62)	Total (N=225)
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Correct age of adolescence 10-19 YEARS	46.0 (29)	48.1 (78)	47.8 (107)	98.4 (62)	98.1 (159)	98.2 (221)
Importance of nutrition during adolescence	57.1 (36)	58.6 (95)	58.2 (131)	100 (63)	98.8 (160)	99.1 (223)
Awareness of malnutrition	4.8 (3)	9.3 (15)	8.0 (18)	93.7 (59)	95.1 (154)	94.7 (213)
Importance of addressing malnutrition during adolescence	12.7 (8)	24.7 (40)	21.3 (48)	93.7 (59)	93.8 (152)	93.8 (211)
Method assessing the nutritional status of adolescents	9.5% (6)	1.9 (3)	4.0 (9)	96.8 (61)	98.8 (160)	98.2 (221)
Importance of assessing nutritional status regularly	65.1 (41)	64.8 (105)	64.9 (146)	100 (63)	97.5 (158)	98.2 (221)
Awareness of their own nutritional status	31.7 (20)	31.5 (51)	31.6 (71)	88.9 (56)	85.2 (138)	86.2 (194)
Awareness about Body Mass Index (BMI)	0 (0)	0 (0)	0 (0)	95.2 (60)	93.8 (152)	94.2 (212)
CAUSES OF UNDERNUTRITION • All correct responses (Total four) • Don't know	34.9 (22) 60.3 (38)	44.4 (72) 50 (81)	41.8 (94) 52.9 (119)	90.5 (57) 3.2 (2)	92.6 (150) 3.7 (6)	92.0 (207) 3.6 (8)

Table 4.3.9: Impact of nutrition health education sessions to students on improvement in knowledge about key issues related to anaemia

Key issues related to anaemia	Before the session			After the session		
	Girls (n = 63)	Boys (n = 62)	Total (N=225)	Girls (n = 63)	Boys (n =162)	Total (N=225)
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Awareness about anaemia	19.0 (12)	9.3 (15)	12.0 (27)	92.1 (58)	85.2 (138)	87.1 (196)
Sources of haem iron						
• Correct answer (meat, poultry, fish)	0 (0)	0 (0)	0 (0)	77.8 (49)	79.6 (129)	79.1 (178)
• Partially correct	6.3 (4)	6.8 (11)	6.7 (15)	14.3 (9)	14.2 (23)	14.2 (32)
• Wrong	25.4 (16)	24.1 (39)	24.4 (55)	3.2 (2)	3.7 (6)	3.6 (8)
• Don't know	68.3 (43)	69.1 (112)	68.9 (155)	4.8 (3)	2.5 (4)	3.1 (7)
Sources of non haem iron						
• Correct answer (pulses, cereals, vegetables, legumes)	0 (0)	0 (0)	0 (0)	74.6 (47)	71.6 (116)	72.4 (163)
• Partially correct	7.9 (5)	12.3 (20)	11.1 (25)	14.3 (9)	22.8 (37)	20.4 (46)
• Wrong	14.3 (9)	18.5 (30)	17.3 (39)	3.2 (2)	1.2 (3)	2.2 (5)
• Don't know	77.8 (49)	69.1 (112)	71.6 (161)	8.0 (5)	3.7 (6)	4.9 (11)
Enhancers						
• Correct answer (Vitamin C rich fruits, meat, fish and other sea foods)	7.9 (5)	6.2 (10)	6.7 (15)	82.5 (52)	71.0 (115)	74.2 (167)
• Partially correct	9.5 (6)	23.5 (38)	19.6 (44)	14.3 (9)	22.2 (36)	20.0 (45)
• Wrong	19.0 (12)	13.6 (22)	15.1 (34)	1.3 (1)	4.3 (7)	3.6 (8)
• Don't know	63.5 (40)	56.8 (92)	58.7 (132)	1.3 (1)	2.5 (4)	2.2 (5)
Inhibitors						
• Correct answer (Coffee, Tea)	6.3 (4)	13.6 (22)	11.6 (26)	93.7 (59)	77.2 (125)	81.8 (184)
• Partially correct	6.3 (4)	12.3 (20)	10.7 (24)	6.3 (4)	16.0 (26)	13.3 (30)
• Wrong	25.4 (16)	18.5 (30)	20.4 (46)	0 (0)	3.7 (6)	2.7 (6)
• Don't know	61.9 (39)	55.6 (90)	57.3 (129)	0 (0)	3.1 (5)	2.2 (5)

Figure in parenthesis indicates number of subjects

Figure 4.3.2: BMI chart plotting by the students after capacity building session

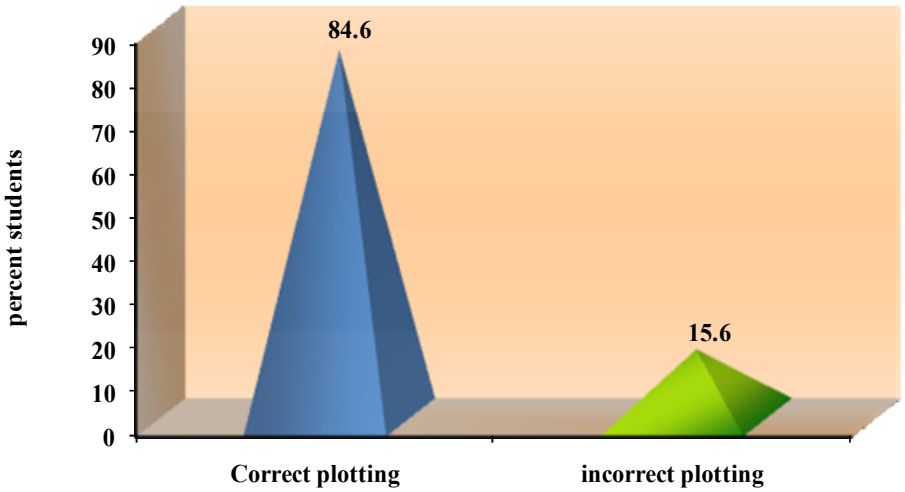


Table 4.3.10: Impact of nutrition health education sessions to the students on improvement in knowledge about key issues related to over nutrition

Responses	Before the session			After the session		
	Girls (n=85) % (n)	Boys (n=170) % (n)	Total (N= 255) % (n)	Girls (n=85) % (n)	Boys (n=170) % (n)	Total (N= 255) % (n)
Five food groups contain						
• Cereals, bread and potatoes	70.6 (60)	76.5 (130)	74.5 (190)	-	-	-
• Pulses and Legumes	11.8 (10)	8.8 (15)	9.8 (25)	-	-	-
• Milk and milk products	5.9 (5)	2.9 (5)	3.9 (10)	-	-	-
• Fruits and vegetables	5.9 (5)	5.9 (10)	5.9 (15)	-	-	-
• Oil Salt and sugar	-	2.9 (5)	2.0 (5)	-	-	-
• All of the above	5.9 (5)	2.9 (5)	3.9 (10)	100.0 (85)	100.0 (170)	100.0 (255)
High intake of salt leads to:						
• High blood pressure	85.9 (73)	89.4 (152)	88.2 (225)			-
• Heart problems	14.1 (12)	10.6 (18)	11.8 (30)			-
• Both				100.0 (85)	100.0 (170)	100.0 (255)
High Intake of sugar leads to						
• Diabetes	90.6 (77)	95.9 (163)	94.1 (240)			
• Increased weight gain	9.4 (8)	4.1 (7)	5.9 (15)			
• Both				100.0 (85)	100.0 (170)	100.0 (255)
High intake of fat leads to						
• Increased blood cholesterol	82.4 (70)	97.1 (165)	92.2 (235)			
• Heart diseases	17.6 (15)	2.9 (5)	7.8 (20)			
• High blood pressure						
• All of the above				100.0 (85)	100.0 (170)	100.0 (255)
How much time daily you should be physically active vigorously?						
• Less than 60 minutes	47.1 (40)	10.6 (18)	22.7 (58)			
• Equal to or more than 60 minutes	52.9 (45)	89.4 (152)	77.3 (197)	100.0 (85)	100.0 (170)	100.0 (255)
How long daily you should watch T.V or sit on computer?						
• More than 2 hours	82.4 (70)	97.1 (165)	92.2 (235)			-
• Equal to or less than 2 hours	17.6 (15)	2.9 (5)	7.8 (20)	100.0 (85)	100.0 (170)	100.0 (255)
How much (in grams) you should consume fruits and vegetables daily?						
• Less than 400 grams	11.8 (10)	32.4 (55)	25.5 (65)			-
• Equal to or more than 400 grams	88.2 (75)	67.6 (115)	74.5 (190)	100.0 (85)	100.0 (170)	100.0 (255)

4.3.3: Impact of one and half years of nutrition and health promotion program on few selected outcome indicators (BMI for age, biophysical parameter, biochemical parameter, and dietary and lifestyle behaviors), as compared to subjects of the control school.

From table 4.3.11, it was observed that both the schools had almost similar prevalence of malnutrition (experimental: 78.8% vs control: 79.3%) at baseline. However, after the intervention period, control school was found to have higher prevalence of malnutrition (82.6%) than the experimental school (77.9%), though no significantly different.

While looking at the results of experimental school from baseline, the decrease in percent prevalence in the malnutrition (in all its forms) was 3.3%, as compared to the percent increase of 4.1% in the control school. This indicates, that the nutrition health promotion programme with combined intervention (creating enabling environment, and providing NHE to the study subjects and parents) had little effect on the BMI status of the study subjects from the experimental school in one and a half years of school nutrition and health promotion program, although a trend towards reduction in malnutrition was seen.

On the other hand (Table 4.3.12), regarding central obesity, at baseline, the control school had higher prevalence compared to experimental school irrespective of the indicators used (WC or WHtR). At baseline, significantly higher ($p \leq 0.01$) high WC existed in the control school subjects, at baseline than the experimental school (17.4% vs 6.2%). Similarly, with respect to high WHtR also, at baseline, the control school subjects had higher prevalence, though not significantly different, than experimental school subjects (41.3% vs 35.5%).

Similarly, after the nutrition health promotion program (intervention) also, the control school had higher prevalence rates of central obesity (WC: 9.8%; WHtR: 38.0%) than the experimental school (WC: 4.5%; WHtR: 31.5%), however, after the intervention non significant differences existed between the schools, thereby suggesting that nutrition health promotion program did not have any impact on central obesity from their respective baseline values.

Coming to the changes in the prevalence of central obesity in experimental and control school, the results from table 4.3.12, showed non significant decrease in both the schools from their baseline values according to WC (experimental: 6.2% vs 4.5%; control: 17.4% vs 9.8%) and WHtR (experimental: 35.5% vs 31.5%; control: 41.3% vs 38.0%).

With respect to the prevalence of suboptimal blood pressure in the study subjects (Table 4.3.13), at baseline, higher prevalence, though not significant, was observed in the experimental school than the control school (23.8% vs 14.1%). However, after the nutrition health promotion program (intervention), the prevalence of sub optimal blood pressure, decreased very highly significantly ($p \leq 0.001$) in the experimental school as compared to control school (4.1% vs 35.9%).

Similarly, on looking at the changes in the sub optimal blood pressure in both the schools from their respective baseline values, the table 4.3.13 demonstrates that in the experimental school a highly significant ($p \leq 0.001$) fall in the sub optimal blood pressure was observed from baseline (23.8% vs 4.1%) while in the control school, the percent prevalence of sub optimal blood pressure, very highly significantly ($p \leq 0.001$) increased from baseline (14.1% vs 35.9%). Hence, showing an impact of nutrition health promotion program on sub optimal blood pressures of the study subjects from the experimental school.

Biochemical profile (fasting lipid and glucose) was taken only for overweight and obese subjects to assess the prevalence of dyslipidimea and glucose Intolerance. Looking at the results from table 4.3.14, for dyslipidimea, irrespective of the classifications used, the prevalence was higher in the control school than in the experimental school, with the difference being non significant between the two schools at baseline (ATP III: 60.7% vs 37.2%; AHA: 39.35 vs 20.9%). However after the nutrition health promotion program (intervention), the control school was found to have significantly higher ($p \leq 0.05$) prevalence of dyslipidimea (according to ATP III) than the experimental school (46.4% vs 19.5%). Similarly, the prevalence of dylipidimea according to AHA also, after the intervention, was found to be highly significantly ($p \leq 0.01$) more in control school than the experimental school (42.9% vs 9.8%). Similarly, looking at the changes in the prevalence in the schools from their respective baseline values (Table 4.3.14), the experimental school showed significant

($p \leq 0.05$) reduction from the baseline prevalence of dyslipidimea according to ATP III (37.2% VS 19.5%) or AHA classification (20.9% vs 9.3%). While in the control group, dyslipidimea decreased, though non significantly from baseline by ATP III classification (60.7% vs 46.4%) and increased non significantly by AHA classification (39.3% vs 42.9%).

Looking into the prevalence of glucose intolerance (GI), from table 4.3.14, before the intervention, 9.3% of the subjects were found to have glucose intolerance in the experimental school than in the control school (0.0%). While after the nutrition health promotion program (intervention), control school (17.9%) was found to have higher prevalence of GI than the experimental school (4.9%), though the difference was statistically non significant. However, in the experimental school, the prevalence of GI reduced from baseline (9.3% vs 4.9%), while the prevalence emerged in the control school (0% vs)

The impact of the intervention in the school was also seen on dietary and lifestyle behaviors of the study subjects from both the schools **(Table 4.3.15).** Looking at the prevalence of the study subjects practicing unhealthy behaviors of consuming carbonated (sweetened) beverages for 2 or more than two days, at base line, the experimental school had significantly higher ($p \leq 0.05$) prevalence than the control school (17.6% vs 8.7%). However, after the nutrition health promotion program (intervention), it was found that the percentage of study subjects practicing this unhealthy behavior of consuming carbonated beverages for 2 or more than 2 days were more in the control school than in the experimental school (13.0% vs 7.1%) though the difference was non significant (Table 4.3.15).

Coming to the changes in the prevalence of this unhealthy behavior in the experimental and control schools from its baseline values, very highly significant ($p \leq 0.001$) reduction was observed in the experimental school (17.6% vs 7.1%), while in the control school very high significant ($p \leq 0.001$) increase was observed in the control school from its baseline prevalence (8.7% vs 13.0%).

On looking at the unhealthy dietary habit of frequent fast food intake (2 or more than two days per week) in the study subjects from table 4.3.15, at baseline, the experimental school subjects had highly significant ($p \leq 0.001$) higher percentage

prevalence of unhealthy habit of taking fast food frequently than in the control school subjects (42.9% vs 18.5%). However, after the nutrition health promotion program, (intervention), non significant difference in the percentage of study subjects practicing this unhealthy behavior was noticed between the two schools. However, the control school subjects had higher percentage of the subjects practicing unhealthy behavior than in the experimental school subjects (22.8% vs 17.2%).

the experimental school the fast food intake decreased very highly significantly ($p \leq 0.001$) from its respective baseline values (42.9% vs 17.2%). On the contrary, in the control group, the intake of fast food in the study subjects increased from 18.5% at baseline to 22.8% after intervention, though it failed to reach statistical significance (Table 4.3.15).

Regarding another unhealthy habit of consuming low fruits and vegetable intake (< 400 gm/day) in the study subjects, table 4.3.15, data revealed that at baseline, more subjects from the experimental school had low fruit and vegetable intake than in the control school (59.0% vs 50.0%), the difference being non significant. However, after the nutrition health promotion program (intervention), the percentage of the study subjects having low fruit and vegetable intake, was very highly significantly ($p \leq 0.001$) higher in the experimental school as compared to the control school (67.4% vs 15.4%).

On comparing the percentages of the study subjects from the two schools with their respective baseline values, table 4.4.5 showed that in the experimental school, the percentage of study subjects consuming low fruits and vegetable (< 400 gm/day) reduced very highly significantly ($p \leq 0.001$) from the baseline (59.0% vs 15.4%). However, in the control school, the percentage of study subjects practicing this unhealthy dietary behavior of low fruit and vegetable intake (< 400 gm/day) significantly ($p \leq 0.05$) increased from the baseline prevalence (50.0% vs 67.4%).

Looking at the physical inactivity pattern of the study subjects, at baseline in the experimental and control schools, the data from **table 4.3.15** revealed that significantly higher ($p \leq 0.05$) percentage of the study subjects were physically inactive in the experimental school as compared to the control school (34.8% vs 22.8%). After the nutrition health promotion program (intervention), the physical

inactivity in the study subjects in the experimental school was very highly significantly ($p \leq 0.001$) lower in the experimental school as compared to the control school (6.0% vs 88.0%).

The change in the physical inactivity pattern from baseline in the experimental school also showed a very highly significant ($p \leq 0.001$) fall in physical inactivity levels (34.8% vs 6.0%), while in the control group, physical inactivity increased very highly significantly ($p \leq 0.001$) from its respective baseline prevalence (22.8% vs 88.0%).

More than or equal to 120 minutes of TV / computer / video games per day is considered as an unhealthy habit, and the data at baseline, from table 4.3.15, revealed that in the experimental school and control school, this unhealthy habit was similarly prevalent in both the schools (41.8% vs 40.2%). However, after the nutrition health promotion program (intervention) the unhealthy habit of higher exposure to TV/ computer / video games was very highly significantly ($p \leq 0.001$) more prevalent in the control school as compared to the experimental school (58.7% vs 38.2%).

Similarly, the comparisons, between the status of this practice, within the experimental and control schools from their baseline values showed that in the experimental school, there was a highly significant ($p \leq 0.01$) drop in the percent of subjects having the unhealthy habit of TV/ computer viewing / video (41.8% vs 32.2%) while in the control group there was a rise in the percent prevalence of the subjects reporting this unhealthy practice (40.2% vs 58.7%), though it did not reach statistical significance (Table 4.3.15).

The data in the literature reveals that accumulation of three or more than three of the unhealthy behaviors enlisted above can have a significant association with overweight and obesity. In the study subjects also, the change in the cumulative unhealthy patterns was also seen in the experimental and control school subjects.

