REVIEW OF LITERATURE

Following sections discuss the review of literature:

- Twin malnutrition in pace with economic development
- Nutritional transition and obesogenic environment: A cause for rising nutritional challenges
- Obesity and Non-Communicable Diseases
- Status of India as a developing country
- Dual Burden of Malnutrition and the Indian Phenotype
- Health status of school children and importance of school health programme
- A review of school health programmes
- CDC's Coordinated School Health Programme
- Behaviour change model for School Health Programme
- Physical activity among children

TWIN MALNUTRITION IN PACE WITH ECONOMIC DEVELOPMENT

Growth has acted as a powerful driving force for poverty reduction in South Asia, but the nutritional status of its population does not clearly reflect the positive outcome of this progress (Tontisirin et al., 2009). Undernutrition and micronutrient deficiencies along with the other face of malnutrition - the NCDs, together threatens millions of lives, (WHO, 2014) and have become the leading risk factors for morbidity and mortality especially among the young population of the developing countries.

In 2002, 0.4% deaths were caused due to infectious diseases among the South Asian countries and 0.2% mortality was recorded due to chronic disease; however this trend is predicted to reverse by 2030 (Epinanalysis, 2013).

Palmer (2003) has forecasted a 10% decrease of communicable diseases and 13% increase of NCDs by 2020, globally.

The prevalence of double burden of malnutrition is increasing in all developing countries of the world including the ECOWAS. This change is associated with economic development, industrialization and urbanization (Shrimpton, 2006; Doak et al., 2005); especially concerning India, China and most of the Asian countries as it exerts considerable stress on the health system (Gales-Camus, 2006).

In 2001, the estimated number of people worldwide suffering from underweight and overweight was equal (Uauy and Solomons, 2006). However, with demographic changes three distinct challenges emerged. First - the double burden of under and overnutrition; second - the challenge of arresting the rise of overweight and obesity (particularly in the urban areas) and third is the increasing prevalence of overweight and obesity in children and adolescents (Florentin, 2002). Such a scenario shows up in urban areas first, then in the same communities and eventually within the same household (SCN, 2006).

Among the Philippines more than 30%, preschooler and 19.8% adolescents were underweight; while less than 1% schoolchildren and 2.9% adolescents were overweight. Vietnam, a country in its early stage of socio-economic transition has less than 2% prevalence of overweight and obesity (Gillespie and Haddad, 2001). China is in the later stage of socio-economic transition and has 14.9% prevalence of overnutrition in urban and 8.4% in rural areas (IOTF, 2000). Thailand, Malaysia and Japan who are in an advanced state of socio-economic transition, have alarmingly high prevalence of overweight and obesity (Chinn and Rona, 2001; Martorell et al., 2000).

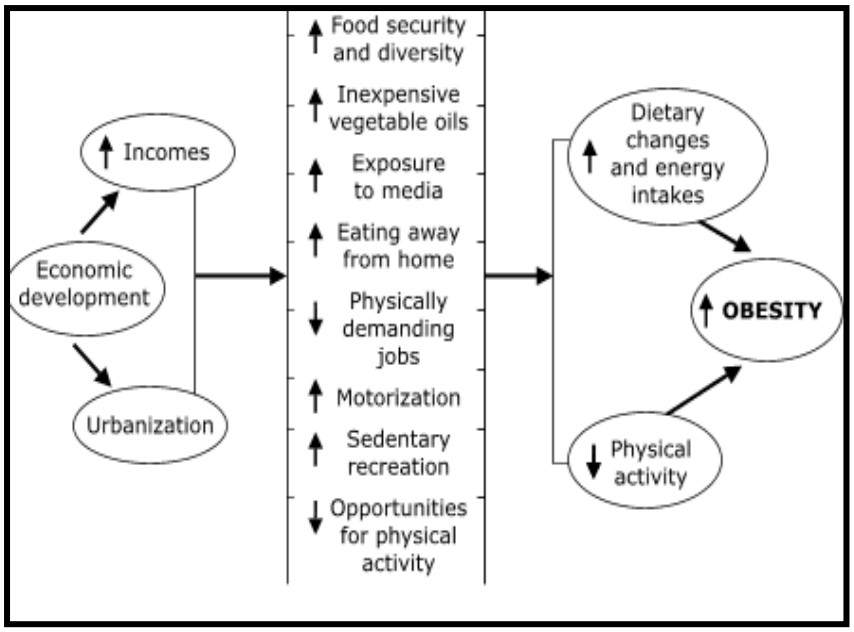
Subramanian et al. (2007), has reported substantial variation of undernutrition and overnutrition between the Indian states. At the national level 33%,

undernutrition is prevalent ranging from 11% in Arunachal Pradesh to 47% in Orissa. Overnutrition on the other hand was highest in Delhi (25%) and least in states of Bihar and Mizoram (0.5%). The results confirm high prevalence of undernutrition coexisting with an appreciable prevalence of overnutrition in India.

