CHAPTER – I

INTRODUCTION

1.1 Obesity : Its Conceptual Shades

1.2 Obesity : Its Empirical Status

1.3 Obesity : The Rationale for the present study
CHAPTER I

INTRODUCTION

1:1 OBESITY: ITS CONCEPTUAL SHADES

Thirty years ago, fundamental changes in social and economic situation occurred all over the world, thus leading to the presence of modern conveniences in homes as well as in the workplace. These changes have shifted societies from communicable to non-communicable diseases (NCD) (Ulijaaszek, 2007; Farooqi et al, 2007; Abdul-Rahim et al, 2001).

Overweight and obesity are a serious health problem, since they are associated with other diseases, and they contribute to ill health (Kopelman, 2007). The World Health Organization (WHO) describes overweight and obesity as one of today’s most important public health problems, which is escalating as a global epidemic (WHO, 2003). It is also increasingly recognized as a significant problem in developing countries and countries undergoing economic transition (Popkin, 2001). The problem of overweight and obesity is confined not only to adults but also being reported among the children and
adolescents of developed as well as developing countries. Since, adolescence is a period of transition from childhood to adulthood; it assumed critical position in the life cycle of human beings, characterized by an exceptionally rapid rate of growth (Tanner, 1978).

The prevalence of overweight and obesity among children and adolescents has increased significantly in the developed countries during the past two decades (Chinn and Rona, 2001; Louis A Baur, 2002) and similar trends are being observed even in the developing world (Martorell et al, 2000).

Obesity, or over nutrition, is a generalized and excessive accumulation of fat in subcutaneous tissue; it is relatively common during pubescence and adolescence in both sexes. It is more common in the higher socioeconomic classes because of dietary habits (Food Containing large amounts of starch and fat are usually involved) Children with moderate obesity in the pubescent years usually require no treatment, since this may be considered normal. Many children who are obese because of over eating will continue to be obese as adult.
In National Centre for Health Statistic (NCHS), USA reported that nearly 15% of adolescents in the United States were obese. Review of the situation in 2000/2001 prior to formulation of the Tenth Five Year Plan (Planning Commission, 2002) showed that although under nutrition and micronutrient deficiencies continue to be major public health problems, over nutrition and obesity are also emerging as a major problem in many states. There is a paradigm shift in the quality of life in urban population resulting in substantial increase in childhood as well as adult obesity in the urban population.

It is observed that 30% of obesity begins in childhood and out of that 50% to 80% become obese adults (Styne, 2001). In the Harvard study, morbidity from cardio vascular disease, diabetes, obesity related cancers and arthritis was 50% to 100% higher in obese individuals who were also obese as children (Must et al, 1992).

**Definition of Obesity:**

The obesity has been defined as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that
health may be impaired (WHO Consultation on Obesity 2000) (WHO, 2000).

Obesity is a complex disease that results from an imbalance of energy intake and expenditure. Children gain weight when the amount of food energy (calories) that is eaten exceeds the amount of energy that is used by the body for activity and growth, thus storing the excess energy as fat (Styne, 2001).

Kopelman (2000) defines the term obesity as “excess fatness” or fatness leading to pathology. The amount of excess fat, its distribution within the body, and the association health consequences vary considerably between obese individuals.

Clinically, it's defined for adults as Body Mass Index (BMI) ≥ 30 (WHO, 2000); while among children it has remained a challenge for many years, as there is no international agreement about the cut-off-point. In 2000, the CDC (Center for Disease Control and Prevention) developed growth charts for children, 2-20 years, taking into account age and gender. Cut-off-point for overweight was 85%, and 95% for obesity. With accelerated spread of obesity in the world, Cole et al., (2000) developed a new chart taking into account age, sex,
internationally pooled, and adult cut-off-point, depending on z score (Cole et al, 2000). Finally, in 2007, the WHO developed a new chart for children and adolescents’ growth, according to the adults' cut-off-point, and depending on z score (SD±3) (De onis et al, 2007). From an epidemiological view, the twenty first century health professionals consider obesity as an epidemic (Wardlaw et al, 2004; Pediatrics, 2002).