At baseline (Table 4.3.15), very highly significant ($p \leq 0.001$) percentage of the subjects in the experimental school had cumulative unhealthy behaviors as compared to subjects in the control school (30.0% vs 9.8%). After the nutrition health promotion program (intervention), the percent prevalence of more than or equal to 3 cumulative unhealthy behaviors was very highly significantly ($p \leq 0.001$) lower in the experimental school subject as compared to control school subjects (4.1% vs 52.2%).

Within the schools also (Table 4.3.15), a very highly significant ($p \leq 0.001$) drop, in the percentage of the subjects, having cumulative unhealthy behaviors was seen in the experimental school (30.0% vs 4.1%), while the reverse trend was seen in the subjects of the control school (9.8% vs 52.2%).

Table 4.3.11: Total percent prevalence of malnutrition in both the schools before and after the intervention

Malnutrition	Experimental % (n)	Control % (n)
Pre	78.8 (215)	79.3 (73)
Post	77.9 (208)	82.6 (76)

Table 4.3.12: Total percent prevalence of central obesity in both the schools before and after the intervention

Central obesity		Experimental % (n)	Control % (n)	Significance level (p value)
Waist circumference (WC)	**Pre**	6.2 (17)[a]	17.4 (16)[b]	a vs b ** (p=0.001)
	Post	4.5 (12)	9.8 (9)	-
Waist to height ratio (WHtR)	**Pre**	35.5 (97)	41.3 (38)	-
	Post	31.5 (84)	38.0 (35)	-

Table 4.3.13: Total percent prevalence of sub optimal blood pressure in both the schools before and after the intervention

Sub optimal blood pressure	Experimental % (n)	Control % (n)	Significance level (p value)
Pre	23.8 (65)[a]	14.1 (13)[b]	a vs b [NS]
Post	4.1 (11)[c]	35.9 (33)[d]	c vs d*** (p= 0.000)
Significance level (p value)	a vs c*** (p=0.000)	b vs d*** (p=0.000)	

Table 4.3.14: Total percent prevalence of dyslipidimea and glucose intolerance in both the schools before and after the intervention

		Experimental (n=43)	Control (n=28)	Significance level (p value)
		% (n)	% (n)	
Dyslipidimea (ATP III)	**Pre**	37.2[a] (16)	60.7[b] (17)	a vs b[NS] (p= 0.088)
	Post	19.5[c] (5)	46.4[d] (13)	c vs d* (p=0.032)
Significance level (p value)		a vs c* (p=0.021)	b vs d [NS]	
Dyslipidimea (AHA)	**Pre**	20.9[e] (9)	39.3[f] (11)	e vs f [NS]
	Post	9.8[g] (4)	42.9[h] (12)	g vs h** (p=0.001)
Significance level (p value)		e vs g* (p=0.04)	f vs h[NS]	
Glucose Intolerance	**Pre**	9.3 (4)	0 (0)	NA
	Post	4.9 (2)	17.9 (5)	NA
Significance level (p value)		NA	NA	

NS: Non significant; NA: Not applicable

Table 4.3.15: Total percent prevalence of unhealthy dietary and lifestyle behaviours in both the schools before and after the intervention

Unhealthy dietary and lifestyle behaviours		Experimental (n=273) % (n)	Control (n=92) % (n)	Significance level (p value)
Carbonated (sweetened) beverages Unhealthy (≥ 2days/ week)	Pre	17.6[a] (48)	8.7[b] (8)	a vs b* (p= 0.045)
	Post	7.1[c] (19)	13.0[d] (12)	c vs dNS
Significance level (p value)		a vs c*** (p=0.000)	b vs d*** (p=0.000)	
Fast food Intake Unhealthy (≥ 2days/ week)	Pre	42.9[e] (117)	18.5[f] (17)	e vs f*** (p=0.000)
	Post	17.2[g] (46)	22.8[h] (21)	g vs h[NS]
Significance level (p value)		e vs g*** (p=0.000)	f vs h[NS]	
Low fruits & vegetable Intake Unhealthy (<400 gms/day)	Pre	59.0[i] (161)	50.0[j] (46)	i vs j[NS]
	Post	15.4[k] (41)	67.4[l] (62)	k vs l*** (p=0.000)
Significance level (p value)		i vs k*** (p= 0.000)	j vs l* (p= 0.020)	
Physical Inactivity Unhealthy (< 3days/ week)	Pre	34.8[m] (95)	22.8[n] (21)	m vs n* (p= 0.033)
	Post	6.0[o] (16)	88.0[p] (81)	o vs p*** (p= 0.000)
Significance level (p value)		m vs o*** (p= 0.000)	n vs p*** (p= 0.000)	
TV/computer playing Unhealthy (≥ 120 min/day)	Pre	41.8[q] (114)	40.2[r] (37)	q vs r[NS]
	Post	32.2[s] (86)	58.7[t] (54)	s vs t*** (p= 0.000)
Significance level (p value)		q vs s** (p= 0.005)	r vs t[NS]	
Cumulative unhealthy behaviors ≥ 3 unhealthy behaviors	Pre	30.0[u] (82)	9.8[v] (9)	u vs v*** (p= 0.000)
	Post	4.1[w] (11)	52.2[x] (48)	w vs x*** (p= 0.000)
Significance level (p value)		u vs w*** (p= 0.000)	v vs x*** (p= 0.000)	

NS: Non significant

Highlights

- Highly significant improvement in knowledge of the students after the NHE sessions regarding control and management of triple burden of malnutrition (under weight, anemia and over weight including obesity) was observed.
- Nutrition health promotion program, very highly significantly reduced the percent prevalence of study subjects practicing unhealthy dietary and lifestyle behaviors in the experimental school as compared to the control schools.
- Nutrition health promotion program had a very highly significant impact in reduction of sub optimal blood pressures in the study subjects belonging to the experimental school, while in the control school, the sub optimal blood pressures appeared to be rising from their baseline values.
- Nutrition health promotion program could significantly reduce the prevalence of dyslipidimea in the overweight and obese subjects of the experimental school, both by ATP III as well as AHA classification.
- A linear compliance dependent improvement was observed with weekly IFA supplementation in the study subjects on anemia reduction, subjects having very good and good compliance of weekly IFA supplementation significantly improved their anemia status, haemoglobin and academic performance levels after three months of supplementation.
- Anaemic subjects showed significant improvements in mean haemoglobin levels and reduction in anaemia prevalence than non-anaemic subjects after weekly IFA supplementation.
- Impact of nutrition health promotion program in the school setting was seen in the trends towards reduction in malnutrition status of the subjects (BMI for age)
- No impact of nutrition health promotion program was noticed on central obesity level of the subjects by both the indicators, namely, high waist circumference (WC) or high waist to height ratio (WHtR) or central obesity.

Discussion

Education and health are interdependent and there is a critical synergistic relationship between learning and the health status of a child .Education is a preparation for life. Childhood, particularly during the period of adolescence is full of demands, conflicts and stress. Life-skills equip children with the ability to cope with challenges which

are increasingly faced by them in a rapidly changing environment. The core life skills that have been identified by WHO include self-awareness, empathy, effective communication, social skills, ability to cope with emotions, creativity critical thinking, problem-solving and decision making. These life-skills have to be integrated to the total curricula and imparted through activity based learning **(Ory et al 2002**). Looking at the emerging issues about childhood malnutrition and its relationship with adulthood non communicable disease burden it is now more important and relevant that children are equipped with the knowledge and skills required to maintain their health and nutritional status in a school setting.

The improvement in knowledge and practice of following healthy dietary and lifestyle practices by students of the experimental school in the present study clearly demonstrates that a school nutrition health promotion program needs to be based on this concept of life skill building of the adolescents, so that the adolescents themselves realize the importance of healthy dietary and lifestyle behaviors they should adopt to lead a healthy life. Thus nutrition health promotion program, besides emphasizing on the parent's participation, should also focus on building the child's capacities and improving their knowledge to make them the change agents for themselves as well as for the families and communities. Their knowledge and skills should be enhanced so much that they start demanding for healthy food choices in the school as well as in their own family and outside homes to stay healthy.

The present nutrition health promotion program was planned with the same objective to create enabling environment in the school as well as build their capacities and enhance knowledge of adolescents regarding healthy dietary and lifestyle behaviors, enabling them to understand about the healthy behavior they should adopt to be healthy.

The results of the NHE sessions in the present program, showed highly significant improvements in the knowledge levels after the NHE sessions, indicating that besides the other efforts to improve students health through a school program, nutrition health education should be an important component of it, as it is imperative to first educate people about the behaviors they need to practice. The results of this study are in line with other studies also which have shown significant improvement in knowledge levels after the NHE sessions or after the introduction of nutrition health curriculum

(Rajalakshmi et al 2010, Gorely et al 2009, Foster et al 2008, Bayne-Smith et al 2004, Warren et al 2003, Caballero et al 2003, Morris and Zidenberg-Cherr 2002, Baranowski et al 2000).

The results also demonstrated significant decrease in the unhealthy dietary and lifestyle behaviors after one and a half years nutrition health promotion program. The results clearly show that if the students are given healthy choices in the school by providing healthy food and beverages in the school canteen and or make them aware about the ill consequences of unhealthy behaviors, they show inclination towards adapting healthy behaviors. Other studies have also shown improvements in changing the behaviors of students by creating enabling environment, or through introducing kitchen garden concept in the school (Rajalakshmi et al 2010, Gorely et al 2009, Angelopoulos et al 2009, Rachaelet al 2007, Warren et al 2003).

Surprisingly in the present study, the prevalence of suboptimal blood pressure was found to be as high as 21.4% among the adolescents which is a cause of worry. The literature has shown increased levels of blood pressure in this population (Noronha et al 2012, Pande et al 2012, Madhusudan et al 2012, Mogra and Kaur 2012). Blood pressure has been associated with high BMI and stress levels (Kaur et al 2013, Sundar et al 2013). However, the results of the present study, showed that after one and a half years of intervention there was a significant decrease in the prevalence of suboptimal blood pressures among the adolescents in the intervened group. This indicates, that if the healthy dietary and lifestyle behaviors are practiced, the blood pressure can be controlled, even though no change in BMI is achieved. Hence, blood pressure could be taken as a good indicator to study the impact of nutrition health promotion programs in a school settings by changes in behaviors of the students.

Though, presently, the reason of occurrence of suboptimal blood pressure among the adolescents is supposed to be high BMI, or the high academic stress levels, the present study demonstrates that promoting healthy diet and lifestyle are the core components of a school nutrition health promotion programme to control blood pressure, a leading risk factor for non communicable disease control..

Therefore it is important to encourage promotion of healthy dietary and lifestyle behaviors through nutrition health promotion programs. Also improvement in parental

knowledge regarding control and management of blood pressures, could have also helped in improving the healthy dietary and lifestyle behaviors of their own children on outside the school setting as well. The studies (Davis-Kean and Pamela 2005, CDC 2012) has shown that uninformed parents indulge in spoiling their own children by promoting unhealthy behaviors (treating in fast food joints, eating out frequently as an incentive for better school performance). Another, major reasons for the development of unhealthy behaviors among the adolescents could be women joining the formal workforce leaving them little time to do household chores including cooking. Thus working mothers who do not have much time to spend in the kitchen, may allow their children and themselves go out for having meals in the restaurants, thereby increasing the frequency of eating food outside home.

It was surprising to note in the present study that though there was a significant fall in the dyslipidimea prevalence in overweight and obese subjects, there was no significant fall in the central obesity among the subjects. The reason may be, that dyslipidimea is also associated with unhealthy dietary and lifestyle behaviors. Hence, due to one and a half years nutrition health promotion program, which focused more on healthy dietary behaviors, the children had controlled their dietary and lifestyle behavior resulting in lower dyslipidimea prevalence.

On the other hand, studies (Mcmurray et al 2002, *Caballero et al 2003, Williamson* et al 2007, Foster et al 2008) shown that reducing anthropometric profiles (BMI for age and central obesity) are not only difficult to change but also require sustained intervention. Since, the present nutrition and health promotion program, focused only on diet and lifestyle behaviors, the reduction was seen more on behaviors rather than on BMI for age or in central obesity. Reductions in over nutrition (over weight including obesity and central obesity) status, needs both diet and physical activity which was not a focus of our study. Hence, nutrition health promotion program in a school should focus both on diet as well as on physical activity promotion in and outside the school.

The results of nutrition health promotion program in the present study demonstrate that schools are a good settings for laying the foundation for controlling and managing NCDs in adults and malnutrition control in children and adolescents. Hence, nutrition health promotion programs in a school settings needs to be promoted,

if we want to curtail the rising trends of NCDs in school going children and adolescents which are going to be productive adults and have lower disability adjusted life years (DALYs).

It was also very surprising to note that 49.3% of the study subjects form middle to high income schools were anemic, irrespective of their nutritional status. Hence, weekly IFA supplementation was an urgent need to start. Therefore the results of the weekly IFA supplementation showed improved haemoglobin levels in the subjects having good compliance than the subjects with poor compliance. The results also showed significant improvement in haemoglobin levels and scholastic performance in the subjects who were anemic before the supplementation than the nonanemics. Hence, blanket supplementation may not be advisable and should not be given to all the students and assessment of anemia status should be important in a school setting before initiating IFA supplementation in both government and non government schools. Anemia control should also be an integral part of nutrition health promotion program in schools, and IFA compliance is likely to improve if IT technology of sending reminders on mobile phones is used to remind students to consume their weekly dose and involving parents to ensure regular IFA intake may further improve the results as in a school setting due to examinations, vacations etc it is difficult to give supervised IFA supplementation in school for 3 months.

Finally, the results of the present study clearly demonstrate that comprehensive multi component (curriculum, food service, school staff and parental involvement) nutrition health promotion program works & helps in controlling malnutrition in all its forms.

Developing countries are undergoing nutritional transition, due to globalization and urbanization, leading to faulty dietary and lifestyle behaviors. Both adults and children of all age groups are being affected by this changing scenario. Hence, unhealthy dietary and lifestyle behaviors, not only leads to malnutrition (overweight including obesity and under weight) but also leads to micronutrient deficiencies, especially iron deficiency (anemia). Children and adolescents are the most vulnerable age group to be malnourished and anemic, hence their basic dietary and lifestyle behaviors need to be corrected at this age only. Adolescents being the last stage of opportunity when their behaviors can be influenced , should be targeted to help them improve their dietary and lifestyle behaviors, to enter healthy adulthood. Hence, schools are the best settings to target adolescents along with their caretakers (parents and teachers), to help them prevent the development of NCD risk factors. Therefore, the school authorities also need to be made aware about their roles and responsibilities in the school nutrition and health promotion and prevention of NCDs.

Hence, the present study was undertaken to study the prevalence of malnutrition (overweight including obesity, underweight and anemia), among the adolescents, aged 10-13 years, and subsequently plan a need based nutrition health promotion program and study its effectiveness in a school setting, with the following objectives:

BROAD OBJECTIVE

To study the impact of a nutrition and health promotion program in adolescents (10-12 years) in a school setting.

SPECIFIC OBJECTIVES

1. To review National Curriculum Framework (NCF, 2005) and Gujarat board curriculum being followed by Central Board of Secondary Education (CBSE) and Gujarat Secondary & Higher Secondary Education Board (GSEB) respectively, with regards to essential topics on health and nutrition.
2. To assess the school ethos and environment with respect to nutrition and health services in the school with the help of Nutrition Friendly School Health Index (NFSHI) adapted from Nutrition Friendly School Initiative (NFSI), and School Health Index (SHI).

3. To assess the canteen services in the school for the nutritional quality of the items being sold in it.
4. To assess the knowledge of the science and physical activity teachers regarding nutrition and health aspects with the help of a pretested questionnaire.
5. To conduct situational analysis of the adolescents with respect to their anthropometric, biophysical, biochemical, dietary and lifestyle practices, and meal pattern with the help of a pretested questionnaire adapted from Global School Health Initiative (GSHI).
6. To create enabling environment in the school, by building capacities of the teachers for tiffin auditing, of parents to provide healthy tiffin and by improving the available nutrition services (canteen) in the school.
7. To improve parents' knowledge attitude and practice, by conducting awareness and capacity building sessions pertaining to understanding various aspects of adolescents and building their capacity to manage underweight and overweight problems faced by their children.
8. To improve anemia status of adolescents by necessary IFA supplementation (60mg elemental iron+ 0.5 mg folic acid) for 3 months.
9. To improve knowledge, attitude and practices of the adolescents regarding healthy dietary and lifestyle practices by nutrition health education and capacity building sessions.
10. To assess the impact of one and a half year "nutrition health promotion programme" on the anthropometric, biophysical, biochemical, dietary and lifestyle practices of the children by comparing the results with a control school.

Methodology

A prospective study was undertaken after the ethical approval from the Department of Foods and Nutrition ethical committee prior to commencement of the research study (Ethical committee no. F.C.Sc./FND/ME/80). The two schools (experimental and control) with comparable fee structure were randomly selected and the permission to conduct the study in the respective schools was taken from the principal. The fee structure of the intervention and control school for classes Vth, VIth and VIIth was in the range of 12,000/- to 13,000 /- per annum. The intervention in the form of need based nutrition health promotion program based on situational analysis at baseline

was conducted in the experimental school, while control school was only used to compare nutritional health status and dietary and lifestyle behaviors at baseline and after intervention. The study was conducted only in classes V-VII, with adolescents aged 10-13 years. The consent form (Annexure 1), explaining the purpose and methodology of data collection, were distributed to all the children of the selected classes by the researcher. The study subjects whose parents consented for their child's participation in the study were enrolled in the study. Also informed consent was taken from the study subjects as well (Annexure 1). There was no specific inclusion criteria as all the children from classes Vth – VIIth were being enrolled after their parent's consent. The exclusion criteria was that the child should not be suffering from any disease.

The whole study was divided into 3 phases, namely:

I. Situational analysis
II. Intervention for creating enabling environment in the experimental school
III. Impact of need based nutrition health promotion program (intervention) in the experimental school and comparison of impact indicators between the experimental and control school

All these three phases were carried out during 1 ½ years school academic calendar, including months when no activities could be carried out due to examinations, annual functions and holidays. The study design (Figure 3.1), shows the various steps (20 in number) undertaken in the 3 phases. The 3 phases of the study operated separately or simultaneously as a need based program was evolved step by step. These steps could be from different phases carried out simultaneously in a given time period. Hence, the time framework (Table 3.1) details out the continuous implementation of these 20 steps (as seen from the study design) during a given time period.