NUTRITION TRANSITION AND OBESOGENIC ENVIRONMENT: A CAUSE OF RISING NUTRITIONAL CHALLENGES

The "Nutrition Transition" is characterised by changing body composition caused due to shifts in diet and physical activity patterns; geared by westernized lifestyle, economic development and market globalization (Nugent, 2002); whereas obesogenic environment (Figure 2.1) comprise of environmental factors that provoke obesity among individuals (Powell et al., 2010). Such a parallel contrast explains: improvements in standards of living, diversification in food availability and increased access to services on one hand. While inappropriate dietary patterns and decreased physical activity on the other (WHO/FAO, 2003).

Figure 2.1: Drivers of nutrition transition and obesogenic environment



**Adapted from Martorell and Stein, 2001 (2), and Popkin, 1994. Available from http://www.cdc.gov/pcd/issues/2005/jan/04_0100.htm*

Economic development and urbanization are the engines of the "nutrition transition", led by increased food security, eating away from home, availability and affordability of ready to eat food rich in saturated fat, salt and sugar (Martorell, 2000). In developing countries, the undernourished children grow in an obesogenic environment which speedups nutrition transition causing a mismatch between early nutritional deprivation and later nutritional affluences. (Corvalan et al., 2006).

Worldwide there is a strong link between unhealthful changes in nutrition pattern such as reduced intake of fruit and vegetables, increased intake of fats, sugar and salt with globalized marketing. Such a marketing strategy has replaced healthier traditional food habits (Puska, 2002). Among the high income countries there has been a theatrical increase in consumption of meat, poultry, fish/seafood's, animal fat, added sugar and dietary fat by 14.9% within a span of 34 years; while the share from carbohydrates has decreased proportionately (Popkin et al., 2001, Misra and Khurana, 2011). In addition, there has been a notable reduction in consumption of indigenous cereals and

coarse grains, worldwide (Smith et al., 2006). Thus, an imbalance in micro and macro nutrient consumption has caused a coexistence of infectious and non-communicable diseases instead of "transition" in disease pattern. (Corvalan et al., 2006).

The "Green Revolution" in India, helped the country to move from chronic shortage of food to an era of surplus and the "White Revolution" resulted in the production of large quantities of milk and milk products; however the benefits of development did not percolate to the poor (Rajagopalan, 2009) . Table 2.1 below gives the data on- dietary changes in India from 1990 to 2005.

Table 2.1 Nutrition transition in India

Nutrients	**1990-1992**	**1993-1997**	**1998-2005**
Calorie intake (kcal/person/day)	2320	2380	2360
Proteins (grams/person/day)	56	58	56
Fat intake (grams/person/day)	41	46	52
Oil intake (grams/person/day)	18	21	27
Percent share of total dietary intake			
Carbohydrate	75	73	71
Protein	10	10	10
Fat	16	17	20
Oil consumption (in million tonnes)	**1993**	**2003**	**2007**
	5.8	10.5	14.3

** World Bank, 2011: Available at http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:20916955~pagePK:146736~piPK:146830~theSitePK:223547,00.html*

The lethal mix of nutrition transition and obesogenic environment has led to increased energy intake and concomitant reduction in total energy expenditure. The technological advancement and developing physical environment has increased sedentariness by creating mechanized lifestyle and obstructing the involvement in physical activities (Macbeth, 1999). Increased

desk time among adults and screen time among children have negatively transformed the physical activity patterns and has tipped the balance in favor of obesity (Martorel, 2005)

"High risk behaivour" obesity tends to occur first among socio-economic groups having lack of time to consume traditional food and enough money to use motorized transportation. With increased purchasing power and living standard, these risks spread to poorer groups (Delisle and Strychar, 2005).

With rapid nutrition and socio-economic transition, the "western lifestyle" problems of overnutrition are emerging with tremendous speed in almost every corner of the world. The changing nature of globalized food supply and easier access to processed foods coupled with sedentary lifestyles is causing a rapid transition from undernutrition to poor nutrition within individuals, families and communities (Gales-Camus, 2006). If we do not react quickly enough now, the emerging health problems may become difficult to prevent.

OBESITY AND NONCOMMUNICABLE DISEASES

Obesity earlier known as the disease of the affluent has now become an epidemic in both developed and developing countries (Wang and Lobstein, 2006). Globally, the prevalence of overweight and obesity has increased to 8.7% from 1983 – 86 (Florintino, 2002). Among the economically developed countries, obesity is the leading cause of preventable disease and death; and is on a steep rise even in the developing countries, especially among children (WHO, 1989; WHO, 2005).