Overweight refers to increased body weight in relation to weight, when compared to the same standard of acceptable or desirable weight. Obesity is defined as an excessively high amount of fat or adipose tissue in relation to lean body mass (stunkard and wadden, 1993). Obesity may develop at any age in either sex and in as increasing health problem. Obesity develops over time and, once it develops, is difficult to treat.

**Pathophysiology of obesity:**-

Obesity is felt to be due to an increase in the number of fat cells, or adipocytes. Adipose tissue associated with upper body obesity contains large insulin-resistant adipocytes while adipose tissue associated with lower body obesity contains
small insulin-sensitive adipocytes. Intra-abdominal adipose tissue is more metabolically active (Bjorntorp, 2000).

**Theories on obesity:**

B.Srilakshmi (2005) describes the theory of obesity. According to B.Srilakshmi, following three theories tells about the biological onset of obesity:-

**Fat cell theory:** Number of fat cells is determined early in life to provide space to store fat. Once they formed, fat cells have a tendency to remain full of fat. Total number of fat cells was set early in life, supporting the notion that juvenile onset obesity was caused by an increase in the number of fat cells while adult-onset was caused by increase in the size of fat cells.

**Set point theory:** - Each person has an ideal biological weight or set point. Once body weight reaches this point, a whole set of signals is produced that influences the person’s food intake to maintain this weight. Research has shown that risk for medical problem is related to the size of the fat cells present more than the number of fat cells or the person’s weight.
**Leptin:** - Obesity gene called ‘ob’ is expressed in the fat cells and codes for the protein leptin. It acts as a hormone in the hypothalamus. It promotes negative energy balance by suppressing appetite and increasing the energy expenditure. People with genetic defect of leptin show sign of poor appetite control, are constantly hungry and eat more and may gain weight. In obesity there is sufficient leptin production but there is insensitivity or resistance of the adipose tissues to leptin. The concentration of leptin in blood is usually proportional to the amount of stored fat. Leptin plays an important role in the long term regulation of energy balance. During starvation and weight loss, leptin production from adipose tissue decreases.

**Types of Obesity:**

1. Type 1 – Excess body mass or percentage fat (ovoid shape).
2. Type 2 - It is excess subcutaneous fat on the trunk particularly in the abdominal area. This type of obesity is also called “android” fat deposition or “apple shaped obesity”. Studies indicate that this type of obesity is high
correlated with the risk of cardiovascular disease (CVD) 
(Laquatra, 2000; Khanna et al, 1997).

3. Type 3 - Excess abdominal visceral fat. Studies suggest that the visceral fat component is strongly correlated with risk factors such as glucose intolerance, hyperlipidemia and hypertension.

4. Type 4 - Excess gluteofemoral fat (gynoid type) is characterized by the “pear” shape created by heavier deposit of fat around the thighs and buttocks. Gynoid obesity is more common reserves to support the demands of pregnancy and lactation (Laquatra, 2000; Khanna et al, 1997).

Assessment of obesity:-

Obesity can be measured in two main ways- generalized obesity and central obesity. Height and weight are the most simple and commonly used measures. A number of weight-for-height indices have been developed of which the body mass index (BMI) [defined as weight/height (Kg/m²)] is the most commonly used measure of overall obesity (generalized obesity) while circumferences and skin folds are measured by
central obesity. Central body fat distribution is measured by waist circumference (WC) and two common used indices, waist-hip-ratio (WHR) and conicity index (CI) (Bhadra et al, 2001).

The fundamental definition of obesity in children is not clear. The measurement of overweight and obesity in children and adolescents posses particular problems due to different rates of maturation and growth. The current standard definition of overweight and obesity uses specific BMI cut points. Some authors use age- and gender-specific 85th and/ or 95th percentile BMI for children to define overweight and obesity. However in the present study, BMI-for-age and gender specific percentile is recommended. Those greater than equal to 95th percentile are considered obese, whilst those greater than equal to 85th percentile are overweight (WHO, 2000).