Major highlights of the study

Background information of the study subjects

The two study schools were co-educational. The experimental school, had both English and Gujarati as teaching medium, however, the subjects belonging to only English medium were enrolled in the study. While the control school had only English as teaching medium, hence all the subjects from English medium class from standard Vth – VIIth were included in the study. The total number of subjects from the experimental school enrolled in the study were 273, while from the control school were 92. Both the schools were under Gujarat Secondary & Higher Secondary Education Board (GSEB) and therefore the GSEB curriculum was also reviewed to compare the topics covered in Central Board of Secondary Education (CBSE) & guidelines given by Center for disease control, Atlanta to also compare the same with International standards.

Regarding the study subjects, majority (94.8%) of the study subjects from both the schools (experimental school: 95.6% & control school: 92.4%) were in their pre adolescent stage (10-13 years). Looking into the gender distribution of the study subjects (Table 4.1.1), boys were almost double (66.3%) in proportion than girls (33.7%) in both the schools. The same trend of boys being more than girls, was observed in the experimental school (boys: 68.9% vs girls: 31.1%) and control school (boys: 58.7% vs girls: 41.3%) also. The overall distribution of the study subjects, with respect to religion showed (Table 4.1.1), three quarters (75.9%) of the subjects belonged to Hindu religion, while 15.3% and 8.2% belonged to Christian and Muslim religions respectively.

Phase I: Situational analysis

Reviewing National Curriculum Framework (NCF, 2005) for CBSE, State Board Curriculum for GSEB and international curriculum (CDC, USA)

National Curriculum Framework (2005) is the latest curriculum framework for making syllabi, textbooks and teaching practices within the school education programs in India. It is framed and implemented by National Council of Educational Research and Training (NCERT), by the Government of India (GOI), to assist and

advise the central and state governments on academic matters related to school education. Understanding the importance of health education in schools, CBSE launched its Comprehensive School Health Programme (CSHP) in 1940s, which advocated that schools become Health Promoting Schools displaying and supporting the commitment to enhance the emotional, social, physical and moral well being of the school community (principal, teachers, students and family). National Curriculum Framework (2005) also categorically states that health is a critical input for the overall development of the child and it influences significantly student enrolment, retention and completion of school.

The CSHP of India is similar to Comprehensive School Health Program (CSHP) of America which was initiated in late 1980s, later changed to "Coordinated School Health Program" (CSHP) in 2007, to better describe the inter disciplinary and interagency collaboration required between the eight components, namely: health education, physical education, health services, nutrition services, counseling psychology & social services, staff health promotion, family& community involvement and healthy environment. Thus, a collaborative effort of CBSE with WHO was initiated in 2007 with an overall goal to strengthen the CSHP of India more effectively by delivering it's interventions in the form of recommending:

- Four comprehensive school health manuals
- Promotion of school health and wellness clubs

Hence, these manuals along with chapters related to nutrition and health were reviewed with the following highlights:

- The NCF 2005, framed by NCERT for CBSE affiliated schools, updated its Comprehensive School Health Program in collaboration with WHO in 2007 to include formal and informal approaches in the curricular pedagogy by developing teacher's training module and establishment of school wellness clubs. However, many gaps were observed in the module and services provided by the school wellness clubs when compared to CDC recommendations.
- The state board (GSEB) however, did not have any such recommendations regarding setting up of school health & wellness clubs.

- The text books of national (CBSE) and state board (GSEB), covered very few essential topics on healthy eating (NCERT: 13.6% vs GSEB: 9.1%) and physical activity (NCERT: 37.5% vs GSEB: 18.8%). When compared with CDC recommendations. The National Curriculum was slightly better than the state (Gujarat) Curriculum, though both need improvements.

Assessment of school ethos and environment

As recommended by Center for Disease Control (CDC), the schools should take up self assessment activity, with the help of SHI to understand their own school's strengths and weaknesses in terms of policies and practices to improve their nutrition and health services. This activity is carried out with NHT members of the school, comprising of the representatives of different members (school administration, teachers, students and parents). However, no representative school health committee was in place to review the policies and practices related to nutrition and health in both the schools.

The results of the SHI, for the four related modules, with the newly formed NHT members, showed that according module 1 (school health policies), no written policies related to nutrition and health were found in both the schools. Further, according to module 3 (physical education and physical activity program), more weaknesses (experimental: 50% vs control: 70%) were observed than the strengths (experimental: 40% vs control: 30%) in both the schools. However, it was observed with the help of module 2 (health education imparted) and module 4 (nutrition services) that no policies related to the modules were being practiced in both the schools.

The canteen services were not nutrition friendly, as depicted by figures 4.1.1 & 4.1.2. The canteen service providers had no knowledge about nutrition. Also the menus of the canteens were not nutritionally planned. Besides, the teachers teaching science and physical activity also did not have technical nutrition and health knowledge to impart evidence based knowledge to students and act as role models for them by demonstrating healthy dietary and life style behaviours.

Assessment of anthropometric (nutritional status, central obesity), sub optimal blood pressure, biochemical (haemoglobin, lipid and glucose) parameters and

dietary and lifestyle behaviors of the study subjects from the selected two schools catering to Middle to High socio economic strata (MHSES)at baseline.

It was very surprising to note that, in schools where students come from middle to high income socio economic groups, only 12% were healthy, i.e., free from any malnutrition (overweight including obesity, underweight or anemic), while 88.0% were either over weight, obese, underweight or anemic (Figure 5.1). More than half of them (53.7%) were found to be under weight with 49.3% of the study subjects being anemic,irrespective of their nutritional status (Figure 5.2), a trend similar to what is seen in under privileged or low income population.

However, contrary to the hypothesis, that children from MHSES are more over weight and obese, a quarter (25.2%) of them were found to be overweight and obese, with 21.4% of the study subjects were having sub optimal blood pressures, indicating an emergence of one of the major NCD risk factors in adolescents also (Figure 5.2). Therefore, it can be seen that triple burden of malnutrition is also the problem in this socio economic strata, with high prevalence of underweight, over weight and micronutrient (anemia) deficiencies.

Central obesity was as high as 37.0% according to high WHtR and 9.0% according to high waist circumference, posing a need for the researchers to explore the validity of WHtR, over waist circumference, which is a proven risk factor for NCDs. The present study also revealed an association between central obesity and sub optimal blood pressure levels with subjects with high WC (OR: 6.28) or high WHtR (OR: 6.18) having six times increased risk of developing sub optimal blood pressures.

Fasting lipid and glucose estimations were carried out only on overweight and obese subjects, with 46.5% and 28.2% identified to be dyslipidemics, according to ATP III and AHA classifications respectively, while 5.6% were identified as having Glucose intolerance. Among five dietary and lifestyle behaviors considered important for maintaining healthy nutritional status of the adolescents, low intake of fruits and vegetable ($\leq$ 400 gm/day) was observed in more than half (56.7%) of the study subjects. TV watching /computer playing was practiced by 41.4% of the study subjects, while 36.7% of the study subjects had frequent fast food (2 or more than 2 days per week). Physical inactivity was present in 31.8% of the study subjects, while

only 15.3% consumed carbonated (sweetened) beverages for two or mor than two days per week.

More boys had highly significant ($p \leq 0.01$) central obesity than girls as indicated by high WHtR (42.6% vs 26.0%). Similarly, highly significant ($p \leq 0.01$) percentage of boys consumed more carbonated beverages than girls (19.0% vs 8.1%). While highly significant ($p \leq 0.01$) percentage of girls were irregular in consuming breakfast (36.6% vs 20.7%).

Phase II: Intervention for creating enabling environment in the experimental school

Multipronged need based efforts were made to create enabling environment in the experimental school to deal with triple burden of malnutrition among the study subjects to design and implement a nutrition health promotion program in the experimental school setting. Hence, various initiatives were made with the help of school administration, teachers, students and parents. The various initiatives were:

- Improving the tiffin menus brought by the study subjects.
- Change the unhealthy menus of the canteen by promoting availability of healthy snacks and beverages in the canteen.
- Conducting NHE sessions for parents to help them improve their knowledge regarding management of triple burden of malnutrition.

Immediately after the situational analysis in phase I, an orientation meeting was held for school administration and parents, to discuss the results of phase I and nutrition health promotion program to be initiated in the school. However, a very poor (0.04%) participation of parents was seen in the first meeting. Though, with very few parents and school administration, a consensus was reached to change the tiffin menus instead of starting a school meal program.

As an alternative strategy to involve parents in the nutrition health promotion program, a duly signed letter by the principal, mentioning the various components of the program were sent to the parents through the study subjects. This initiative was taken to make parents especially those who did not attend the earlier orientation meetings to make them aware about the nutrition health promotion program to be

initiated in the school. Also another effort was made to involve parents in the decision making process, to decide which component of the program they would want to be initiated in the school for the betterment of their own child.

The response of this activity was better as compared to the orientation meeting, as 47.3% of the parents responded to the letters sent to them. The results showed that most (82.2%) of the parents who responded to the letter wanted a change in the canteen menus, while 71.3% were in favour of a school meal program.

Since, in the first orientation meeting the school administration had shown unwillingness to start a school meal program, and urged mothers to send healthy tiffin from home, a 6 days cyclic menus (Annexure 14) was planned by the researchers to provide 1/3rd of the RDA with iron rich recipes and sent to the mothers. While on the other hand an effort was made with the school canteen contractor to help him change the canteen menus to provide healthier options to students of the school.

The tiffin auditing results either done by researcher or the class teachers showed that the percentage of the study subjects bringing healthy tiffin increased from 49.9% at baseline to almost 100.0%, after the introduction of two sets of 6 days cyclic menus (providing 1/3rd of the RDA and iron rich) as an alternative to school meal program.

An effort was also made to build the capacities of class teachers to help them do the tiffin auditing with the help of checklist (Annexure 18) developed by the researchers. However, they could do it only for one month and were unable to audit tiffin menus of the study subjects due to overload of their own teaching schedules.

An effort was also taken up to improve the school canteen menus. However, the canteen contractor was unwilling to start low fat milk beverages in the canteen, therefore, to convince him a five days pilot trial was initiated to study the sale trend of the proposed product by the students. In all the five days of the trial, there was a consistent demand for butter milk and flavoured milk as compared to the sweetened beverages (Figure 5.3). On looking at the response the canteen contractor made arrangements for providing the healthy beverages in the school canteen.

Besides, all the efforts taken to involve parents, in the nutrition health promotion program in a school setting, improving the knowledge of parents regarding the

management of triple burden of malnutrition for their own children is very essential. Hence, two NHE sessions with the help of power point presentations during the whole one and a half years nutrition health promotion program were conducted for the parents. The results showed significant improvements in the knowledge of parents regarding prevention and control of triple burden of malnutrition (overweight including obesity, underweight and anemia).

The parent's participation throughout the program was not 100%, though it improved gradually at every occasion. From 0.04% participation of parents in the first orientation meeting, it improved to 47. 3% as seen by the response of parents to the letters sent to them, briefing about the nutrition health promotion program initiated in the school. However, only 22.0% actually attended the first NHE session, while it increased to 33.0% in the second NHE session.

Hence it can be concluded that greater efforts are required to involve parents in the nutrition health promotion program initiated in the school setting by making them aware about their roles and responsibilities to make the program effective and improving their own child's health.

PHASE III: Interventions for the study subjects from experimental school

Anemia was found to be present in 49.3% of the study subjects, hence IFA supplementation was immediately initiated, which was also supported by 57.4% of the parents (Table 4.2.1). Later four NHE and capacity building sessions were conducted for the study subjects according to the availability of free periods during one and a half years academic school years. These sessions were conducted to enhance the knowledge of the study subjects about prevention and management of triple burden of malnutrition. Hence the impact of these sessions was seen on their knowledge levels at the end of each session as compare with their knowledge before the session. The impact of full one and a half years nutrition health promotion program was seen on the selected few outcome indicators (anthropometric profile, biophysical and dietary and lifestyle behaviors) of the study subjects from the experimental school and compared with the control school.

Impact of weekly IFA supplementation of 60 mg elemental iron and 0.5 mg folic acid for a period of 3 to 4 months (12 doses) on the prevalence of anaemia

After 3 to 4 months of nutrition health promotion program activities and IFA supplementation (combined interventions), a mild reduction in anaemia prevalence (49.3 to 48.7) in the study population (though not significant) was seen . To study the impact of intervention among the study subjects on haemoglobin and anemia levels, further analysis was done according to the compliance of the tablets taken by the study subjects. Therefore the subjects were categorized according to the compliance of IFA tablets into 4 groups namely : very good, good, average and poor compliance groups respectively (11- 12 tablets, 9-10 tablets, 8 tablets and < 8 tablets).

Overall girls had better compliance than boys. Majority of the girls (74.1%) as compared to the boys (65.9%) had taken ≥9 doses ie. equal to or more than 75% of the required dose of total 12 doses. On looking at the prevalence of anaemia, a reduction was seen in very good (11 – 12 tablets) compliance group (56.6 Vs. 40.8) followed by average compliance group (50 Vs. 40) and good compliance group (59.3 to 52.5). On the contrary a very highly significant increase in anaemia prevalence (18.7 Vs. 68.7) was seen in poor compliance group (Figure 5.4).

Similarly on looking at the mean haemoglobin levels with respect to compliance, a highly significant ($p<0.001$) increase (11.30± 1.9 gm/dl Vs. 11.91±1.2 gm/dl) in the haemoglobin levels was seen in the subjects who had very good compliance (11-12 tablets), and also in good compliance group (11.28±1.7 gm/dl to 11.49±1.0 gm/dl) and average compliance (11.59±1.6 gm/dl to 11.74±0.9 gm/dl) categories. However in the subjects with poor compliance (<8 tablets) a significant decrease in haemoglobin levels (12.97±1.7 gm/dl to 11.3±0.92 gm/dl) was seen (Table 4.3.4). An increase (though not significantly) in haemoglobin levels from base line were seen anemic subjects after the IFA supplementation give little more detail(Table 4.3.5).

Shift in severity of anaemia

Shift in the severity of anaemia was also analyzed with respect to compliance of the total tablets consumed. Moderate anaemia decreased in all the compliance categories (36.8 Vs. 3.9 in 11-12 tablets group), (38.9 Vs. 8.4 in 9-10 tablets group), 13.3 Vs.3.3 in 8 tablets group) and (9.3 Vs. 6.2 in <8 tablets group). Similarly in subjects with

very good (38.1 Vs.57.8), good (28.8 Vs. 35.5) and average (36.6 Vs. 46.6) compliance, a higher percentage of subjects were present in normal categories after intervention as compared to their base line values, except for subjects with poor compliance (81.2 Vs. 25), who registered a highly significant ($p<0.001$) decrease in mean haemoglobin levels after intervention from baseline (Figure 5.5, 5.6, 5.7, 5.8).

Impact of weekly IFA supplementation of 60 mg elemental iron and 0.5 mg folic acid for a period of 3 to 4 months (12 doses) on the academic performance of the study subjects

A significant improvement (from baseline) was seen in the academic scores obtained by the study subjects in the supplemented group (IFA) as compared to the non-supplemented group (191.2±45.20 Vs. 169.86±48.53). Similarly, when comparisons were made in the academic scores obtained between anaemic (174.38±45.46 Vs. 179.57±45.56) and non anaemic (187.87±82 Vs. 190.6±82) subjects the data clearly demonstrated highly significant ($p \leq 0.01$) improvement in anemic group than the non anemic group after the IFA supplementation.

Nutrition health education and capacity building session with students

To improve knowledge of the students, nutrition health education (NHE) and capacity building sessions were conducted, after which marked improvement in knowledge was shown. More than 90% of the study subjects became aware about various nutritional aspects of adolescence like under nutrition, overweight including obese, anaemia. After the capacity building session regarding BMI plotting, 84.6% of the study subjects were able to correctly plot their own BMI on the charts.

Impact of nutrition and health promotion program on few selected outcome indicators (BMI for age, biophysical parameter, biochemical parameter, and dietary and lifestyle behaviors), in comparison to the control school.

After one and a half years of nutrition health promotion program, no significant difference was seen between the experimental and control schools in the prevalence of malnutrition (77.9% vs 82.6%). Though looking at the malnutrition prevalence in the experimental school after the nutrition health promotion program, a decrease in the prevalence of malnutrition was observed from its baseline values (78.8% vs 77.9%),

though it failed to reach significant levels. In the control school after the nutrition health promotion program the prevalence of malnutrition increased from its baseline values (79.3% vs 82.6%).

Regarding central obesity, after nutrition health promotion program, no significant difference existed between the experimental and control school, as indicated by high WC (4.5% vs 9.8%) and high WHtR (31.5% vs 38.0%) with control school having higher prevalence of central obesity than the experimental school.

The prevalence of central obesity within the two schools also did not show any significant decrease as compared to their respective baseline values irrespective of the indicators (WC and WHtR) used.

The prevalence of sub optimal blood pressures, after the nutrition health promotion program was very highly significantly ($p \leq 0.001$) high in control school than in the experimental school (4.1% vs 35.9%). In the experimental school, after the nutrition health promotion program a very highly significant ($p \leq 0.001$) fall was also observed in the prevalence of sub optimal blood pressures from their baseline values (23.8% vs 4.1%). However, a reverse trend was observed in the control school, where very highly significant ($p \leq 0.001$) rise was observed from its baseline values (14.1% vs 35.9%) after nutrition health promotion program.

The impact of one and a half years nutrition health promotion program was also observed on biochemical profile (fasting lipid and glucose) which was taken only for overweight and obese subjects to assess the prevalence of dyslipidimea and glucose Intolerance. After the nutrition health promotion program (intervention), the control school was found to have significantly higher ($p \leq 0.05$) prevalence of dyslipidimea (according to ATP III) than the experimental school (46.4% vs 19.5%). Similarly, the prevalence of dylipidimea according to AHA also, after the intervention, was found to be highly significantly ($p \leq 0.01$) more in the control school than the experimental school (42.9% vs 9.8%). Similarly, looking at the changes in the prevalence in the schools from their respective baseline values, the experimental school showed significant ($p \leq 0.05$) reduction from the baseline prevalence of dyslipidimea according to ATP III (37.2% VS 19.5%) or AHA classification (20.9% vs 9.3%). While in the control group, dyslipidimea decreased, though not significantly from

baseline by ATP III classification (60.7% vs 46.4%) and increased non significantly by AHA classification (39.3% vs 42.9%).