In the United States, an estimated 15.5% of adolescents were obese in 1999; and showed an escalation in other developing regions (NCHS, 2005; Sidhu et al., 2005, Labadarios et al., 2005). Papadimitriou et al., 2006 has projected the prevalence of childhood obesity among various European countries such as

Spain (13.9%), Italy (9.9%), Portugal (11.3%), Poland (3.6%) France (3.8%), China (3.6%), Russia (6%), Singapore (6.9%) and Japan (10.5%) those have similar geographic patterns in childhood obesity as observed among adults (Singh, 2010).

Due to the variability in measurements, prevalence of childhood obesity or that among adolescents is discrete; but importantly, it is prevalent and increasing rapidly. Hereditary led obesity varies from 6% to 85% depending on the population examined (Quazi et al., 2010). As much as 26% Canadian youth (Shields, 2006); 25% Spanish boys and 13% girls (Moreno et al., 2005) and nearly 8.1% youth of China is suffering from overweight and obesity (Xiaodong, 2006).

Overweight and obesity generally rises from childhood to adulthood and in the Asian countries the prevalence rises concomitantly with the country's level of socio-economic transition (Florintino, 2002; Wang et al., 2002); causing serious health consequences especially diabetes that begins to appear earlier in life (Thiam et al., 2006).

Overweight or obesity in childhood, adolescence and young adulthood accelerates the damage to the cardiovascular system, metabolic functions, digestive and skeletal system and it also hampers the psychosocial well being on an individual (Daniel, 2006). Approximately three million deaths occur due to the "epidemic" of obesity and related non - communicable diseases. These chronic diseases bear a massive cost in terms of human sufferings, social distress, loss of productivity and economic burden to the health (WHO 2014).

Several Indian studies have also shown a varying degree of overweight and obesity prevalence. Adolescents of 12 – 17 years, belonging to affluent families had 3.25% prevalence of overweight as compared to those belonging to (3.73%) low-income groups, in a study conducted by Kaneria et al., 2006 in

Rajasthan. Saraswathy et al. (2011) observed a significant difference in the prevalence of overweight children residing in urban (7%) and rural (0.8%) Karnataka. Goyal et al. (2012) have reported 6% prevalence of obesity and 13% prevalence of overweight among the affluent schoolchildren of Surat, Gujarat. Prevalence of overweight was higher among girls of Devangare city than among boys and the prevalence of obesity was found to be 5.74% (Kumar et al., 2007). Studies conducted by Mani et al. (2008), reported 8.4% prevalence of overweight and 1.5% prevalence of obesity among 10-18 year children studying in private schools of Vadodara.

Though high prevalence of obesity has been reported worldwide and in India, yet it is preventable. Childhood overweight and obesity has shown multifactorial associations (Saraswathy et al., 2011); such as age, dietary pattern, physical activity and parental history (Kumar et al., 2007). Thus, it is possible to avoid obesity and the related morbidities, especially type II diabetes by changing lifestyle factor, weight management and exercising throughout life span (Hu et al. 2001; Stampfer et al., 2000). High-risk screening and effective public-intervention educational programs can play a preventive role in curbing early initiation of metabolic syndrome (Misra et al., 2007).

STATUS OF INDIA AS A DEVELOPING COUNTRY

India today is a nation of contrasts. It is the second-fastest growing global economy with 9% increase in the GDP (Raghav et al, 2013) but has persistent poverty. It is self sufficient in food production for the past four decades, but there are still pockets of hunger. Decline in undernutrition among the poor is slow but there is rapid escalation of obesity among the affluent (Varma, 2013). India is an important medical tourism destination and but the public health system is struggling to provide essential health care for its citizens

(Ramchandran, 2011). More so the development oriented shift towards sedentary lifestyle pattern is emerging in both the rural and urban areas (Raghav et al, 2013).

At the time of independence, India was a veritable museum of florid and frank nutrition deficiency diseases (Gopalan, 1999) worst affected by poverty, illiteracy and unemployment. Followed by several reforms, the country has undergone slow and uneven socioeconomic, demographic, nutrition and health transitions with a mix of desirable and undesirable consequences (Ramchandran, 2011).

The green revolution technologies saved India from famines and severe food shortage; increased the availability of cereals to Indians, but lead to a reduction in cultivation and consumption of the varieties of staple crops (Nugent, 2002). Thus, the important sources of high–quality protein and minerals essential in vegetarian diets were reduced (Gopalan, 2011). Between the 1970's and 1990's there was a slow but steady decline in undernutrition but simultaneous increase in fat fold thickness, suggesting the coexistence of stunting with increased body weight mainly comprising of body fat; as explained by the concept of "Indian Phenotype".

Even post green and white revolution; the consequences of past famine, food scarcity, undernutrition and micronutrient deficiencies reflected on the vicious cycle of maternal malnutrition (Gosh et al., 1979). The prevalence of stunting thus increased either due to pre-natal Intra-Uterine Growth Retardation (IUGR) or due to post-natal series of infections. Apart from undernutrition, Chronic Energy Deficiency (CED) and micronutrient deficiencies took toll in terms of morbidities and mortality (NSSO, 2011). Even among the richest 20% population in India 64% children are anemic, with high prevalence in all the states of the country (Rajagopalan, 2009).