Other markers of obesity are; bioelectrical impedance analysis, Dual energy X-ray absorptiometry (DEXA), Air displacement plethysmograpy (BODPOP) method. All these markers have their individual advantages but none are really standardized as yet.
Consequences of obesity:

Regardless of its cause, obesity may be associated with a variety of risks. Obesity causes or exacerbates many health problems, both independently and in association with other diseases. In particular, obesity is associated with the development of type-II diabetes mellitus or non-insulin dependent diabetes mellitus [NIDDM] (Gordon et al., 1977; Bose, 1992), coronary heart diseases [CHD] (Foster and Burton, 1985; Ghose et al., 2003, 2004), respiratory complications, dyslipidaemia, gout, osteoarthritis of large and small joints, sleep apnea and other degenerative conditions associated with higher mortality (Seidell and Bouchard, 1997). Obesity has been implicated as a risk in the development of hypertension [HT] (Bose and Mascie-Taylor, 1998; Vague et al., 1988). Some studies on obese children and adolescents showed that very low density lipoprotein (VLDL) and low density lipoprotein levels are positively correlated with BMI (Guida et al, 1989).

**Level of Blood total and LDL cholesterol in children and adolescents [NCEP, 1991]**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>TOTAL</th>
<th>LDL CHOLESTEROL</th>
</tr>
</thead>
</table>

* CATEGORY: **LIB**
The most common consequence of obesity in children is poor psychological functioning. Pre-adolescent children associate the shape of an overweight body with poor social functioning, impaired academic success and reduced fitness and health \((\text{Hill et al, 1995})\). Among teenagers, cross sectional studies have documented an inverse relationship between bodyweight and both self-esteem and body image. Hepatic disorders in obese children have been reported, particularly hepatic steatosis characterized by raised serum transaminase levels \((\text{French et al, 1995})\). Obese children are at higher risk for the development of gallstones \((\text{Honore et al, 1980})\). In adolescent females, the higher mortality rate is associated with polycystic ovary syndrome and endometric, gallbladder, cervical, breast cancers in adult life \((\text{Garfinkel, 1985; Dunai, 1992})\).

**Determinants of obesity:** -

<table>
<thead>
<tr>
<th>CHOLESTEROL (mg/dl)</th>
<th>(mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCEPTABLE</td>
<td>&lt; 170</td>
</tr>
<tr>
<td>BORDERLINE</td>
<td>170 - 199</td>
</tr>
<tr>
<td>HIGH</td>
<td>&gt;= 200</td>
</tr>
</tbody>
</table>

*SOURCE: Krummel, 2000.*
Several factors may contribute to the development of obesity. It is not a single disorder but a heterogeneous group of conditions with multiple causes.

**Junk food:**

The variety of such products being manufactured and heavily advertised through the media (e.g. Pictures of large sodas with snacks etc) makes the young child compel the parents to procure these items and he keeps munching them anytime and anywhere. Not surprisingly, the child misses regular meals. The temptation of little surprise gift with the product traps children. Wafers, chocolates, crunches, especially flavored namkeen, kurkure, burgers, pizzas; noodles are easily available in every nook and corner. Most of these items are high on calories or even empty calories since they are devoid of other important nutrients like vitamins, iron, calcium etc. it is postulated that consumption of extra 100 calories per day will result in 5 Kg weight in one year time. Nibbling in-between the meals, eating at night and consumption of refined, starchy and fatty foods, social pressures, the need of
eating out often and attending parties can also result in an increased energy intake mainly fat (Khanna et al, 1997).