Looking into the prevalence of glucose intolerance (GI), after the nutrition health promotion program (intervention), the control school (17.9%) was found to have higher prevalence of GI than the experimental school (4.9%), though the difference was non significant, while a significant difference existed at baseline between the two schools. However, in the experimental school, the prevalence of GI reduced from baseline (9.3% vs 4.9%), while the prevalence emerged in the control school.

It was also observed that unhealthy dietary and lifestyle behaviors were more in the experimental school than in the control school before the nutrition health promotion program, while after the intervention, these behaviors were found to be very highly significantly ($p \leq 0.001$) high in the control school than in the experimental school.

On looking at the changes in the prevalence of unhealthy behaviors in the experimental school, very highly significant ($p \leq 0.001$) decrease was observed from their baseline values for (carbonated/ sweetened beverage intake, fast food intake, Low fruits and vegetable intake, physical inactivity) While high significant ($p \leq 0.01$) decrease from its baseline values, in the experimental school was observed in TV watching/ computer playing. On the contrary, in the control school, after one and half years nutrition health promotion program (intervention) very highly significant ($p \leq 0.001$) increase was observed in percent prevalence of study subjects who consumed carbonated (sweetened) beverages, became physically inactive. While significant increase ($p \leq 0.05$) was observed in the percent prevalence of the study subjects from the control school who consumed fruits and vegetable less than 400 gm/day. Similarly, with respect to fast food intake and TV watching / computer playing, non significant increase was observed in the control school from their respective baseline values.

After the nutrition health promotion program (intervention), the percent prevalence of more than or equal to 3 cumulative unhealthy behaviors was very highly significantly ($p \leq 0.001$) lower in the experimental school subjects as compared to those in control school subjects (4.1% vs 52.2%).

Within the schools also, a very highly significant ($p \leq 0.001$) drop, in the percentage of subjects, having cumulative unhealthy behaviors was seen in the experimental school (30.0% vs 4.1%), while the reverse trend was seen in the subjects of the control school (9.8% vs 52.2%).

Conclusions

The present study aimed to initiate a nutrition and health promotion program in a school setting where students from middle to high socio economic strata come. The assessment of nutritional status of the study subjects showed that, adolescents from middle to high socio economic status are not only at risk of overweight and obesity, but are more at risk of being under nourished (under weight and anemic). The rapid nutritional transition in the developing countries, like India due to economic growth and globalization and women joining the work force has led to replacement of traditional healthy food with more unhealthy energy dense, low nutrient foods. This unhealthy nutrition transition is also supported by food processing industries, who market their processed products with great advertising skills, without thinking on the nutritional aspects of the product.

However, this transition, is also largely accepted by the society as there has been a shift in female's role also. The females are now more taking up jobs outside home, and find it difficult to spend more time in the kitchen. Hence, these processed foods and ready to eat foods are well accepted by the society, without the realization of the unhealthy dietary habits it perpetuates and its role in the rising burden of non communicable diseases and its risk factors in the population.This rising burden of NCD risk factors can be controlled at the early ages. These modifiable NCD risk factors are overweight including obesity, high blood pressure, unhealthy dietary and lifestyle behaviors. Hence, to control these modifiable risk factors among children and adolescents is much easier than in adulthood where behavior patterns are set and often difficult to change. Also if these NCD risk factors are left unrecognized and uncontrolled in this age group, then these at risk adolescents enter unhealthy adulthood, with risk of earlier manifestations of developing NCDs. Therefore, adolescents, being the age of opportunity to develop healthy dietary and lifestyle behaviors, should be targeted as adolescent overweight and obesity is rising in the developing countries also.

To capture this age group at one time, for their nutritional assessments and to help them modify their dietary and lifestyle behaviors, schools are the best settings. Therefore, school administration of the schools should be made aware of the recommendations regarding nutrition and health policies to be implemented in the schools for the students. They should also be made aware of the fact that schools hold immense potential to change an individual's life. With the help of teachers and parents, they should take initiative to make their school nutrition friendly. Also to make any nutrition and health promotion program sustainable, policies need to be made so that it becomes mandatory for the schools to follow nutrition recommendations. Hence, a monitoring committee should be there to monitor the various eight aspects of school health, namely, health education, physical education, health services, nutrition services, counseling, psychological and social services, healthy school environment, health promotion for staff and family/community involvement. Also science teacher's knowledge about nutrition health being poor and parent's apathy towards attending school health promotion program needs to be improved by discussing results of nutrition assessment during Parents Teachers Meetings.

The school's curriculum and environment should be made in such a way to help children practice healthy dietary and lifestyle behaviors. The curriculum of the school besides other subjects should contain chapters, providing technically correct information about nutrition to the students. The curriculum should be in line with the national recommendations for children and adolescents. Therefore, these chapters should be framed with the help of a person who is technically sound in nutrition aspects. In the school also, to teach nutrition and health, a nutrition expert trained to impart evidence based knowledge and skills to children of various age groups should be employed, and the other subject teachers should not be given this job.

Nutritious meal program is essential in schools as tiffin auditing is much more cumbersome and time consuming activity which can be avoided if nutritious meals are served in schools. This will also ease parents/ mothers pressure of making healthy meals in the mornings and giving tiffins, especially when more and more mothers are now doing jobs or doing some business etc. Teacher's participation and supervision of

nutritious meal program with peer influence will promote healthy eating and teachers can be effective role models for promoting healthy eating.

Also regarding the meal services to be provided in the school campus, school authorities should have a say in the food products sold in the school campus and should frame a healthy canteen policy to be adopted by the contractor and should be a part of nutrition and health committee of the school, so that she/he is made aware of the recommendations regarding the nutritious food services in the school campus. Besides, the nutrition aspect of the food being served in the school for students, they should also be trained in food safety measures and healthy cooking practices.

A school nutrition health promotion program is always incomplete without the participation of parents, hence, more of parents participation should be encouraged to reinforce the knowledge of students outside school. Involvement of parents also enables them to gain knowledge about their own child's nutritional status and nutrition and lifestyle behaviors that need to be promoted during adolescence period. Therefore various strategies should be adopted to involve parents as much as they can be, because it is the parents who will help children to sustain these healthy dietary and lifestyle behaviors lifelong.

As is seen in the underprivileged or low income population, it was surprising and worrisome to note that in the present middle to high income schools also the burden of under nutrition is highest with more than 50.0% of the pre adolescents being under weight. Similarly anemia (49.3%) in the population was also a public health problem in the selected school. The results of the study indicate that governments and school authorities need to give importance to this aspect. At present government of India runs National Programs (school health program, Anemia control program, SABLA etc) to tackle the problem of under nutrition and anemia in government or corporation schools. However, in private non government schools there is no mandatory provision of identifying under nutrition and anemia. Consequences of under nutrition and anemia in this age group can cause intergenerational cycle of malnutrition and can have both short term and long term consequences. Therefore, it is important that all schools government or private should have mandatory requirement for assessment of nutritional status and identifying anemia as anemia is a universal phenomenon in

India and there is a need to tackle this problem in this age group due to its adverse consequences in reducing cognitive performance and physical work capacity.

Till now many of the school nutrition and health promotion programs have been planned to prevent overweight and obesity among school going children and adolescents, however, looking at the triple burden of malnutrition among the adolescents age group from the present age and income group, the schools should plan to tackle the triple burden of malnutrition in this socio economic strata also. Therefore, nutrition and health promotion programs after development of a comprehensive school health policy for all the schools of India, needs to be institutionalized.

RECOMMENDATIONS OF THE STUDY

For the government (national and state)

- Advocacy to the government is needed to give due importance to school health or school as a setting for nutrition health promotion in all sections of society, this can play a significant role in curbing the rising trend of NCDs.
- National level / state level steering committee on school health needs to be formed consisting of school administration, teachers, nutrition experts/ specialists, educationists, parents, behavior change experts, health experts, physical activity experts and psychologists (counselors) etc, and they should oversee the curriculum development and school health promotion strategies.
- National data base for nutrition and health status of school children needs to be created which will help in guiding the school authorities and national governments, the steps that need to be taken to promote school health.
- National and state school policies related to healthy eating and physical activity should be mandatory for all the schools (public and private).
- School meal programs should be initiated in MHSES schools, preferable school breakfast programs providing 1/3rd of the RDAs.
- The records of the nutritional status of all the students nationally, should be decentralized so that the data is available as and when required. These records should be analyzed and discussed at national level to make changes in the national recommendations if required.

For Research

- Nationwide and state wide mapping of all the schools for nutritional status is required using uniform standards for comparisons.
- Newer markers for assessing at risk adolescents for NCD need to be identified like (Waist to height ratio, neck circumference, blood pressure etc).
- Efficacy of blood pressure assessment and monitoring needs to be validated in adolescent population in view of controversies regarding its use as screening tool in this population.
- The role of blood pressure monitoring as an indicator for practicing healthy behave iours in population as shown in the present study also need to be validated by larger trials.

Figure 5.1: Percent prevalence of healthy and malnourished study subjects in the selected two schools

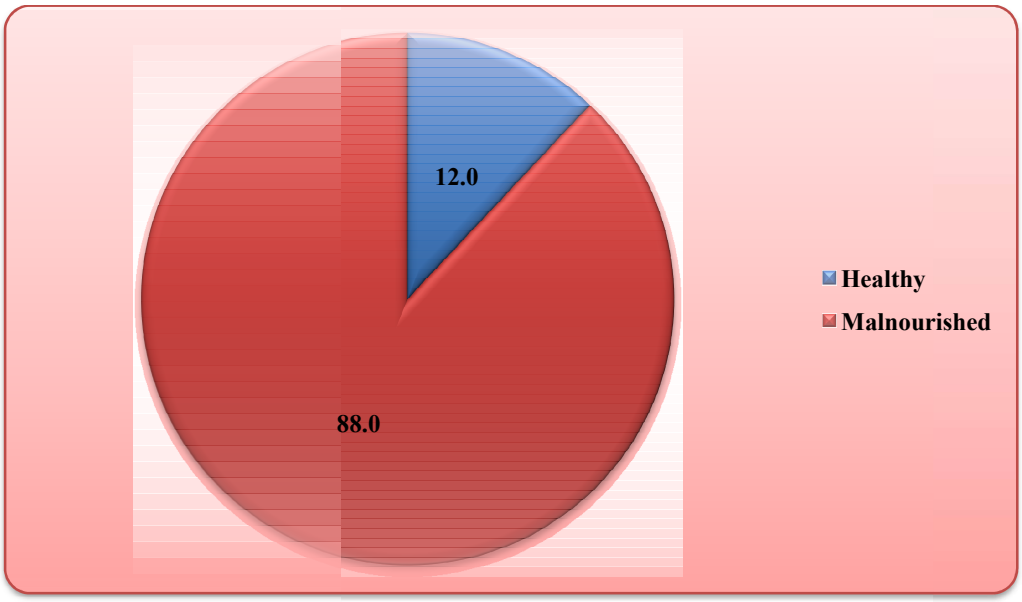


Figure 5.2: Percent prevalence of malnutrition, central obesity and high blood pressure among the study subjects

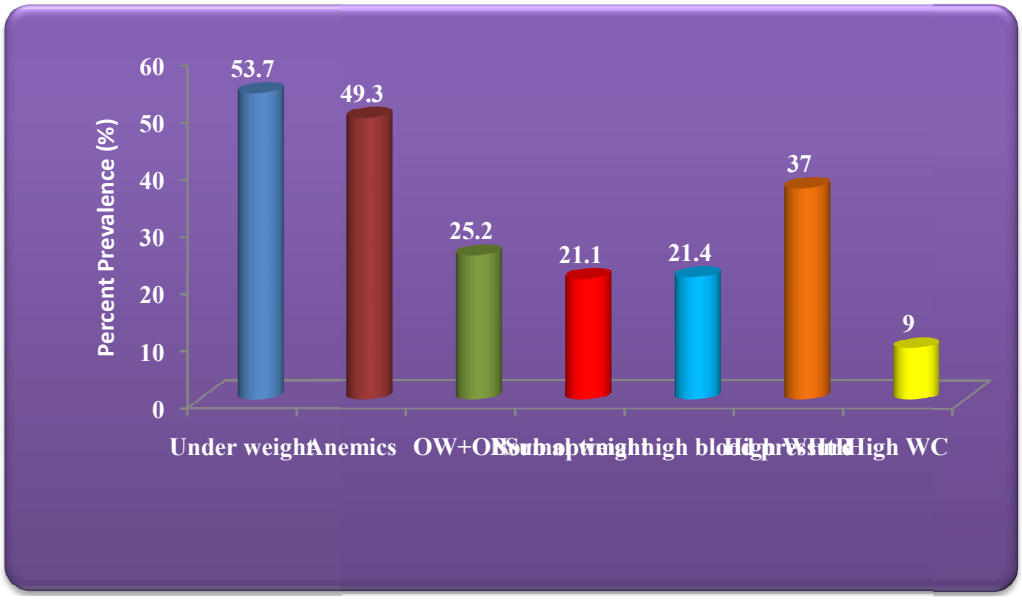


Figure 5.3: Mean number of products sold in five days pilot trial

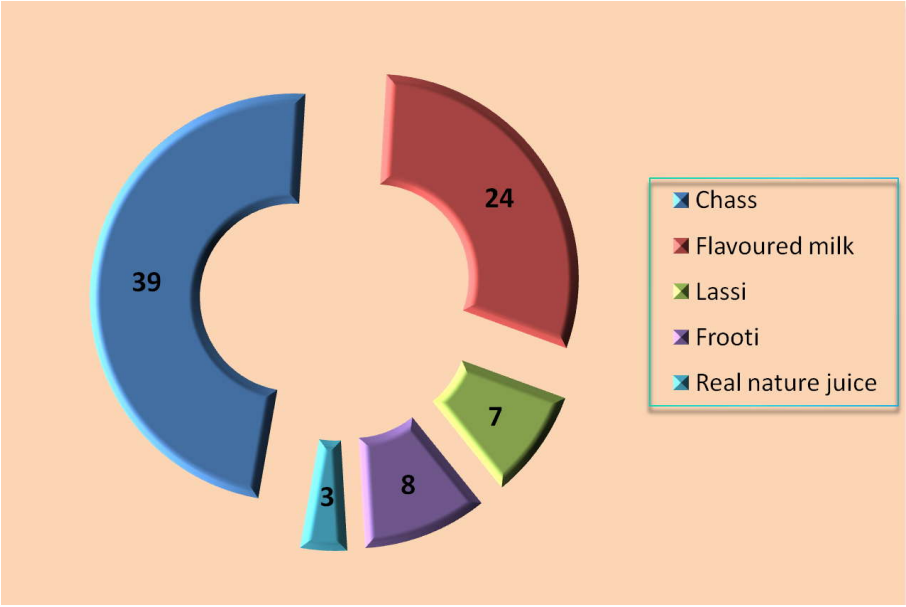


Figure 5.4: Changes in prevalence of anaemia in the study subjects before and after intervention in relation to compliance of IFA tablets

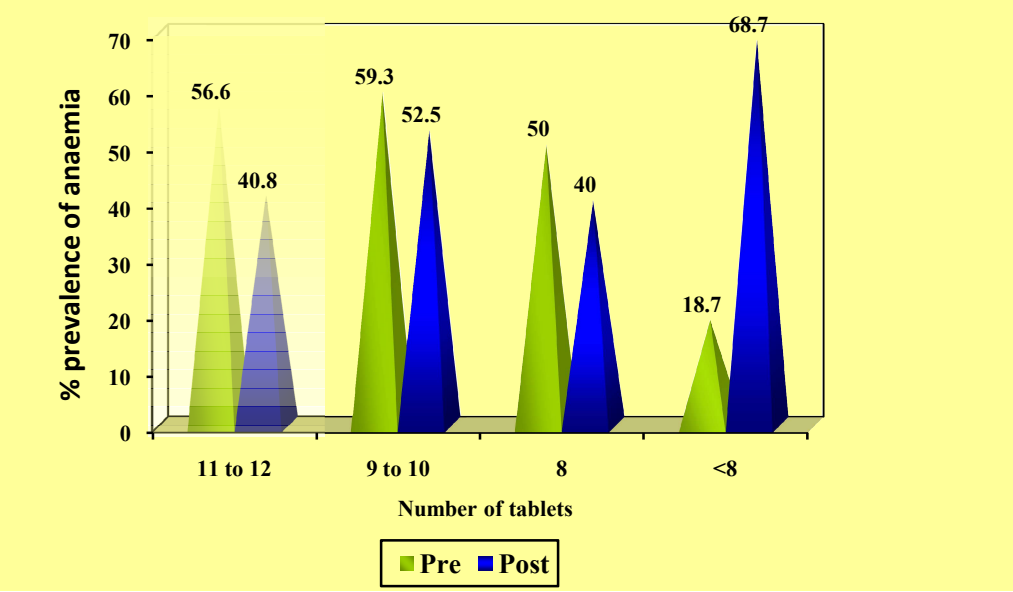


Figure 5.5: Percent change in prevalence of anaemia in relation to compliance of IFA tablets (11-12 tablets) among the study subjects (N=197)