"Smallness in poor children of developing countries was acceptable as a costless biological adaptation: Gopalan, 1983" but with rise in development, stunting has

overgrown as overweight and obesity among these children. The obesity in children and adolescents is gradually becoming a major public health problem in India (Popkin and Doak, 1998). The results of studies among adolescents from parts of Punjab, Maharashtra, Delhi and in South India revealed that the prevalence of overweight and obesity was high (11 – 29%) (Kaur et al., 2005).

Nationwide distinct pockets of overnutrition started emerging; in Punjab 12-14% prevalence of overweight and 6% prevalence of obesity was recorded; with higher prevalence among girls. This statistics was higher as compared to some of the developed nations (Kaur et al., 2006). Amin et al. (2008) reported comparable findings among 10-14 year old school children.

Thus the foetal programming affected by nutrition transition among Indians have led to higher abdominal adiposity right from birth through childhood and adolescence, and into adulthood making them more prone to metabolic syndrome, insulin resistance, type 2 diabetes mellitus (T2DM) and coronary heart disease (CHD) (Ramchandran, 2011; Misra and Khurana, 2011; Florentino, 2002).

Table 2.2: Prevalence of Overweight/Obesity among 14 to 18 year old urban Indian adolescents in eight cities of India

City (number)	Overall Overweight/Obesity	Private Schools	Public Schools
New Delhi (n = 11789)	22.0	31.5	9.2
Agra (n = 10013)	14.9	24.5	5.3
Jaipur (n = 9039)	10.4	15.9	5.4
Allahabad (n = 11940)	14.9	18.6	8.6
Mumbai (n = 2168)	22.3	33.9	8.4
Lucknow (n = 1053)	14.9	14.9	NA
Dehradun (n = 1879)	15.4	17.0	2.4
Pantnagar (n = 1561)	3.4	NA	3.4
All cities (n = 49442)	15.7	22.9	6.9

** Kaur et al., 2005*

DUAL BURDEN OF MALNUTRITION AND INDIAN PHENOTYPE

Indians exhibit unique features of abdominal obesity, increased subcutaneous and intra-abdominal fat along with excess body fat (Misra et al., 2009). The Indian phenotype well described by the nutrient conserving metabolic pattern throughout the lifespan termed as "early life programming" describes the phenomena of dual malnutrition. The concordance between intrauterine choice and the external reality in later life represents an adaptive match (McMillen and Robinson, 1999). Discordance, however leads to a dysadaptive outcome and increased risk of either undernutrition or non-communicable illnesses, depending on the direction of the mismatch. This is where the two components of malnutrition converge, becoming evident that they are connected (Gales-Camus, 2006).

Many studies have documented the link between foetal undernutrition, stunting in early childhood and tendency of accelerated weight gain leading to overweight or obesity in later life (Wahlqvist, 2002; Uauy and Solomons, 2006). Such individuals become more susceptible to nutrition related chronic disease such as type 2 diabetes, heart disease, high blood pressure and stroke in adulthood; especially observed in South Asia and other developing countries (Yagnik, 2002; Barker, 1995).

Poor early nutrition has short and long-term negative consequences across the life course (James et al., 2000). The immediate consequence is death, but those who survive suffer impaired metabolic programming and changed body composition that affects the body function throughout the life course (Moore et al., 1997; Puska, 2002). This latter set of consequences is of greatest relevance to the nutrition transition and the double burden of malnutrition indicating the relevance of life course approach in explaining the dual burden of malnutrition (Shrimpton, 2006; Hales and Barker, 1992).

Another pursuit of dual malnutrition is its effect on compromised immune function. CED and micronutrient deficiency such as vitamin $B_{6,}$ B_{12} and folic acid lead to homocysteinamia, thrombosis and arterial damage (Welch et al., 1998); deficiency of amino acids like arginine affects the arterial function (Wu et al., 2000) thus predisposing the children to "chronic disease" as well as communicable disease. Micronutrients like and phytochemicals required from a spectrum of foods for at least their antioxidant, which have properties to protect tissues from chronic disease (Wahlqvist et al., 1998).

HEALTH STATUS OF SCHOOL CHILDREN AND IMPORTANCE OF SCHOOL HEALTH PROGRAMME

The up-scaling epidemic of dual malnutrition is spreading across the segments of population in the developing economies. It reflects a modified pattern of "protracted-polarized model", where communicable and non-communicable diseases coexist over long periods of time (Shetty, 2009; Kennedy et al., 2006) worst affecting the adolescents. Other than genetics, a wide range of factors such as food, physical activity, inflammatory processes, social factors and economic factors (Wahlqvist, 2002) affects the health of adolescent.

