METHODS

& METHODOLOGY

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 I (Situational analysis of the two schools)

A) Reviewing National Curriculum Framework (2005) for CBSE & Gujarat board for GSEB with respect to nutrition and health curriculum for classes Vth to VIIth

B) Formation of Nutrition Health Team (NHT) in school comprising of

Administrators (2), Parent (1), Teachers (3), Student representatives (2), Research Investigators (2)

C) Assessment of school ethos and environment

- Assess Policies & Practices with the help of Nutrition Friendly School Health Index (NFSHI), adapted from NFSI (WHO, 2006) & School Health Index (CDC, 2005) with respect to
  - School Health & Nutrition Policies
  - Health Education strategies & skills imparted
  - Physical education and physical activity programs in school
  - Nutrition Services provided in the school
- Assessment of school canteen
- Assessment of Nutrition health knowledge of science and physical activity teachers of classes V – VII.

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

Anthropometric Measurements, N= 365
- Height
- Weight
- BMI
- Waist circumference (WC)/ Waist to Height Ratio (WHtR)
- Blood Pressure

Biochemical Estimations
- Haemoglobin (for all students), n=361
- Fasting Lipid & Glucose (for over weight & obese students only), n=62
- Stool (for under weight: n=196 and anemic: n= 178 students),

Recall of the students with respect to
- Food consumption pattern of the study subjects before coming to school and in the school campus.
- Dietary & lifestyle behaviours

E) Development of Health cards and NHE materials

- Health Cards
- Power points
- Posters
- Book marks

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.

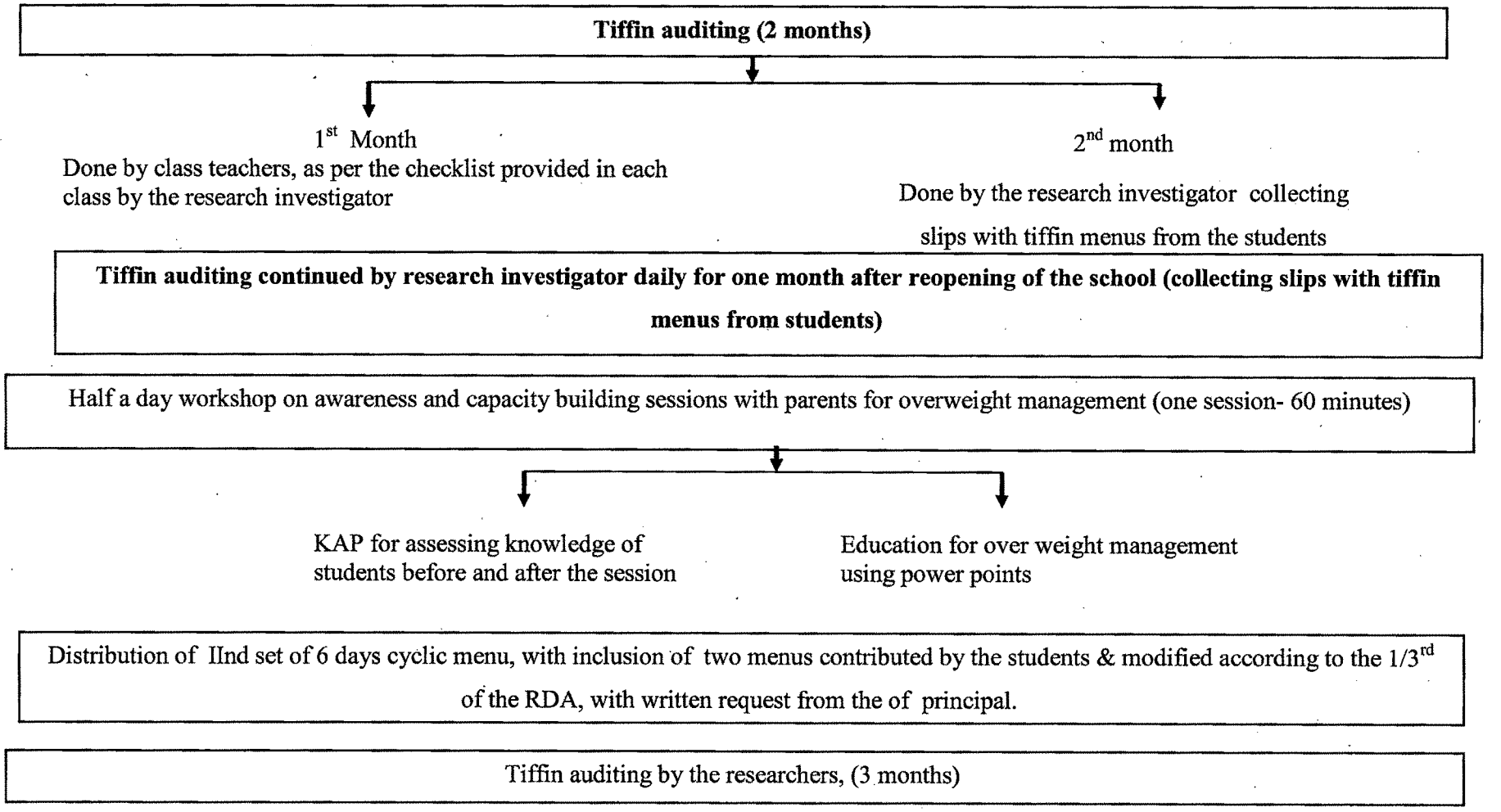
(D) **Creating enabling environment in the school by initiating parent's engagement in the nutrition and health promotion program in the school**

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)

(A) IFA supplementation,(n=197)

(60mg elemental iron + 0.5mg folic acid)

12 doses of IFA, supplemented weekly for 3-4 months including holidays in between.

↓

Monitoring of compliance of doses given weekly through compliance cards

↓

Assessing The Impact of IFA supplementation on

- Haemoglobin levels
- Academic scores of IFA supplemented with non supplemented students

(B) Awareness & Capacity building of students for management of triple burden of malnutrition

Under weight management

↓

Session 1 (60 minutes)

- KAP for assessing the knowledge of students before and after the session
- Education for under weight management using power point presentation

↓

Session 2 (30 minutes)

Skill building session to calculate BMI

↓

Session 3 (30 minutes)

Capacity building to plot and interpret BMI for age WHO (2007) growth charts

(C)

Over weight management

↓

Session 1 (60 minutes)

- KAP for assessing the knowledge of students before and after the session
- Education for over weight management using power point presentation

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 experimentalschoo l)	Distribution of planned Ist set of 6 days cyclic menus to parents			
		12	**Phase II** (Intervention for creating enabling environment in the experimentalschoo l)	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 experimentalschoo ol)	**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.

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

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

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

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

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.

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

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

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

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 $1/3^{rd}$ 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

Capacity building sessions were organized for parents, 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 *** $P \leq 0.001$.