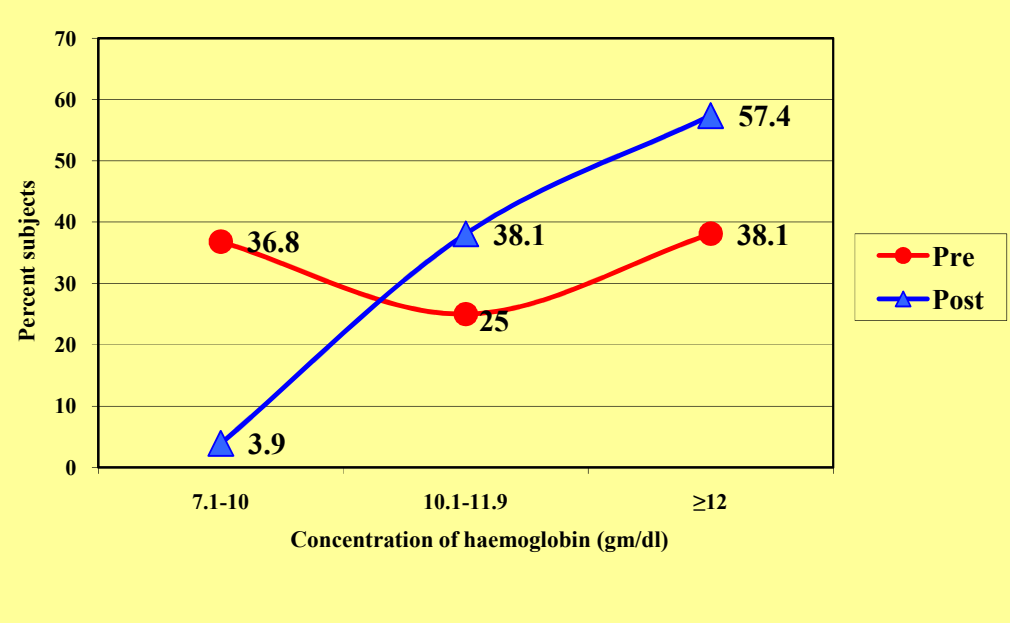


Figure 5.6: Percent change in prevalence of anaemia in relation to compliance of IFA tablets (9-10 tablets) among the study subjects (N=197)

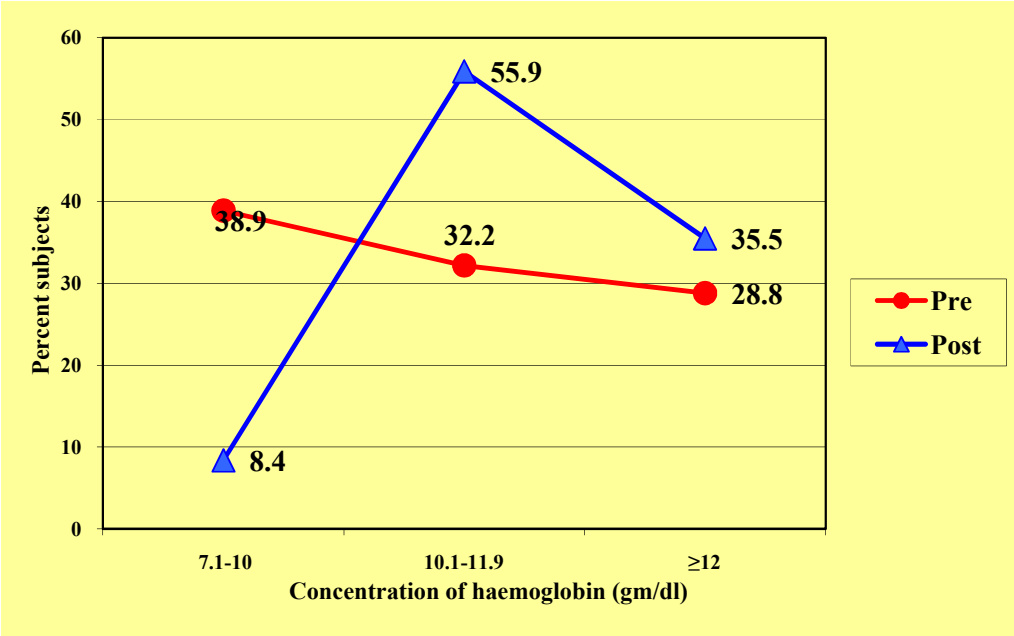


Figure 5.7: Percent change in prevalence of anaemia in relation to compliance of IFA tablets (8 tablets) among the study subjects (N=197)

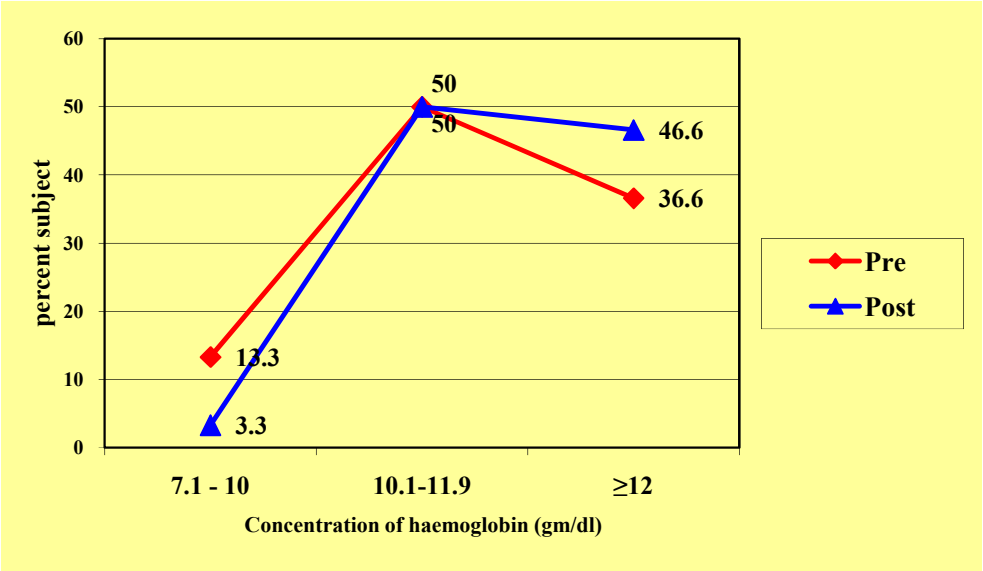
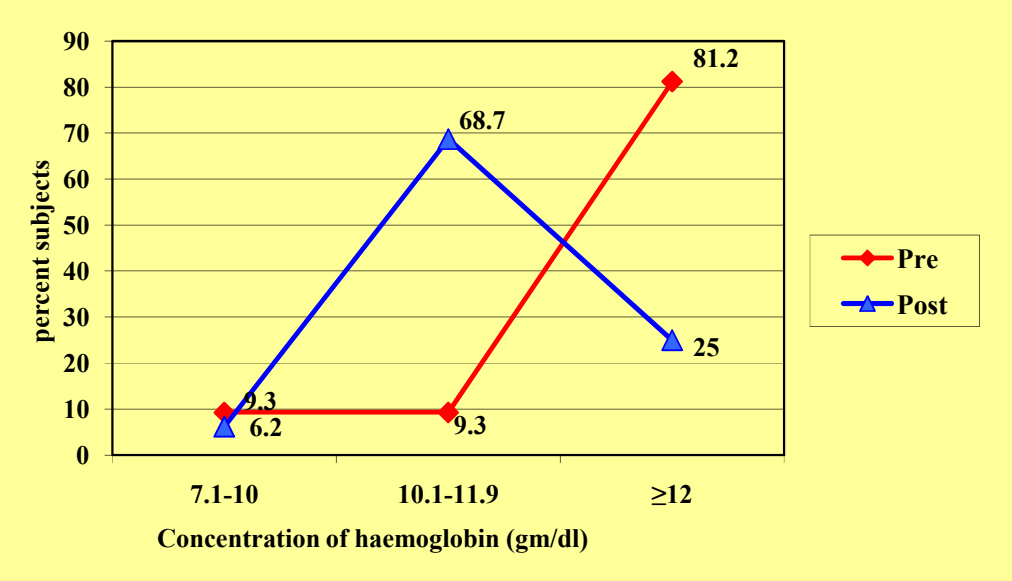


Figure 5.8: Percent change in prevalence of anaemia in relation to compliance of IFA tablets (< 8 tablets) among the study subjects (N=197)



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Annexure 1

INFORMED CONSENT LETTER

Dear Parents,

Promoting healthy behaviors among students is an important part of the fundamental mission of schools: To provide young people with the knowledge and skills they need to become healthy and productive adults, there is a need to initiate a school nutrition health promotion program.

Improving student health can

- Increase student's capacity to learn
- Reduce absenteeism
- And improve physical fitness and mental alertness

There has been a rising concern that our youngster's are adopting unhealthy dietary and lifestyle habits, which are detrimental for their health. Out of the ten leading causes of death, 7 are related to faulty diets and lifestyle. There is an increasing public health concern that our children are increasingly becoming overweight and obese, which doubles their risk of developing diseases like diabetes, hypertension and heart attacks at an early age. Similarly studies conducted by us reveal that 30% children have high cholesterol levels!. School settings has been recommended as one setting in which preventive measures can be undertaken to develop healthy dietary and lifestyle habits as school offers an excellent opportunity for developing healthy habits in young children due to the child's willingness to listen to their teachers and a very good reinforcing environment to practice healthy behaviours. We would also like mothers participation in the program also, as mothers play a vital role in the development of child's initial habits,

The child will be required to fill up some questionnaires and their anthropometric measurements (height, weight, waist circumference and hip circumference) and blood pressure will be taken. After the anthropometric measurements, the child will be categorized as overweight, obese, under weight and normal. Certain biochemical tests will have to be done twice (at the start of the study and after one year of the counseling period to determine the improvement in your child after the program. Biochemical estimations are necessary as they will indicate the choesterol levels and blood sugar levels in the child.

CATEGORY	HEMOGLOBIN	STOOL	LIPDID PROFILE	GLUCOSE
Over weight	√		√	√
Obese	√		√	√
Underweight or anemic	√	√		
Normal	√			

The biochemical tests will be carried out in the school premises, in coordination with THYROCARE, an internationally reputed laboratory. The blood samples will be collected by a trained lab technician using disposable syringes.

Therefore, we urge you to give your consent to the school to start a nutrition health promotion program to achieve productivity and health goals for your child at no cost.

Please note that this is purely a service being provided to improve the health and well being of your child. During one year, your child is free to withdraw, if he/she is not happy with the program.

We hope that the attachment provided will give an insight of the services that will be provided to your child in this program.

Principal Vice Principal

SUMMARY OF THE SERVICES WE WILL PROVIDE FOR EACH STUDENT

- Frame a comprehensive school policy on nutrition. A policy that promotes healthy eating through classroom lessons and a supportive school environment (Enabling environment: Recommending nutritious and healthy meals and snacks in the school premises, games and physical activity classes).
- Monitor thrice a year nutritional and health status of each child by recommended WHO standards. The parameters to be included will be:

✓ Growth Monitoring to identify optimal growth, identify signs of over and under nutrition, Nutritional anemia, goiter and other deficiency signs, if any. Prescribe nutritional supplements, if required by the student based on clinical and biochemical profile.

✓ Prepare a health card for each child to monitor the progress every year based on anthropometric and biochemical assessments.

✓ Integration of school food service and canteen services by monitoring healthy school meals based on recommended dietary allowances for each child, while taking special care to provide limiting nutrients in diets such as iron, fiber, potassium etc…

✓ Try and create enabling environment for promoting physical activity in school for at least one hour daily.

✓ Nutrition education, staff training, family and community involvement, and program evaluation. Work with teachers, parents and students, to develop the most effective and relevant nutrition education plans for the school.

AGREE: _____ DISAGREE:_____

SIGNATURE OF BOTH PARENTS: FATHER: _____

MOTHER: _____

NAME OF THE STUDENT: _____CLASS: _____

DATE: _____ RETURNING DATE:_____

Annexure 2

NUTRITION FRIENDLY SCHOOL

HEALTH INDEX

(NFSHI)

A self assessment tool and planning guide

Adopted from

World health organization (WHO)

&

Center for disease control (CDC)

2007

MODULE 1

SCHOOL HEALTH POLICIES

1. Does the school have a representative* committee that meets at least twice a year and oversees school health and safety policies and programs?
   a) Yes
   b) There is a committee that does this, but it could be more representative.
   c) There is a committee, but it is not representative, or it meets less often than twice a year.
   d) No.
2. Does the school have written polices* that govern all of the following areas related to student health?
   i. Healthy education curriculum
   ii. Physical education curriculum
   iii. physical activity programs (e.g., intramural, interscholastic, recess, after school)
   iv. school food service
   v. food and beverages available on campus beyond school food service
   vi. school health promotion for staff
   vii. health promotion for staff
   viii. family and community involvement
   ix. school physical environment (e.g., indoor and outdoor air quality, safety hazards)
      a) Yes, written policies cover all (9 points) these areas.
      b) The written policies cover nearly all (7 points) these areas.
      c) The written policies cover some (5 points) of these areas.
      d) The written policies cover none (0 points) of these areas.

3. Developed in consultation with children, parents, school staff and the wider community
   a) Yes
   b) No

4. Developed using information collected from a baseline survey conducted by the school or education council/committee at the municipal level?
   a) Yes
   b) No

5. Does the school communicate its school health policies in all of the following ways?
   i. Staff orientation and staff meetings
   ii. Student orientation
   iii. Student handbook
   iv. Staff handbook
   v. Parent handbook
   vi. Contact with outside vendors and organizations that rent school facilities
   vii. announcements at school events
   viii. community meetings

   a) Yes, in all (8 points) of these ways.
   b) In most (6 points) of these ways
   c) In some (4 points) of these ways
   d) In none (0 points) of these ways

6. Do the school's staff and environment promote a sense of connectedness* in students and their families with all of the following practices?
   I. At least one adult communicates personally with each student each day
   II. Faculty and staff encourage students to ask for help if there is a problem
   III. Faculty and staff promote respect for and appreciation of individual differences
   IV. Faculty and staff take action to solve problems reported by students and their parents
   V. Faculty and staff praise of students' behavior to students and their parents
   VI. Faculty and staff promote active parent participation in the school
      a) Yes, with all (6 points) of these practices.
      b) With most (4 points) of these practices.
      c) With some (3 points) of these practices.
      d) With none of these practices.

7. Does the school offer, to all students who need them, a variety of programs* designed to help students overcome barriers to learning**?
   a) Yes.
   b) The school offers a variety of programs to most but hot to all of the students who need them.
   c) The school offers a limited variety of programs, or many students who need them do not have access to them.
   d) No, the school does not offer such programs.

8. Does the school provide a broad variety of student enrichment experiences* that are accessible to all students?
   a) Yes.
   b) The school offers a variety of experiences, but some students do not have access to them.

c) The school offers a limited variety of experiences, or many students do not have access to them.
d) No, the school does not offer enrichment experiences.

9. Does it include a clear rationale focusing on improving the nutritional status of children, their families? And school staff, such as
   a) Yes
   b) No

10. Does it include clear objectives with feasible timelines and milestones (e.g.,what, when?)
   a) Yes
   b) No

11. Does include an action plan (e.g., how will the objectives be achieved be active and who will be involved in achieving them?)
   a) Yes
   b) No

12. Can all students use your school's indoor and outdoor physical activity facilities outside school hours*?
   a) Yes, both indoor and outdoor facilities are available to all students.
   b) Indoor and outdoor facilities, but not both, are available to all students.
   c) Indoor and outdoor facilities are available to all students, but the hours of availability are very limited.
   d) No, neither indoor nor outdoor facilities are available to all students.

13. Are the physical activity facilities adequate in all of the following ways?

MODULE 2

HEALTH EDUCATION

1. Do all who teach health education use active learning strategies* and activities that students find enjoyable and personally relevant?
   i. Supervised practice
   ii. Discussion
   iii. Cooperative learning
   iv. Simulations and learning games
   v. Teacher and peer modeling
   vi. Role playing
   vii. Goal-setting
   viii. Rehearsal
   ix. Visualization
      a) Yes, all do.
      b) Most do.
      c) Some do.
      d) None do, or no one teaches health education.

2. Do all who teach health education train students on the skills needed to adopt healthy lifestyles,* by giving students opportunities to practice these skills rather than just having them learn facts?
   Examples of skills needed to adopt healthy lifestyles include
   - ✓ Reading food labels
   - ✓ Planning healthy meals
   - ✓ Developing a safe, individualized physical activity plan
   - ✓

   a) Yes, all do.
   b) Most do.
   c) Some do.
   d) None do, or no one teaches health education.

3. Do all who teach health education use assignments and projects that encourage students to interact with family members* and community organizations**?
   *examples of way to interact with family members include
   - ✓ Doing homework assignments with parents, guardians, or other family members
   - ✓ Conducting surveys of family members
   - ✓ Sharing information with family members
   - ✓ Exhibiting student projects at school for family viewing
   - ✓ Participating in fun family discussion of the negative aspects of tobacco use, bullying, and violence
   - ✓ Preparing and practicing a home fire escape plan with the family.

   ** Examples of way to interact with community organizations include

   - ✓ Gathering information about existing community-based services
   - ✓ Having students volunteer to help deliver services though community-base organizations, services learning, and community-based special events and attending community based organization after school
   - ✓ Participating in community actions such as supporting tobacco-free environments
   - ✓ Participating in community advocacy groups (e.g., students against drunk driving, 4-H, and family, career, and community leaders of America)

     a) Yes, all do.
     b) Most do.
     c) Some do.
     d) None do, or no one teaches health education.

4. Dose the health education curriculum address all of these essential topics on physical activity?
   i. Meaning of physical activity, exercise, and health-related fitness
   ii. Physical, mental, and controlling body weight
   iii. Role of physical activity in controlling body weight
   iv. Commended amounts and types of physical activity for adolescents and adults
   v. Role of a sedentary lifestyle in development of chronic diseases
   vi. Way to increase daily physical activity

vii. Physical activities that contribute to maintaining or improving the components of health related fitness
viii. Influence of culture and media on physical activity
ix. Finding valid information and services related to physical activity and fitness
x. Interpersonal communication skills related to physical activity
xi. Behavioral skills related to physical activity (e.g., goal-setting, decision-making, self monitoring)
xii. Planning a personal physical activity program
xiii. Effects of tobacco use on fitness and physical performance(e.g., impaired lung function, reduced stamina)
xiv. Method for avoiding and responding to physical exhaustion, sunburn, heat stroke, and hypothermia
xv. Proper wear and use of safety equipment for specific physical activities
xvi. Importance of hydration in physical activity
xvii. Effects of and legal issues related to using performance-enhancing drugs

a) Yes, addresses all (17 points) of these topics.
b) Addresses most (13 points) of these topics
c) Addresses some (10 points) of these topics
d) Addresses none or these of these topics. Or there is no health education curriculum.