Adolescents eating habits are frequently erratic: snacking, skipping meals, high consumption of fast foods and sweetened drinks, low consumption of fruits, vegetables and dairy products; mostly influenced by personal preferences and cultural factors. They are a victim of "Passive over consumption" due to media, peers and marketing influence on food (Sharma, 1998; Grier et al., 2007) as well as a progressively sedentary life style (Hills and Wahlqvist, 1994). As a result, there is a rapid weight gain without concomitant increase in height. Thereby, the stunted populations move from being underweight to overweight and obese (Uauy and Solomons, 2006).

Bhargava et al. (2004), report that individuals who were obese, had high blood pressure, impaired glucose tolerance or diabetes at 12-14 years of age were more likely to be thin at birth, have a low BMI up to two years of age. Such individuals would have an accelerated BMI increase during childhood and adolescence (Monterio et al., 2003; Kanani and Jain, 2008; Iyer and Gandhi, 2004).

Sever nutritional insults during the fetal growth coupled with rapid shifts in nutritional status (Dietz, 1998) results in an early appearance of dyslipidemia. Biochemical markers may appear in form of elevated serum LDL-C, TG, lowered HDL-C and glucose intolerance leading to early onset of type II diabetes (Popkin et al., 2001; Woodward-Lopez et al., 2005). Inflammatory markers like CRP a potent risk marker for atherosclerotic macro vascular disease (Festa et al., 2001; SoRelle, 2002) would also show a rise.

Looking into the serious health and economic consequences of childhood malnutrition, its prevention stands to be crucial (Delisle and Strychar, 2005). Schools stand out to be the best option as children and adolescents spent majority of their day in schools. Schools should thus ensure maximal utilization of this window of opportunity and inculcate optimal dietary and physical activity habits (Katz, 2008). Several school based nutrition and health programmes have shown a positive impact on preventing overweight and obesity and related health risks. The school system would thus be an ideal channel for the promotion of health and nutrition education (Gopalan, 2011).

A REVIEW OF SCHOOL HEALTH PROGRAMMES

Multi component nutrition program is a promising way to tackle challenges associated with the nutrition and lifestyle transition (Katz, 2008). School health interventions have not revealed consistent results, yet researchers have documented its beneficial effects. There no single route to develop behaivour changes among children and adolescents; instead many and mixed

approaches need to be attempted to meet the needs of many and mixed groups (Active living, 2003; Anderson et al., 2002).

"JUNJI" national programme in Chile provides free education along with various educational programmes to reach families with different needs. It also addresses multiple aspects such as dietary intake, nutritional education, physical activity, etc. for increasing its impact. Similarly, the "Classical Nursery School" also is the largest educational programme addressing the nutritional deficiencies among children (Corvalan, 2006).

Singapore's "Trim and Fit" (TAF) program launched in 1992, involves the integration of physical activity and nutrition education in the school curriculum at primary, secondary and preuniversity level (Contento, 2005). Student's physical fitness is monitored annually while their height and weight is assessed twice a year. Parental involvement, supportive school environment, training of teachers, and incentives and awards, are important parts of the strategy.

A communication program "ACTIVATE" helped the children and their families to achieve healthy lifestyles through regular physical activity and good nutrition. Other program elements include a website targeted to "tweens", and the Take 10! Program which promotes one or more 10 min periods of physical activity everyday for schoolchildren, coupled with nutrition education (Florentino, 2002).

WHO launched a "Mega Country Health Promotion Network" in December 2001, for 11 countries including India to promote healthy lifestyle that emphasized on healthy diet and increased physical activity. However, identifying an effective model for healthy lifestyles in countries undergoing transition is the key strategy for improvement (Kennedy, 2002).

A Mexican programme "Oportunidades" is an incentive-based development programme with nutritional intervention, which showed positive results with improved linear growth among low-income infants (Corvalan, 2006).

Considering the statistical facts given in the "World Youth Report", 2003 the WHO adopted a global strategy on "Diet, Physical activity and health". The health promotion approach, which acts on the determinants of health and aims at empowering people to assume responsibility for their own well-being, is particularly appropriate for addressing obesity prevention in adolescents (Delisle and Strychar, 2006).

CATCH was a large randomized study with third to fifth graders based on social cognitive theory and designed to lessen cardiovascular disease risk factors by focusing on decreasing fat intake, increasing intake of higher-fiber foods, and increasing physical activity. It consisted of a classroom education component, physical education intervention, food service cafeteria intervention, and a parent/ home component (Contento, 2005).

An intervention study with children in kindergarten to the sixth grade, called Cook Shop, increased preferences for and consumption of minimally processed whole gains and fresh vegetables; it combined cooking these foods in the same recipes in the cafeteria (Liquori et al., 1998). Nutrition educators worked with school food service directors to provide training. All students took parent newsletters home that had shopping tips and low–cost recipes.