5. Does the health education curriculum address all of these essential healthy eating topics?
   i. Benefits of healthy eating
   ii. Importance of eating healthy breakfast
   iii. Importance of making healthy choices when eating out
   iv. Importance of making healthy choices when snacking
   v. The relationship of unhealthy eating to chronic diseases such as heart disease, cancer, diabetes, hypertension, and osteoporosis
   vi. The dietary guidelines recommendations
   vii. The food guide pyramid and nutritious choices for each group
   viii. Using food labels
   ix. Importance of moderation in a person's eating habits
   x. Identifying key nutrients (e.g., water, vitamins, minerals, protein, carbohydrates, and fiber) and major food sources of each.
   xi. Identifying foods that are low in fat, saturated fat, cholesterol, sodium, and added sugars
   xii. Preparing a variety meals and snacks
   xiii. Influence of personal preferences, family, peers, culture, and media on dietary behavior
   xiv. Finding valid information and related to healthy eating
   xv. Goa;-setting and decision-making skills for healthy eating
   xvi. How students can influence and support others to engage in healthy eating
   xvii. Balancing food intake and physical activity
   xviii. Healthy weight management
   xix. Accepting body size differences
   xx. Risks of unhealthy weight control practices, such as crash or fad diets, purging, diet pills, and tobacco use
   xxi. Eating disorders (e.g., anorexia, bulimia)

xxii. Food safety, including hand washing and safe food purchasing, preparation, and storage

a) Yes, address all (22 points) of these topics.
b) Address most (17points) of these topics.
c) Address some (13points) of these topics.
d) Address one or more of these topics, or there is no health education curriculum.

MODULE 3

Physical education and other physical activity program

1. Do all students in ah grade receive physical education* for at least 225 minutes per week** throughout the school year?
   a) Yes,
   b) 135-224 minutes per week for all students in each grade throughout the school year.
   c) 90-134 minutes per week for all students in each grade throughout the school year.
   d) Fewer than 90 minutes per week or not all students receive physical education throughout the school year.

2. Do physical education classes have a student/teacher ratio comfortable* to that of other classes?
   a) Yes,
   b) The ratio is somewhat larger (up to one and a half time larger) than the ratio for most other classes.
   c) The ratio is considerably large (more than one and half times larger). But there are plans to reduce it.
   d) The ratio is considerably large (more than one and half times larger) and there are no plans to reduce it.

3. Do all who teach physical education use a sequential* physical education curriculum that is consistent** with state or national standards for physical education?
   a) Yes,
   b) Some use a sequential physical education curriculum and it is consistent with state or national standards.
   c) Some use a sequential physical education curriculum but it is consistent with state or national standards.
   d) None do, or the curriculum is not sequential, or there is no physical education curriculum.

4. Do students earn grades for required physical education courses? Do the grades carry the weight as greases for other subjects toward academic recognition (e.g., honor roll, class rank)?
   a) Yes, (note: if the school does not give academic recognition but does give a grade. You can select 3.)
   b) Students earn grades, but the grades count less than grades for other subjects.
   c) No, but there are plans to change this procedure.

d) No, and there are no plans to change this procedure, or there are no required physical education courses.

5. Does the school prohibit substitution* of other courses or activities for physical education?
   a) Yes,
   b) Yes, but occasional exceptions are made.
   c) No, but there are plans to start prohibitions substitution.
   d) No, or there is no physical education.

6. Do students design and implement their own individualized physical activity/fitness plans* as part of the physical education program? Do physical education teachers provide ongoing feedback to students on progress in implementing their plans?
   a) Yes,
   b) Students design and implement their own individualized plans, teachers provide only occasional feedback.
   c) Students design and implement their own individualized plans, teachers provide no feedback.
   d) Students do not design and implement their own individualized plans, or there is no physical education program.

7. Do teachers keep students moderately to vigorously active* at least 50% of the time* during most or all physical education class sessions?
   a) Yes, during most or all classes.
   b) During about half the classes.
   c) During fewer than half the classes.
   d) During none of the classes, or there are no physical education classes.

8. Do teachers avoid using practices* than result in some students spending considerable time being inactive in physical education classes?
   a) They never use such practices.
   b) They rarely use such practices.
   c) They occasionally use such practices.
   d) They frequently use such practices, or there no physical education classes.

9. Do most students, including most who are athletically gifted and most who are not as athletically gifted, find physical education an enjoyable and fun experience?
   a) Yes, most of one group and other group find it enjoyable.
   b) Most of one group but few of the other group find it enjoyable.
   c) Few in both groups find it enjoyable.
   d) Hardly anyone I either group find it enjoyable. Or there is no physical education.

10. Does the physical education program promote student participation in a variety of community physical activity options* through three or more methods**?
    i. Class discussions
    ii. Bulletin boards
    iii. Public address announcements

iv. Guest speakers who promote community programs
v. Take-home flyers
vi. Homework assignments
vii. Newsletter articles
viii. Academic credit for participating in community physical activity and programs
   a) Yes, through three or more methods.
   b) The program promotes participation in a verity of community physical activity options. But through only one or two methods.
   c) The program promotes participation in only one type of community physical activity options.
   d) The program does not promotes participation in community physical activity options, or there is no physical education program.

11. Do all who teach physical education particulate at least once a year in professional development/continuing education* in physical education?
   a) Yes, all do.
   b) Most do.
   c) Some do.
   d) None do, or no one teaches physical education.

12. Do at least 50% of boys and 50% of girls participate in school-sponsored extracurricular physical activity programs*?
   a) Yes, at least 50% boys and at least 50% of girls participate.
   b) At least 50% of one sex participates, but less than 50% of the other sex do.
   c) Less than 50% of boys and less than 50% of girls participate.
   d) There are no school-sponsored extracurricular physical activity programs.

MODULE 4

Nutrition services

1. Does the school offer nutritious breakfast and lunch programs* that are fully accessible** to all students?
   a) Yes.
   b) The school offers breakfast and lunch programs, but they are not fully accessible to all students.
   c) The school offers only a lunch program, but there are plans to add a breakfast program.
   d) The school offers only a lunch program and there are no plans to add a breakfast program, or the school does not offer a breakfast or a lunch program.

2. Do school meals* include a variety of foods**?
   a) Yes, meets all four of these criteria for variety.
   b) Meets three criteria.
   c) Meets one or two criteria.
   d) Meets none of these criteria.

3. Does the school food service offer low-fat* and skim milk every day?
   a) Yes, low-fat and skim milk are offered every day.
   b) Either low-fat or skim milk is offered every day.
   c) Low-fat or skim milk is offered. But not every day.
   d) Neither is offered any day.

4. Do school meals include at least one appealing,* low-fat** fruit, vegetable, and dairy product every day?
   a) Yes, meals include at least one appealing, low-fat item from each of these three food groups every day.
   b) Include at least one appealing, low-fat item from two of these food groups every day.
   c) Include at least one appealing, low-fat item from one of these food groups every day.
   d) School meals do not include appealing, low-fat items from any of these three food groups every day.

5. Does the school food consistently follow all of these food purchasing and preparation practices to reduce the fat content of food served?
   i. Spoon solid fat from chilled meat and poultry broth before using
   ii. Use specification requiring lower fat content in ordering prepared foods such as burger, pizza, puffs, etc.
   iii. Rinse browned meat with hot water to remove grease before adding to other ingredients.
   iv. Remove skim from poultry before or after cooking
   v. Roast, bake, or boil meat rather than fry it
   vi. Roast meal and poultry on rack so fat will drain
   vii. Use low-fat or reduced-fat cheese on pizza
   viii. Prepare vegetable using little or no fat
   ix. Cook with nonstick spray or pan liners rather than with grease or oil
   x. Offer low-fat salad dressings.
      a) Yes, follows all ten of these practices.
      b) Follows six to nine of these practices.
      c) Follows three to five of these practices.
      d) Follows two to fewer of these practices.

6. Do the a la carte offerings*include at least one appealing, low-fat fruit, vegetable, and dairy product every day?
   a) Yes, a la carte offerings include at least one appealing, low-fat item from each of these three food groups every day.
   b) Include at least one appealing, low-fat item from two of these three food groups every day.
   c) Include at least one appealing, low-fat item from one of these three food groups every day.
   d) The daily a la carte offerings do not include appearing, low-fat items from any of these three food groups.

7. Do most or all sites outside the cafeteria* offer appealing, low-fat fruits. Vegetables, or dairy products?
   i. Vending machines
   ii. School stores and canteens
   iii. Concession stands
   iv. Parties and special events
   v. Meetings
   vi. Extended day programs(i.e., school-sponsored after-school programs)
      a) Yes, most or all sites outside the cafeteria do.
      b) About half the sites do.
      c) Fewer than half the sides do.
      d) None of the sites do.

8. Are food and beverage choice that are low in fat, sodium, and added sugars promoted through the following methods?
   i. Plan in more prominent positions than less nutritious choices.
   ii. Offer at competitive prices compared with less nutritious choices.
   iii. Display nutritional information about available foods.
   iv. Display promotional materials such as posters.
   v. Highlight healthy cafeteria selection in menus that are distributed or posted
   vi. Offer taste-testing opportunities
   vii. Make school-wide audio or video announcements
   viii. Have contests
      a) Yes, promoted through five or more of these methods.
      b) Promoted through three or four of these methods.
      c) Promoted through one or two of these methods.
      d) Promoted through none of these methods.

9. Do students have at least 10 minutes to eat breakfast and at least 20 minutes to eat lunch, counting from the time they are seated?
   a) Yes, (note: if the school does not have a breakfast program. But dose provide at least 20 minutes for lunch. You can select 3.)
   b) Have adequate time for breakfast or lunch, but not for both.
   c) No, but there are plans to increase the time.
   d) No.

10. Do food services staff use three or more of the following methods to collaborate with teachers to reinforce nutrition education lessons taught in the classroom?
   i. Participate in design and implementation of nutrition education programs
   ii. Display educational and informational materials that reinforce classroom lessons
   iii. provide food for use in classroom nutrition education lessons
   iv. provide ideas for classroom nutrition education lessons
   v. teach lessons or give presentation to students
   vi. provide cafeteria tours for classes
      a) Yes, use three or more methods.
      b) Use two of three methods.
      c) Use one of these methods.
      d) Use none of these methods.

11. Does the school provide students with a clean, safe and pleasant cafeteria, according to the following criteria?
    i. Physics structure (e.g., walls, floor covering) does not need repairs
    ii. Table and chairs are not damaged and are of appropriate size for all students
    iii. Seating is not overcrowded (e.g., never more than 100% of capacity)
    iv. Rules for safe behavior (e.g., running, no throwing food or utensils) are enforced
    v. Tables and floors are cleaned between lunch periods or shifts
    vi. Age-appropriate decorations are used
    vii. Appropriate practices are used to prevent excessive noise levels(e.g., no whistles)
    viii. Smells are pleasant and not offensive
    ix. Appropriate eating devices are available when needed for students with special health care needs.
        a) Yes, cafeteria meets all nine of these criteria.
        b) Meets five to eight of these criteria.
        c) Meets three or four of these criteria.
        d) Meets two or fewer of these criteria.

12. Are school food service staff and cafeteria monitors (e.g., teachers. aids) trained to respond quickly and effectively to the following types of food emergencies?
    i. Choking.
    ii. Natural disasters(e.g. ,electrical outages affecting refrigeration)
    iii. Medical emergencies(e.g., severe food allergy reactions, diabetic, reactions)
    iv. Attempts to introduce biological or other hazards into the food supply
    v. Situations that require students or others to shelter in the school
        a) Yes, trained for all five types of emergencies.
        b) Trained for three or four types of emergencies.
        c) Trained for one or two types of emergencies.
        d) Trained for none of these types of emergencies.

Annexure 3

Score card

Module 1

School health and safety policies and environment

Instructions

1. Carefully read and discuss the module 1 discussion questions, which contains questions and scoring descriptions for each items listed on this score card.
2. Circle the most appropriate score for each item.
3. After all questions have been scored, calculate the overall module score and complete the module 1 planning questions located at the end of this module.

NAME OF THE RESPONDENT: _____

DESIGNATION: _____

		Fully in place	Partially in place	Under development	Not in place
1	Representative school health committee	3	2	1	0
2	Written school health and safety policies	3	2	1	0
3	Communicate school health and safety policies to Students, parents, staff and visitors	3	2	1	0
4	Connectedness to school	3	2	1	0
5	Overcome barriers to learning	3	2	1	0
6	Enrichment experiences	3	2	1	0
7	Access to physical activity facilities outside school hours	3	2	1	0
8	Adequate physical activity facilities	3	2	1	0
9	Prohibit physical activity as punishment	3	2	1	0
10	Prohibit using food as reward or punishment	3	2	1	0
11	Fundraising efforts supportive of healthy eating	3	2	1	0
12	Restrict access to food of minimal nutritional value	3	2	1	0
13	Restrict access to other food of low nutritive value	3	2	1	0

Score card

Module 2

Health education

Instructions

1. Carefully read and discuss the module 2 discussion questions, which contains questions and scoring descriptions for each items listed on this score card.
2. Circle the most appropriate score for each item.
3. After all questions have been scored, calculate the overall module score and complete the module 2 planning questions located at the end of this module.

NAME OF THE RESPONDENT: _____

DESIGNATION: _____

		Fully in place	Partially in place	Under development	Not in place
1	Active learning strategies	3	2	1	0
2	Opportunities to practice skills	3	2	1	0
3	Assignments encourage student interaction with family and community	3	2	1	0
4	Essential topic on physical activity	3	2	1	0
5	Essential topic on healthy eating	3	2	1	0

NFSHI Score cards

Module 3

Physical education and other physical activity programs

Instructions

1. Carefully read and discuss the module 3 discussion questions, which contains questions and scoring descriptions for each items listed on this score card.
2. Circle the most appropriate score for each item.
3. After all questions have been scored, calculate the overall module score and complete the module 3 planning questions located at the end of this module.

NAME OF THE RESPONDENT: _____

DESIGNATION: _____

		Fully in place	**Partially in place**	**Under development**	**Not in place**
1	225 minutes of physical education per week	3	2	1	0
2	Adequate teacher/student ratio	3	2	1	0
3	Sequential physical education curriculum consistent with standards	3	2	1	0
4	Physical education grading	3	2	1	0
5	Prohibit substitution for physical education	3	2	1	0
6	Individualized physical activity/fitness plans	3	2	1	0
7	Students activity at least 50% of class time	3	2	1	0
8	Teachers avoid practices that result in student inactivity	3	2	1	0
9	Physical education is enjoyable	3	2	1	0
10	Promote community physical activity	3	2	1	0
11	Participation in extracurricular physical activity programs	3	2	1	0

Annexure 4

CANTEEN

SCHOOL: _____ DATE: _____

NAME OF THE CONTRACTOR:

TIMINGS OF THE CANTEEN:

DURATION OF THE CANTEEN:

1. What are the items (ready to eat) sold in the canteen?

S.NO.	NAME OF THE ITEMS	COST (Rs.)	NUMBER OF ITEMS BROUGHT DAILY	NUMBER OF ITEMS SOLD DAILY
1				

2. Are cold drinks sold in the canteen?
   A. Yes

NAME OF THE COLD DRINKS	AMOUNT	COST (Rs.)	NUMBER OF COLD DRINKS BROUGHT DAILY	NUMBER OF COLD DRINKS SOLD DAILY

3. Are beverages sold in the canteen?

   A. Yes

   B. No

TIME	NAME OF THE BEVERAGE	COST (Rs.)	NUMBER OF BEVERAGES MADE DAILY	NUMBER OF BEVERAGES SOLD DAILY

4. What are the snacks prepared in the canteen, mention the names along with the prices:

SNACKS	COST	NUMBER MADE	NUMBER SOLD PER DAY

5. Is there any item you prepare occasionally?
   A. Yes B. No

6. Are there any milk products sold in the canteen? If yes, mention the names along with the prices:

A. Yes B. No

7. Do you sell any fruit items?
   A. Yes B. No

PREPARING AND COOKING PRACTICES

8. Do you wash vegetables before or after cutting them? _____
9. Which oil you use for cooking? _____
10. Do you use blend of oils (more than one oil) for cooking canteen items? If yes, then mention the names of the different oils you use.
    A. Yes B. No

11. What is the average amount of oil used per month? _____
12. What other cooking mediums you use?

    _____
    _____

13. Do you add soda, salt and oil in the refined flour, which you use to prepare canteen items?
    A. Yes B. No

SERVING OF THE FOOD

14. How do you give the food items that is prepared?
    _____
15. If you reheat the items, what is the procedure you follow? Mention separately for different items the process of reheating.

OTHERS:

FRIDGE	VENDING MACHINE	OVEN
GAS	TAVA	GRATER
KNIFE	DISPOSABLE DISHES	

Annexure 5

QUESTIONNAIRE FOR TEACHERS

General information:-

1. Write your name capital letters.
   Surname:_____
   Name:_____
2. Contact no.:_____
3. Address:_____
   _____
   _____
4. Religion:_____
5. Gender:_____
6. Education level:
   A. Primary
   B. Secondary
   C. Graduate
   D. Post graduate
   E. Others, specify

Also, specify your degree.

_____
_____
_____

7. Are you aware of your weight (in KG)? Mention if, yes.
   A. Yes
   B. No

_____
_____

8. How do you describe your weight?
   A. Very underweight
   B. Slightly underweight
   C. About the right weight
   D. Slightly overweight
   E. Very overweight
9. Which class/standard do you teach?
   _____
   _____

10. Please mention your working hours and specify the timings.
    _____
    _____
    _____
11. Which subjects do you teach?

_____
_____
_____

The next segment asks about eating habits & beverage intake.