Multi component Dutch obesity intervention (Do-it) program directed at influencing body composition and aerobic fitness through following behaviours: reduced consumption of sweetened beverages and high-calorie sacks, decreased sedentary behaviours, and increased physical activity (Singh et al., 2007). School cafeterias were asked to serve healthier products, restrict access to vending machines, serve smaller portion , and use labels on foods signifying better not (red label), sometimes (yellow label), and Do- it (green

label) foods. Schools increased time devoted to physical activity. Results showed a positive impact on weight but not on fitness and also on sweetened beverages but not other targeted behaviours. It also had an impact on some of the mediators (Singh et al., 2007).

CDC'S COORDINATED SCHOOL HEALTH PROGRAMME

A multi-component approach can address the complex psychosocial and environmental influence on the health, nutritional status and behaivour practices among schoolchildren and adolescents. Comprehensive school-based nutrition and lifestyle education involving parents and teachers can motivate adolescents for a positive behavioral change (Singhal et al., 2010; Broussard, 2002). Caballero et al., 2003 has documented the feasibility of implementing a multi-component program for obesity prevention in elementary schools.

CDC recommended a strategy of "Coordinated School Health" approach for improving students' health and learning, as it is the fundamental mission of a school. Effective school health programmes can improve mental health, reduce physical inactivity, and prevent chronic illness or hunger that may lead to poor school performance (Kolbe, 2002). Coordinating various health dimensions (Table 2.3) in a systematic approach can help to increase health-based knowledge, develop skills and attitude for healthy behaviour change, which improves health, education, as well as social outcomes (CDC, 2013).

Table 2.3: Relevance of eight components covered under the CDC's Coordinated School Health Approach

Sr. No.	Components	Relevance
1.	Health Education	• To provide the students with an opportunity to acquire the knowledge, attitudes, and skills necessary for adopting health-enhancing behaviors and health promotion. • To address topics such as healthy eating/nutrition, mental and emotional health, personal health and wellness, physical activity through school curriculum. • To ensure availability of qualified, trained teachers for teaching health education.
2.	Physical Education	• To impart necessary skills and knowledge for lifelong participation in physical activity. • To design a curriculum that provides cognitive content and learning experiences in a variety of activity areas. • To ensure availability of a qualified, trained teacher to teach physical education.
3.	Health Services	• To ensure access or referral to primary health care services and provides emergency care for illness or injury. • To promote and provide optimum sanitary conditions for safe school environment. • To ensure availability of qualified professionals such as physicians, nurses, dentists, health educators, and other allied health personnel provide these services.
4.	Nutrition Services	• To provide access to a variety of nutritious and appealing meals. • To offer students a learning laboratory for classroom nutrition and health education • To ensure availability of a qualified child nutrition

		professionals to provide these services
5.	Counseling, Psychological, and Social Services	• To improve students' mental, emotional, and social health • To include individual and group assessments and interventions • To ensure availability of professionals such as certified school counselors, psychologists, and social workers to provide these services.
6.	Healthy and Safe School Environment	• To provide a healthy and safe physical and aesthetic surroundings; psychosocial climate and culture in the school • To ensure safety in the physical environment by considering the school building and the area surrounding it, any biological or chemical agents that is detrimental to health, and physical conditions such as temperature, noise, and lighting. • To ensure safety in the physical, emotional, and social conditions that affect the well-being of students and staff.
7.	Health Promotion for Staff	• To provide an opportunity for the school staff members to improve their health status • To involve the staff in activities such as health assessments, health education, and health-related fitness regimes • To encourage the staff members to pursue a healthy lifestyle that contributes to their improved health status, improved morale, and a greater personal commitment to the school's overall coordinated health program.
8.	Family/Community Involvement	• To enhance the health and well-being of students • To increase parent engagement in promoting positive health behaviors among students

BEHAVIOUR CHANGE MODEL FOR SCHOOL HEALTH PROGRAM

"Lifestyle Behaviour" acquired, as a part of the growing process is not easy to change. This behaviour adopted from childhood; gets' shaped in adolescence and becomes a habit in adulthood. More so an individual acquires his/her eating behaviour over a lifetime under the complex interplay of social, cultural, family and community based practices (Contento, 2005).

The human body has developed to function in an environment of "food scarcity" and "high levels of physical activity". Therefore, human physiology encourages deposition of fat as a defense mechanism against energy loss (Neel 1962; Eaton and Konner 1997). However today's environment of "energy dense food abundance" and "sedentary life" call for a conscious effort in eating and lifestyle behaviour (Lowe 2003; Chakravarthy & Booth 2004). This lies true especially for children and adolescents dramatically influenced by media, marketing and peers.

A review of 14 interventions on prevention of dual malnutrition in children and adolescents concluded that nutritional education, promotion of physical activity, reduction in sedentary activities and involvement of family must be a part of behaivour modification programmes (Corvalan, 2006). Various behavioural modification strategies initiated in institutions such as schools, workplace, industries can have weaknesses and constraints. To achieve sustained behaviour change especially in children (Florentino, 2002), the programmes should have effective communication techniques with strong healthy lifestyle campaign, directed towards people at different levels (Gopalan, 2011) and should be fun and enjoyable.

Schools are an important milieu to reach children and adolescents as they provide a wealth of opportunities to improve nutrition: through curriculum

content, environmental changes, cooking, improved physical activity levels and through adolescent-teacher-parent interactions (Delisle and Strychar, 2006).

Food and nutrition specific knowledge, skills and self-regulatory processes predominant in the action and maintenance phase of the behaviour change process (Bagozzi 1992). Large sections of the people do not have ready access to correct information and are therefore not fully aware of health promoting practices. Therefore, raising public awareness is important to create a "pull" effect among the community (Gopalan, 2011).

Some of the most useful theories or models are social cognitive theory; self-regulation or self-influence models (Gollwitzer 1999) such as the health action process approach (Schwarzer and Fuchs 1995; Sniehotta et al., 2005); and the trans-theoretical or stages of change model (Prochaska and Diclemente, 1984). These models identify factors that explain motivation for health behaviours.

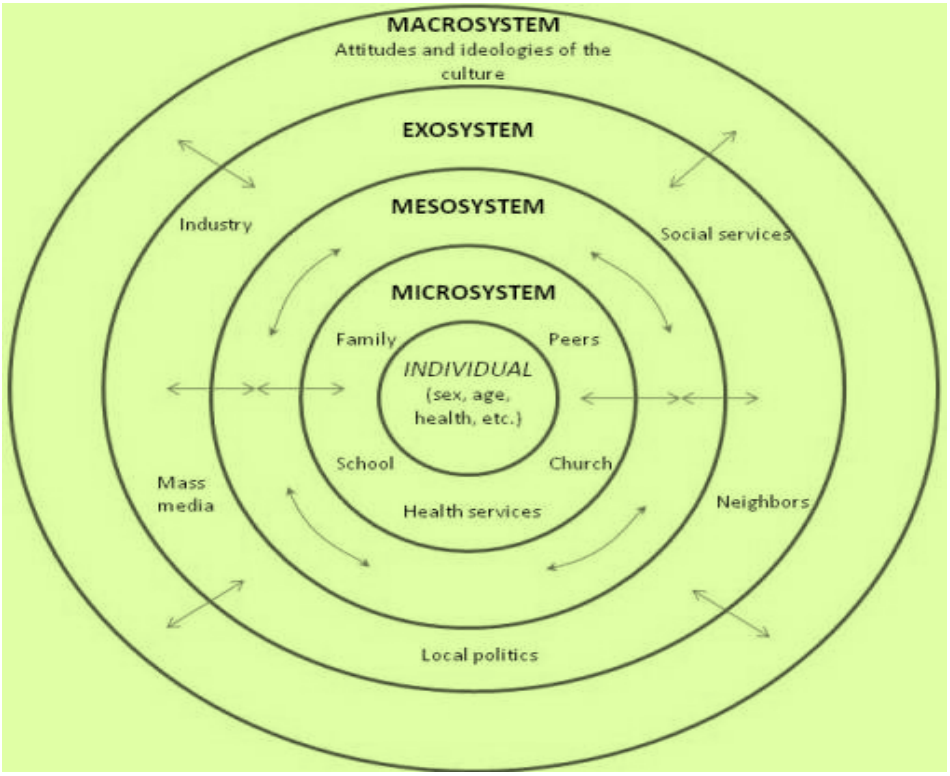
An ecological approach coupled with a life course perspective may also be a useful framework for school based behaviour change model. School – health and nutrition programmes can have practical benefits, can be implemented at low cost, and teachers can be trained to play important roles (Delisle and Strychar, 2006).

The "Socio-Ecology Model" introduced by sociologist in the 1970s, was applied to research studies in the urban setting (Bronfenbrenner, 1979). This model helps to understand the dynamic interrelations among various personal and environmental factors. It bridges the gap between behavioral theories that focus on small settings and anthropological theories that analyze larger settings (Langille and Rodgers, 2009). The SEM can be applicable at community level, organizational level, and individual level. It may also assess the environmentally based components of a comprehensive programme. It is extensively used in measuring the scope and sustainability of intervention

related to bullying, obesity, overeating and physical activity, multi-level interventions and have shown to be most effective in changing behavior (Kumar et al., 2007).

As described in Figure 2.2, the socio-ecology model comprises of several systems. Table 3.5 discusses roles of each of these systems in details.