12. Do you think it is important to teach about healthy behaviors and diet in school? Give your reason.
    A. Yes
    B. No

    _____
    _____

13. Do you think schools & teachers play any role in shaping a child's behaviors and eating habits? Discuss.
    A. Yes
    B. No

    _____
    _____
    _____

14. Do you think the school canteen provides healthy food to meet a child's nutritional requirements?
    A. Yes
    B. No

    _____
    _____
    _____
    _____

15. What is your idea of healthy food?

    _____
    _____
    _____
    _____

16. According to you, what is the number of complete meals a child should have in a day?
    A. 1
    B. 2
    C. 3
    D. 4
    E. More than 5

17. What do you think constitutes a healthy breakfast?
    A. Only milk
    B. Milk and cereal(bread/chapatti/cornflakes/paratha)
    C. Milk, cereal and some vegetable(excluding potato)
    D. Milk, cereal, and fruits
    E. Milk, cereal. Fruits and nuts.
    F. All the above
    G. Any other,

_____
_____

18. In your view important a breakfast as a meal for a child? Give your reasons.
A. Very important
B. As important as other meals
C. Not very important
D. Not at all important
19. How many servings of vegetables (excluding potatoes, sweet potatoes) do you think a child should eat per day? (please write)
_____serving(s). #include one katori of cooked beans (whole legumes like rajma, kala chana, kabuli chana, lobia as 2 servings of vegetables) *one small katori of cooked dry vegetables to be taken as one servings.

20. How many servings of fruits do you think a child should have in a day? *one serving is small banana, orange, apple, 2chikus, one small katori of grapes etc.

_____
_____
_____

21. Do you think soft drink can important health benefit to a child? Explain
A. Yes
B. No

_____
_____
_____
_____

22. In the current academic year, how many times have you taught your students regarding healthy behaviors or healthy diet?

_____
_____
_____

23. Do you check your student's tiffin during breaks? if yes then specify the reasons.
A. Yes
B. No

_____
_____
_____

24. Have you laid guideline for the parents as to what they should give as packed lunch for their child? Specify. If any.
A. Yes
B. No

_____
_____
_____
_____
_____

The next * questions ask about physical activity and T.V watching. Physical activity is any that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are running, fast walking, biking, dancing, or football.

25. Do you think it is important for a child to be physical active? Give your reasons.
    A. Yes
    B. No

_____
_____
_____
_____

26. What is the minimum level of physical activity that a child should undertake in your view?
    A. Should not undertake at all
    B. ½ hour
    C. 1 hour
    D. 1-2 hour
    E. More than 2 hours

27. Do you allow/encourage your students to get involved in any kind of physical activity/games during leisure or free time after school?
    A. Yes
    B. No

28. How many hours of T.V viewing do you think should be allowed when at home?

    A. Less than 1
    B. 1 hour
    C. 1-2 hours
    D. 2-3 hours
    E. More than 3 hours

29. Have you ever advised students as to how much time they should devote to T.V/ computer games?
    A. Yes
    B. No
    C.

30. Have you ever discouraged T.V watching or spending long hours on computers? Give your reasons.

A. Yes
B. No

_____
_____
_____
_____

31. Have you ever quizzed the students for how much time they devote to television/computers daily on an average? Support with your reasons.
A. Yes
B. No

_____
_____
_____

32. Do you think prolonged T.V viewing can have an effect on a child's growth and development? Reasons.
A. Yes
B. No

_____
_____
_____
_____

THANK YOU FOR YOUR TIME!

Annexure 6

BMI for age classification according to percentiles

Cut off values	Categories
≥ 97th percentile	Obese
≥ 85th to < 97th percentile	Over weight
50th to < 85th percentile	Normal
< 50th to ≥ 15th percentile	Mild under weight
< 15th to ≥ 3rd percentile	Moderate under weight
< 3rd percentile	Severe under weight

Source: Nutritional status according to WHO 2007 (de Onis et al. (2007)

BMI for age classification according to z- scores

Cut off values	Categories
-1 to +1 z score	Normal weight
> + 2 to +3 z score	Over weight
> +3 z score	Obese
< -1 to – 2 z score	Mild under weight
< -2 to -3 z score	Moderate under weight
< - 3 z score	Severe under weight

Source: Nutritional status according to WHO 2007 (de Onis et al. (2007)

Central Obesity

High Waist Circumference	
Age (years)	**Criteria**
6 - < 10	≥ 90th percentile
10 - > 16	≥ 90th percentile or adult cut off
16 or more	Adult cut off
High Waist to Height Ratio	
≥ 0.5	

Source: High Waist circumference (Ferna´ndez et al.2004), High waist to height ratio (McCarthy and Ashwell. 2006)

Hypertension

Cut off values	Categories
< 90th	Normal
≥ 90th to < 95th	Pre hypertension
≥ 95th to 99th plus 5 mmHg	Stage I (Primary hypertension)
> 99th plus 5 mmHg	Stage II (Secondary hypertension)

Source: (NIH 2005)

Anemia

Age wise classification	
5 – 11 years	> 11.0 g/dl
12 – 14 years	≥ 11.5 g/dl
15 or above (females)	≥ 12.0 g/dl
15 or above (males)	≥ 13.0 g/dl
Severity of anemia	
≥ 12 g/dl	Normal
10.1 – 11.9 g/dl	Mild anemic
7.1 – 10 g/dl	Moderate anemic
≤ 7.0 g/dl	Severe anemic

Source: WHO 2007

Dyslipidemia and Glucose Intolerance

Classification	Optimal values				
	TC	**LDL- C**	**TG**	**HDL**	**FBS**
ATP III	< 200	< 100	< 150	> 40	
AHA	< 200	< 130	≤ 150	≥ 35	
IDF					< 100

Source: ATP III 2002, AHA classification, IDF 2007

Annexure 8

INFORMED CONSENT LETTER FOR BIOCHEMICAL ESTIMATIONS

Dear Parents,

As you all know that we are conducting a study on your wards, for which you have given your consent. We have finished with the first phase of the study, i.e., gathered information about their dietary and lifestyle behaviors through a questionnaire. In the second phase we have taken their anthropometric measurements (height, weight, waist circumference and hip circumference) and classified them into overweight and obese.

In the consent letter, we had already mentioned that those children who would fall in one of these categories will have to undergo certain biochemical estimations (fasting lipid profile and fasting glucose test). These tests are important as it will reflect the blood cholesterol levels and blood glucose levels. High levels of these biochemical parameters are the main risk factors for chronic diseases. Now, as your child falls in one of these categories, so we request parents or guardians to accompany the child, as venous blood is required. Since we have to test fasting lipid profile and fasting glucose levels the child should come empty stomach (overnight 10-12 hours fasting) in the morning. After the tests, the child will be provided with some refreshments in the school.

The biochemical tests are being carried out in the school premises, in coordination with THYROCARE, an internationally reputed laboratory. The blood samples will be collected by a trained lab technician using disposable syringes.

Therefore, we request you to please help us in carrying out these estimations on your ward on **1 March (Saturday), 7.00 am.**

Principal Vice Principal

Signature of the parents/ guardian:_____

Contact number:_____

Name of the student:_____

Class:_____

Annexure 9

Dear STUDENTS, following is a simple questionnaire which you are required to fill. The questions do have any right or wrong answers. You only have to answer which you feel is correct. The information you are providing and your identity would not be disclosed. The data would only be used for research purpose. The answers would not affect your class marks or any grades.

YOUR NAME:_____

CLASS: _____

DATE: _____

The next 3 questions ask about information on your age and gender.

1. Mention your date of birth: _____
2. What is your sex?
   A. Male
   B. Female

The next 10 questions ask about your dietary habits.

12. During the past 7 days, how often did you eat breakfast before you left for school?
   A. Never
   B. Rarely
   C. Sometimes
   D. Most of the time
   E. Always

12 (a): If you skip your breakfast, mention the reasons for it

   A. I do not have time for breakfast.
   B. I cannot eat early in the morning.
   C. I have to finish my home work in the morning.
   D. Some other reason

_____
_____
_____
_____
_____

13. What do you usually consume for breakfast?

A. Only milk
B. Milk and cereal (bread/ chapatti/cornflakes/parantha)
C. Milk , cereal and some vegetable (excluding potato)
D. Milk , cereal and fruits
E. Milk, cereal, fruits and nuts.
F. All the above
G. Any other

_____
_____
_____
_____
_____

14. What do you usually eat before coming to school?

_____
_____
_____
_____
_____

15. During the past 7 days, how many days did you **usually** eat fruit, such as apple, mango, banana, pineapple, papaya, jackfruit, guava, or chikoo?

A. One day
B. Two days
C. Three days
D. Four days
E. Five days
F. All days

16. During the past 7 days, how **times in a day** did you **usually** eat fruit, such as apple, mango, banana, pineapple, papaya, jackfruit, guava, or chikoo?

A. I did not eat fruit during the past 30 days
B. Less than one time per day
C. 1 time per day
D. 2 times per day
E. 3 times per day
F. 4 times per day
A. 5 or more times per day

17. Since yesterday at this time, how many fruits did you eat? (Please write)

Write the name of the fruit and the number of fruits:

_____
_____
_____
_____
_____

18. During the past 7 days, how many **day** did you **usually** eat vegetables, such as cauliflower, ladyfinger, pumpkin, brinjal, cabbage, spinach, peas, tomato, cucumber, or beans?

A. One day
B. Two days
C. Three days
D. Four days
E. Five days
F. All days

19. During the past 7 days, how **many times <u>per day</u>** did you **usually** eat vegetables, such as cauliflower, ladyfinger, pumpkin, brinjal, cabbage, spinach, peas, tomato, cucumber, or beans?

A. I did not eat vegetables during the past 30 days
B. Less than one time per day
C. 1 time per day
D. 2 times per day
E. 3 times per day
F. 4 times per day
A. 5 or more times per day

20. Since yesterday at this time, how many servings of vegetables excluding potatoes, sweet potatoes did you eat? (Please write)

Write the name of the vegetable and the number of katories you had:

_____
_____
_____
_____

<u>The next 5 questions ask about fast-foods you might eat and your soft-drink intake.</u>

22. During the past 7 days, how many **<u>day</u>** did you usually drink carbonated soft drinks, such as Coke, Pepsi, Limca, or Fanta?
A. A. One day
B. Two days
C. Three days
D. Four days
E. Five days
F. All days

23. Since yesterday at this time, how many **servings of soft /carbonated drink** did you take? (Please write)

_____ Glass (es)

24. During the past 7 days, on how many **days** did you eat at a fast food restaurant, such as McDonalds, Goodies, Pizza Hut, Fridgetemp or at those serving quick meals (eg. Samosas, patties, burgers, noodles, tikkis, or ice creams)? Also take into account the fast food like burger, franky Chinese samosa etc, that you might have eaten in the school canteen.

A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

25. In the past 7 days how often have you eaten out (outside your home) with your family?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

26. In the past 7 days how often have you eaten out (outside your home) with your friends?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

The next questions ask about your food consumption pattern in the school.

27. How many recess breaks do you have in the school? Also mention at what time you get the breaks.

A. None

B. One _____

A. Two _____

28. Mention what you usually eat during your recess:

A. I get my own packed lunch
B. I buy food from the canteen.
C. Both

29. What do you usually buy from your school canteen during your free time?

_____
_____
_____
_____
_____

30. Do you carry your lunch to the school? Mention what you usually carry for lunch/

A. Yes
B. No

_____
_____
_____
_____
_____

31. During the past 7 days, how often did you bring your lunch box to school?

A. Never
B. Rarely
C. Sometimes
D. Most of the time
E. Always

The next questions ask about physical activity and T.V watching. Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are running, fast walking, biking, dancing, or football.

ADD UP ALL THE TIME YOU SPEND IN PHYSICAL ACTIVITY EACH DAY. DO **NOT** INCLUDE YOUR PHYSICAL EDUCATION OR GYM CLASS.

33. During the past **7 days**, on how many days were you physically active for a total of at least 60 minutes (1 hour) per day?

A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

34. Since yesterday at this time, how many minutes did you exercise at home? (Please write)_____ Minutes

35. During a typical or usual week, on how many days are you physically active for a total of at least 50-60 minutes per day?
    A. 0 days
    B. 1 day
    C. 2 days
    D. 3 days
    E. 4 days
    F. 5 days
    G. 6 days
    H. 7 days

The next questions ask about physical education class and stretching exercises.

36. During this school year, on how many days did you go to physical education class each week?

A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 or more days

37. During the past 7 days, on how many days did you do stretching or strengthening exercises, such as toe touches, knee bends, or push-ups?

A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. days
H. 7 days

The next questions asks about the time you spend mostly sitting when you are not in school or doing homework

38. Typically, how many hours do you sleep per day?

A. Less than 4 hours
B. 4 to 6 hours
C. 6 to 8 hours
D. 8 to 10 hours
E. More than 10 hours

39. How much time do you spend during a **typical or usual** day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities, such as listening to music?

A. Less than 1 hour per day
B. 1 to 2 hours per day
C. 3 to 4 hours per day
D. 5 to 6 hours per day
E. 7 to 8 hours per day
F. More than 8 hours per day

40. Since yesterday at this time, how many hours TV did you watch or played on computer?
(Please write) _____ Hour(s)

The next questions ask about going to and coming home from school.

41. What is your mode of transportation to and from school?
   A. Walking
   B. Bicycle
   C. Public transport
   D. Automated vehicle

42. During the past 7 days, on how many days did you **walk** or **ride a bicycle** to and from school?

   A. 0 days
   B. 1 day
   C. 2 days
   D. 3 days
   E. 4 days
   F. 5 days
   G. 6 days
   H. 7 days

43 During the past 7 days, how long did it **usually** take for you to get to and from school each day? ADD UP THE TIME YOU SPEND GOING TO AND COMING HOME FROM SCHOOL.

   A. Less than 10 minutes per day
   B. 10 to 19 minutes per day
   C. 20 to 29 minutes per day
   D. 30 to 39 minutes per day
   E. 40 to 49 minutes per day
   F. 50 to 59 minutes per day
   G. 60 or more minutes per day

Thank you for your time

Annexure 10 to 14 (In the CD)

Annexure 14

Ist SET OF 6 DAYS CYCLIC MENUS

MENU: 1 RAJMAH CHAWAL AND FRUIT

FOOD ITEM	INGREDIENTS	AMT (gm)
RAJMAH	Rajmah	30
	Onion/Dungri	60
	Tomato/Tamatar	30
	Iron rich oil seeds	7.5
	Oil	20
	Curd/Dahi	125
RICE	Rice/Chawal	60
SEASONAL FRUIT	Banana/ kela	100
Nutritive Value: Energy: 730 kcal; Protein: 18gm; Fat: 20.3gm; Iron: 11.3gm		

MENU:2 PAV BHAJI WITH FRUIT

FOOD ITEM	INGREDIENTS	AMT (gm)
PAV	Pav(3)	180
	Oil/ Butter	5
BHAJI	Peas/Matar	15
	Potato/Batata	70
	Cauliflower/patta gobi	10
	Onion/Dungri	10
	Tomato/Tamatar	10
	Iron rich oil seeds	6
	Oil/ butter	5
SEASONAL FRUIT	Banana/ Kela	100
Nutritive Value: Energy: 754 kcal; Protein: 17.5gm; Fat: 19gm; Iron: 8.9gm		

MENU: 3 MIXED VEGETABLE PULAO, CURD & FRUIT

FOOD ITEM	INGREDIENTS	AMT (g)
PULAO	Rice	60
	Green Peas/ Matar/ Vatana	20
	Onion/ Dungri	50
	Tomato/ Tamatar	20
	Iron rch oil seeds	5
	Oil	5
	Potato/Batata	70
CURD	Curd/Dahi	125
	Sugar/sakkare	5
SEASONAL FRUIT	Banana/kela	100
Nutritive Value: Energy: 731.8 kcal; Protein: 19.9gm; Fat: 18.3gm; Iron: 10.5gm		

MENU: 4 POORI, CHANNA,CURD & FRUIT

FOOD ITEM	INGREDIENTS	AMT (gm)
PURI (4)	**Wheat flour/Atta**	**60**
	Oil	**5**
CHANA	**Chana**	**30**
	Onion/ Dungri	**50**
	Tomato/ Tamatar	**40**
	Cauliflower/ phul gobi	**15**
	Oil	**5**
Curd	**Dahi**	**100**
SEASONAL FRUIT		**100**
Nutritive Value: Energy: 720.1 kcal; Protein: 23.5gm; Fat: 20.1gm; Iron: 12.4gm		

MENU:5 VEGETABLE UPMA WITH BANANA

FOOD ITEM	INGREDIENTS	AMT (gm)
VEG UPMA	Semolina/Sooji	50
	Sprout (Chana dal)	15
	Green peas	10
	Ground nut	5
	Onion/Dungri	30
	Potato/ Batata	70
	Carrot/ Gajar	40
	French fries	50
	Iron rich oil seeds	7.5
	0il	10
Fruit	Banana/Kela	200
Nutritive Value: Energy: 762.6kcal; Protein: 18gm; Fat: 15.7gm; Iron: 12.5gm		

MENU: 6 STUFFED PARATHA WITH CURD AND SAPOTA

FOOD ITEM	INGREDIENTS	AMT (g)
PARATHA	Wheat flour/Atta	60
	Iron rich powder	5
	Potato/Batata	70
	Onion/Dungri	50
	Tomato/Tamatar	10
	Sprouts (Green gram)	10
	Oil	20
CURD	Curd/Dahi	125
SEASONAL FRUIT		100
Nutritive Value: Energy: 741.9kcal; Protein: 17.7gm; Fat: 28.5gm; Iron: 12.7gm		

Annexure 15

Parent Consent Letter to Make Changes In The School Environment

Adolescents represent tomorrow's work force hence investing time in their today is crucial

Dear Parents,
You all are aware that a "Nutrition Health Promotion Programme" has been started in the school. After the analysis of the data, collected during the last school session, we are providing a health card which will give you an insight to your child's health status. The problem of "**Malnutrition"** (over nutrition and under nutrition) persists among the children.

Over nutrition (over weight or obesity) has serious long-term consequences. These consequences are not apparent immediately, but has a significant risk factor associated with a range of serious non communicable diseases in adulthood, such as:

- ✓ Hypertension
- ✓ Hypercholesterolemia
- ✓ Type 2 Diabetes Mellitus
- ✓ Gall Bladder
- ✓ Asthama
- ✓ Mental health concerns and
- ✓ Orthopedic disorders have been linked to obesity

Under nutrition (under weight or anemics) also has serious long term consequences as**,** it affects child's cognitive ability (remembering capabilities) and results in poor performance in the class. These children are also vulnerable to infections, which interferes with their holistic development.