Figure 2.2: The concept of Socio-Ecology Model



**SEM,Adopted from: http://en.wikipedia.org/wiki/Social_ecological_model*

Table 2.4: Role of each system of the socio – ecology model and its application in current study

Sr. No.	System	Role	Current Study	
			Target Group	**Their Function**
1.	Micro-system (Berk, 2000; Rogoff, 2003)	It is the closest layer to the child and contains the structures with which the child has direct contact such as family, school, neighborhood, or childcare environments. Bi-directional influence at this level is the strongest and has greatest impact on the child.	Students	• Influence and motivate maximum
			Parents	• Help in developing habits
			Teachers	• Help in reinforcing the habits
2.	Meso-system (Swick and Williams, 2006; Bronfenbrenner, 1979)	It moves beyond the dyad or two-party relation and connects two or more systems in which a child and his family live.	Family	• Support system for positive change
			School	• Provides adequate time and environment for behaviour change
			Media	• Provides exposure and governs decisions

3.	Exo-system (Berk, 2000; Bronfenbrenner, 1994)	It defines the larger social system in which the child does not directly function but affect the child's development by interacting with some structure in his/her Microsystems. For example school, peers, parent's workplace, neighbors, communities, local politics and industry.	Family culture	• Imbibes habits in daily routine
			School policies	• Enforcement for developing healthy school environment
			Market	• Awareness for becoming cautious consumer
4.	Macro-system (Berk, 2000)	It is composed of cultural values, customs, and laws and refers to the overall patterns of ideology and organization that characterize a given society or social group. It is the outermost layer in the child's environment.		
5.	Chrono-system (Bronfenbrenner, 1989)	It encompasses the dimension of time as it relates to a child's environment.		

PHYSICAL ACTIVITY AMONG CHILDREN

Studies have shown that young children (11–12 year) show sedentary behavior, which, if not intervened in time, would lead to childhood overweight, and obesity (Chen et al., 2014). "Health-optimizing" interventions involving physical activity among school going children can reduce sedentariness. Schools have played a central role in the provision of physically active environment. However declining physical activity and emerging chronic health epidemics among children have become a characteristic of the 21st century (Pate et al., 2006).

Numerous environmental factors such as urban housing design and land use influence the physical activity of the residents of that area. Studies have shown that increasing access to physical activity in an organized, structured and supervised manner is effectively beneficial for youth (Quazi et al., 2010). Thus, physical education (PE) within school curriculum is a conventional channel to promote MVPA and reduce sedentariness. Changing diets and decreasing physical activity explains the increasing prevalence of obesity. Socio-cultural restrictions to adolescent girls' mobility may also contribute to lack of physical activity. (Freedman et al. 2005).

Many studies that have applied different combinations of physical activity performed for varying intensity have shown mixed results (Edward et al., 2003) insufficient to draw specific outcome. In general, interventions on "regular physical activity" have documented decreases in the risk of cardiovascular disease, type 2 diabetes mellitus, osteoporosis, depression, obesity, breast cancer, colon cancer, and much more (NICE, 2008).

Investing for promotion of an active lifestyle in children and youth should be one of the health priorities among the developed countries. Schools can most effectively implement such priority actions by facilitating physical activity during school breaks, PE classes, after school programmes and such other strategies (Groffik et al., 2012).

The role of physical activity both aerobic and strength training is of crucial importance to public health as it allows adequate and appropriate food and nutritive substance intakes without over fatness, discourages substance abuse, encourages social activity, enhances CNS function, helps maintains reserve capacity such as cardio-respiratory, locomotors; reduces certain neoplastic disease processes. Regular physical activity increases survival and compresses morbidity towards the end of longer lives (Fiatarone et al., 1995; Savige et al., 2002; Hills et al., 1994; Fries, 1996).

Studies have documented (Marcus et al., 2006; Dudley et al., 2011) that moderate to vigorous physical activity conducted daily for minimum 3 months to maximum 12 months brings marginal to appreciable changes respectively; in different parameters of health status among the children (Khan et al, 2014). As stated by Faigenbaum et al 1999, endurance exercise improves muscular strength and endurance during childhood years.

An accumulated time of at least 60 minutes in a day, spent in performing moderate intensity of aerobic physical activity have demonstrable health benefits (Strong et al. 2005) such as reduction of high blood pressure, obesity and depression; increases in fitness and bone-mineral density among children (Janssen and LeBlanc 2010).

TO SUM UP THE REVIEW

India's escalating economy and developing physical environment has foully altered the fundamentals of healthy life for individuals up to 25 years of age; giving a rise to concurrent prevalence of under and over nutrition. The spectrum of lifestyle risk factors, together with genetic predisposition, dysregulates metabolic processes among Indians. Such a - "Third World" transition have created a double jeopardy of communicable and non-communicable diseases even in a provincially small city like Vadodara. Sudden nutritional transition makes it inevitable to have strategies for preventing undesirable lifestyle alterations. Innovative behaivour change model encapsulated within a school system can augment healthy lifestyle and dietary modification during formative years of life can track in to adulthood as healthy preferences.