Normal weight children are also in the age group where there is a possibility of them becoming malnourished due to faulty eating and lifestyle habits. Moreover, this age group of students are prone to obesity rebound and are likely to get malnourished if adequate care about their diet and lifestyle is not maintained.

This double burden of malnutrition (over nutrition and under nutrition) can be reduced by creating an enabling environment for the children in the **school** as well as in the **family** (especially educating mothers)**,** i.e., helping children to modify their dietary and lifestyle behaviors.

Initiating a "School Feeding Programme" has been shown to be an effective strategy for improving dietary habits of children and a planned menu helps to meet all the nutrient requirements required for the meal. Under nutrition, Over nutrition and Iron deficiency anemia is present in 80% of the school population. Our study has also shown that students are spending Rs. 15 on an average in buying unhealthy food from the canteen, therefore we feel that parents should encourage in the development of healthy eating behaviors by investing in a **"School Feeding Programme".**

Besides starting a **"School Feeding Programme"** in the school there are some changes which needs to be established in the school to create an enabling environment for your child, to which you are requested to give your consent by putting a tick mark in the box given. Please note that all the following changes are required in the school

environment, however, only for those we get the maximum consent, the changes can be implemented:

SCHOOL

- □ Starting a "School Feeding Programme"
- □ In the Canteen: Restricting the sale of unhealthy food items and providing healthy snacks and milk beverages.
- □ Iron Folic Acid Supplementation for all .

FOR THE FAMILY

Organisation of workshops for family members (especially for mothers) once or twice a month, in the school, including:

- □ Presentations on how family members can influence the development of healthy dietary and lifestyle practices of children.
- □ Demonstrations of healthy menus.
- □ Talks by eminent personalities to build the capacities of the family members.

With this concern, the school is organizing a talk on **"Importance of School Feeding Programme" on 9th August, 2008 in the auditorium at 8.30 am**. You all are requested to attend this talk where we can have an open discussion on the need to start a School Feeding Programme.

Name of the child:_____lass:_____

Signatures Father:_____ Mother:_____

Principal Vice Principal

Principal Vice Principal

Annexure 16

Letter to Initiate Healthy Tiffin Program

Dear Parents/ Mothers,

As a part of the ongoing nutrition programme in the Rosary School, we are starting a "Healthy Tiffin Programme". In this we are providing you with six tiffin menus, attached with the letter. These menus have been calculated for their nutritive values. We request you to send these menus only, in your child's tiffin.

The purpose of this programme is to replace the fried snacks in their tiffins with healthy home cooked food. Another reason is to make children develop healthy dietary habits in school with your help.

Therefore, we request you to please send the recepies (provided with this letter) in your child's tiffin and help them to have healthy food instead of fried snacks. Their tiffins will be checked from now on, as they will be made to finish their tiffins in the class during the recess for 10 minutes after which they will be allowed to go in the playground. For this, we also request you to send rough sheet of newspaper, so that they can spread it on their tables to have tiffin.

We also request you to please contribute, some easy to cook recepies to us. These recepies should be easy to cook, easy to bring in the tiffins and most importantly it should be easy for children to finish it fast in ten minutes. The recepies which you will send to us, will be modified for their nutritive values. After the modification we will again send you the next set of menus for another month. This will help to add varieties in the tiffin menus. It will also be easy for you to decide which menu to give in the tiffin.

Annexure 17

Informed Consent Letter to Initiate Iron Folic Acid Supplementation

Adolescents represent tomorrow's work force hence investing time in their today is crucial

Dear Parents,
You all are aware that a "Nutrition Health Promotion Programme" has been started in the school. After the analysis of the data, collected during the last school session, we are providing a health card, which will give you an insight to your child's health status. The problem of "Malnutrition" (over nutrition and under nutrition) persists among the children.

Under nutrition (under weight or anemics) also has serious long term consequences as**,** it affects child's cognitive ability (remembering capabilities) and results in poor performance in the class. These children are also vulnerable to infections, which interferes with their holistic development.

This double burden of malnutrition (over nutrition and under nutrition) can be reduced by creating an enabling environment for the children in the **school** as well as in the family (especially educating mothers)**,** i.e., helping children to modify their dietary and lifestyle behaviors.

With this concern, the school is organizing a talk on "Importance of School Feeding Programme" on 9th August, 2008 in the auditorium at 8.30 am. You all are requested to attend this talk where we can have an open discussion on the need to start a School Feeding Programme.

Name of the child:_____ Class:_____

Signatures Father:_____ Mother:_____

Annexure 18

TIFFIN AUDITING CHECKLIST

CLASS VI B

Name	Tiffin					Cereal					Pulse/legumes/milk product					Vegetable (except potato)					Fruit				
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**M**	**T**	**W**	**T**	**F**	**M**	**T**	**W**	**Th**	**F**	**M**	**T**	**W**	**Th**	**F**	**M**	**T**	**W**	**Th**	**F**
AHUJA MAHIMA F.																									
WILLIAMS CYNTHIA V.																									
VINCENT JOYAL V.																									
TRIVEDI PRANSHU P.																									
THAKUR HARSHWARDHAN H.																									
SUTHAR PARSHAD H.																									
TANNA AKASH S.																									
SORANGWALA TAHA HUSAIN M																									
SHETH RATNESH H.																									
SHETH PARTH P.																									
SHARMA ADITYA S.																									
SHAIKH SOHAIL F.																									
PHILIP FIBIN P.J.																									
PATHAK SHIVANI S.																									
PATEL DHRUV V.																									
PATEL ZEAL P.																									
PATEL RAHUL R.																									
PARMAR MOHIT A.																									
PARMAR HARSHIL J.																									

Annexure 20

Letter For Parents To Attend Awareness And Capacity Building Sessions

(under weight management)

Parents and families are crucial for child's behavioral change

Dear Mothers,

As a part of the ongoing "Nutrition Health Promotion Programme" in the school, besides the counseling sessions related to "Healthy Dietary and Lifestyle Practices" for the children, it will also be organized for mothers. These sessions, for mothers, are important as you play an important role in the child's behavioral development and also you could help us to reinforce the key messages to children in the home (when they are away from the school environment).

The first session will be related to Under nutrition management, covering the following health topics:

- What is undernutrition?
- What are the causes an consequences of undernutrition?
- How healthy dietary eating habits may be developed.
- How cooking can be made healthy.

Therefore, we request all the mothers to attend theses sessions, as it will help to make the ongoing programme more effective, which is for the benefit of your child.

Date: 3.12.08

Time: 11.15 a.m

Venue: School Auditorium

Annexure 21

PARENTS

KNOWLEDGE, ATTITUDE, PRACTICE (KAP) – PART I

Class: **Name of the student:**

1. What is the age group of adolescents?

1. 0 – 5 years **2**. 6 – 9 years **3.** 10 – 19 years **4.** 19 years and above

2. Do you know that nutrition is important for adolescents?

1. No **2.** Yes

3. Why nutrition is important for adolescents?

1. Adolescence is a rapid growth period
2. Physical and mental growth take place
3. Muscle mass development take place in boys
4. Adolescence is a time to prepare for healthy adult life.
5. It is appropriate age to shape and strengthen healthy eating and life style behaviours.
6. All of the above

4. What is malnutrition?

1. Under nutrition **2.** Over nutrition **3.** Both over nutrition and under nutrition

5.

6 Do you know what is the most relevant method to assess your child's nutritional status (normal weight, under weight, over weight & obesity)?

1. No **2.** Yes

12. What is the name of the method? Give it's formula also.

_____

_____

_____

13. Calculate Body Mass Index for a child whose:

Weight = 63.0 Kg

Height = 5 feet 2 inches

Note: 1 feet = 30.48 cm; 1 inch = 2.54cm

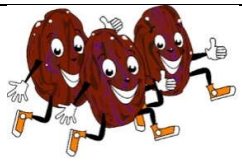
What are the causes of under nutrition?

1. Skipping breakfast **2.** Unhealthy dietary practices
3. Consumption of aerated drinks **4.** Unhealthy school meal / tiffin.

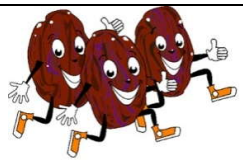
9.Do you know what is anemia?

1. No **2.** Yes

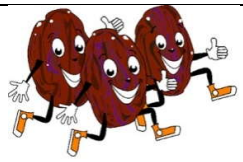
30. Tick on the sources of haem iron?

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

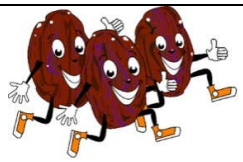
31. Tick on the sources of non haem iron?

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

32. Tick on the enhancers (foods that increase iron absorption).

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

33. Tick on the inhibitors (foods that reduces iron absorption).

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

34. Water melon seeds are rich in iron. **True/False**

35. Never drain out boiled water of green leafy vegetables, rice and cottage cheese (while making paneer). That water can be used to make gravies, dals and can be used to knead doughs. **True/False**

36. Green leafy vegetables may be added to dals, rice, khichdi and snacks to increase the iron content. **True/False**

37. Knead the flour with green leafy vegetables or left over dals, to make parathas or chappatis. **True/False**

38. Cauliflower greens are rich sources of iron. **True/False**

39. Sprouted legumes, salads with lemon toppings may be used as a snack or should be eaten along with meals to improve iron status. **True/False**

40. Fruits should be cut just before eating in order to prevent excessive exposure to air, which results in the destruction of vitamin C. **True/False**

Annexure 22

STUDENTS

KNOWLEDGE, ATTITUDE, PRACTICE (KAP) – PART I

Class: **Name of the student:**

1. What is the age group of adolescents?
1. 0 – 5 years **2**. 6 – 9 years **3.** 10 – 19 years **4.** 19 years and above

2. Do you know that nutrition is important for adolescents?
1. No **2.** Yes

4. What is malnutrition?
1. Under nutrition **2.** Over nutrition **3.** Both over nutrition and under nutrition

3. Why nutrition is important for adolescents?
1. Adolescence is a rapid growth period
2. Physical and mental growth take place
3. Muscle mass development take place in boys
4. Adolescence is a time to prepare for healthy adult life.
5. It is appropriate age to shape and strengthen healthy eating and life style behaviours.
6. All of the above

11. Do you know what is the most relevant method to assess your nutritional status (normal weight, under weight, over weight & obesity)?
1. No **2.** Yes

What is the name of the method? Give it's formula also.

_____
_____
_____

13. Calculate Body Mass Index for a child whose:

Weight = 63.0 Kg

Height = 5 feet 2 inches

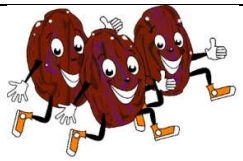
Note: 1 feet = 30.48 cm; 1 inch = 2.54cm

5. What are the causes of under nutrition?
1. Skipping breakfast **2.** Unhealthy dietary practices
3. Consumption of aerated drinks **4.** Unhealthy school meal / tiffin.

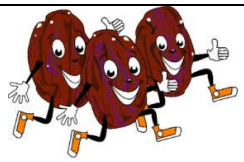
9. Do you know what is anemia?

1. No **2.** Yes

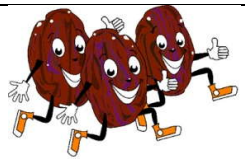
Tick on the sources of haem iron?

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

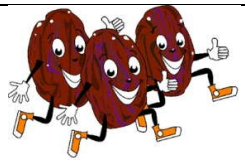
31. Tick on the sources of non haem iron?

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

32. Tick on the enhancers (foods that increase iron absorption).

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

33. Tick on the inhibitors (foods that reduces iron absorption).

 **Chicken**	 **Kishmish (Raisins)**
 **Green leafy vegetables**	 **Fish**
 **Tea/ coffee**	 **Ascorbic acid**
 **Dates**	 **Fermented foods**

Annexure 23

Letter For Parents To Attend Awareness And Capacity Building Sessions

(Over weight and obesity management)

Parents and families are crucial for child's behavioral change

Dear Mothers,

As a part of the ongoing "Nutrition Health Promotion Programme" in the school, besides the counseling sessions related to "Healthy Dietary and Lifestyle Practices" for the children, it will also be organized for mothers. These sessions, for mothers, are important as you play an important role in the child's behavioral development and also you could help us to reinforce the key messages to children in the home (when they are away from the school environment).

The first session will be related to Under nutrition management, covering the following health topics:

- What is undernutrition?
- What are the causes an consequences of undernutrition?
- How healthy dietary eating habits may be developed.
- How cooking can be made healthy.

Therefore, we request all the mothers to attend theses sessions, as it will help to make the ongoing programme more effective, which is for the benefit of your child.

Date: 3.12.08

Time: 11.15 a.m

Venue: School Auditorium

Annexure 24

KNOWLEDGE, ATTITUDE, PRACTICE (KAP) – PART II

Class: **Name of the student:**

1. **Five food groups contain:**
   1. Cereals, bread and potatoes
   2. Pulses and legumes
   3. Milk and milk products
   4. Fruits and vegetables
   5. Oil, salt and sugar.
   6. All of the above

20. High intake of salt leads to:

1. High Blood Pressure 2. Heart problems 3. Both

21. High intake of sugar leads to:

1. Increased weight gain **2.** Diabetes 3.Both

22. High intake of saturated fat leads to:

1. Increased blood cholesterol **2.** Heart disease **3.** High Blood Pressure 4. All of the above

23. How much (gm/day) your child should consume fruits and vegetables daily?

1.Less than 400 gm/day 2. Equal to or more than 400 gm/day

27. How much time daily your child should be practically active vigorously?

1. Less than 60 minutes 2: Equal to or more than 60 minutes

28. How long your child should watch T.V. or sit on computer?

1. More than 2 hours **2.** Less than 2 hours

Annexure 25 (In the CD)

Annexure 26

IInd SET OF 6 DAYS CYCLIC MENUS

MENU: 1 RAJMAH CHAWAL AND FRUIT

FOOD ITEM	INGREDIENTS	AMT (gm)
RAJMAH	Rajmah	30
	Onion/Dungri	60
	Tomato/Tamatar	30
	Iron rich oil seeds	7.5
	Oil	20
	Curd/Dahi	125
RICE	Rice/Chawal	60
SEASONAL FRUIT	Banana/ kela	100
Nutritive Value: Energy: 730 kcal; Protein: 18gm; Fat: 20.3gm; Iron: 11.3gm		

MENU:2 PAV BHAJI WITH FRUIT

FOOD ITEM	INGREDIENTS	AMT (gm)
PAV	Pav(3)	180
	Oil/ Butter	5
BHAJI	Peas/Matar	15
	Potato/Batata	70
	Cauliflower/patta gobi	10
	Onion/Dungri	10
	Tomato/Tamatar	10
	Iron rich oil seeds	6
	Oil/ butter	5
SEASONAL FRUIT	Banana/ Kela	100
Nutritive Value: Energy: 754 kcal; Protein: 17.5gm; Fat: 19gm; Iron: 8.9gm		

MENU: 3 MIXED VEGETABLE PULAO, CURD & FRUIT

FOOD ITEM	INGREDIENTS	AMT (g)
PULAO	Rice	60
	Green Peas/ Matar/ Vatana	20
	Onion/ Dungri	50
	Tomato/ Tamatar	20
	Iron rch oil seeds	5
	Oil	5
	Potato/Batata	70
CURD	Curd/Dahi	125
	Sugar/sakkare	5
SEASONAL FRUIT	Banana/kela	100
Nutritive Value: Energy: 731.8 kcal; Protein: 19.9gm; Fat: 18.3gm; Iron: 10.5gm		

MENU 4: BEET THEPLA WITH BANANA

FOOD ITEM	INGREDIENTS	AMT (gm)
BEET THEPLA	**Wheat flour**	**50**
	Bajra Flour	**40**
	beetroot	**50**
	Iron rich seeds	**5**
	Jaggery	**15**
	Curd	**60**
	OIL	**10**
CURD	**Curd**	**60**
	sugar	**10**
SEASONAL FRUIT	**Banana (small)**	**100**
Nutritive Value: Energy: 744.6 kcal; Protein: 19gm; Fat: 18.8gm; Iron: 12.5gm		

MENU 5: VEG SEVAI WITH BANANA

FOOD ITEM	INGREDIENTS	AMT (gm)
VEG SEVAI	Vermicilli	50
	Chana dal	15
	Green peas	10
	Ground nut	5
	Onion	30
	Potato	70
	carrot	40
	French beans	50
	Iron rich oil seeds	**5**
	Oil	10
Fruit	Banana	200
Nutritive Value: Energy: 753.6 kcal; Protein: 16.6gm; Fat: 14.9gm; Iron: 10.2gm		

MENU: 6 STUFFED PARATHA WITH CURD AND SAPOTA

FOOD ITEM	INGREDIENTS	AMT (g)
PARATHA	**Wheat flour/Atta**	**60**
	Iron rich powder	**5**
	Potato/Batata	**70**
	Onion/Dungri	**50**
	Tomato/Tamatar	**10**
	Sprouts (Green gram)	**10**
	Oil	**20**
CURD	**Curd/Dahi**	**125**
SEASONAL FRUIT		**100**
Nutritive Value: Energy: 741.9kcal; Protein: 17.7gm; Fat: 28.5gm; Iron: 12.7gm		

Annexure 27

STUDENTS

KNOWLEDGE, ATTITUDE, PRACTICE (KAP) – PART II

Class: **Name of the student:**

1. Five food groups contain:

1. Cereals, bread and potatoes 2. Pulses and legumes
3. Milk and milk products 4. Fruits and vegetables
5. Oil, salt and sugar. 6. All of the above

20. High intake of salt leads to:

1. High Blood Pressure 2. Heart problems 3: Both

21. High intake of sugar leads to:

1. Increased weight gain **2.** Diabetes 3: Both

22. High intake of saturated fat leads to:

1. Increased blood cholesterol **2.** Heart disease **3.** High Blood Pressure 4: All of the above

23. Do you know how much (gm/day) fruits and vegetable you should consume daily?

1. Less than 400 gm / day 2. Equal to or more than 400 gm/day

29. Do you know that you should engage in 30-45 minutes of vigorous physical activity.

1. No **2.** Yes **3.** Don't know

30. How long you should watch T.V. or sit on computer?

1. More than 2 hours **2.** Less than 2 hours