**Television/computer watching:**

Watching television is the strongest predictor of childhood obesity. Studies have also indicated a strong correlation between the amount of time children and youth spend watching television and the prevalence of obesity. Researchers have shown that obesity in adolescents’ increases by 2% for each additional hour of television viewed per day (Gortmaker et al, 1990). On the other hand, a report showed that by decreasing a child’s TV view by seven hours a week, the risk of obesity is reduce by 30% (Crespo et al., 2001). Studies have also shown an association between television viewing and pediatric hypercholesterolemia. Excessive television viewing (on an average 2 or more hours/ day) is associated with elevated cholesterol level in children (acceptable total cholesterol in children is < 170 mg/dl) NCEP, 1991 (Wong et al, 1992). Television viewing is thus a global marker for identifying children lifestyle characterized by physical inactivity and unhealthy dietary habits.
**Lack of physical activity:**

A significant change responsible for obesity is the lack of exercise that children now a day get. Children get exercise, due to high risen flats isolating them from playgrounds and thus leaving only small areas for play. Also, now a day’s buses cars frequently take children to school, if it is any distance from home further reducing activity (Francis et al, 1986). An inactive child can become obese even while eating less food than an active child. Children who are obese tend to move less quickly than the lean and expend less energy in sitting, standing and walking even before they become obese i.e. reduced activity is therefore the cause of, rather than the result of weight gain (Whitney, 1998). Recently it was shown a strong protective effect of physical activity on the long-term changes in body fat from preschool to early adolescence (Moore et al., 2003). By age 11, the most active children had lower BMI and much less subcutaneous fat (skin fold thickness), than did children in the lower two activity categories. Furthermore, adiposity rebound occurred at a later age for the most active children, perhaps further reducing their risk of obesity later in life.
**Social factors:-**

Increasing per capital income of the middle income groups has led to an increase in the trend of social gathering, function and celebration. In school, children celebrate their birthdays by getting sweets, pastries or savories (that are often high calories) for their classmates. In a class of an average 60 – 70 percent children’s, there would be an equal number of such occasions spread out not so far apart. Georges et al, 1997 suggest a larger role for socio-cultural factors in the patterning of body fat distribution.

**Socio economic situation:-**

The Socio-Economic status is the non-nutritional causal factor, which greatly influence the nutritional status of a community. The per capita income, family size, educational status of the house wife and social status of the family play a role in the consumption to the well being of an individual. Socio-economic status (SES) and behavioral factors are important determinants of weight gain and overweight (Rissanen et al., 1991). Both environmental and behavioral changes brought about by economic development, modernization and
urbanization. The increased levels of obesity are associated with the transition from rural to urban lifestyle. The urban lifestyle has been linked with dramatic changes leading to increased consumption of high energy dense foods and decrease in physical activity. Obesity is increasing in children and adults, especially women due to increased dependence on convenience food, like packed and frozen food, as a result of economic development and urbanization.
### Table 1.1 Impact of urbanization on our lifestyle*

<table>
<thead>
<tr>
<th>Location or Type of activity</th>
<th>Effect of Modernization</th>
<th>Impact on obesity</th>
</tr>
</thead>
</table>
| **Transportation**           | Rise in car ownership  
Increase in driving shorter distances.                                                   | Decrease in walking or cycling.                                                  |
| **At home**                  | • Increase in the use of modern application(e.g. microwaves, dishwashers, washing machines)  
• Increase in ready-made foods and ingredients for cooking.  
• Increase in television viewing, popularity of computers and video games. | • Decrease in manual labor  
• Increase in consumption of convenience foods that contribute to obesity.  
• Decrease in time spent on more physical active recreational pursuits. |
| **In the Workplace**         | Increase in sedentary occupational lifestyles due to technology-increase in computerization. | Decrease in physically demanding manual labor.                                   |
| **Public Places**            | • Increase in the use of elevators, escalators and automatic doors.                     | • Decrease in daily physical activity patterns such as climbing stairs.          |
| **Urban Residencency**       | Increase in crime in urban areas.                                                      | Prevent women, children and elderly from going out alone for exercise and leisure activities. |

*SOURCES: WHO fact sheet series III.*

**Psychological factors:**
Obese children may also face psychological consequences. An overweight child may experience criticism from peers while finding it difficult to participate in age-related activities. Obese children seem to be affected more by taste and appearance of food rather than hunger and satiety (feeling of fullness) and therefore tend to eat more than the body’s need (Khanna et al, 1997). Emotional overeating is when a child disregards hunger and satiety cues and eats in response to emotions such as sadness, anger, stress, tension, fear, boredom etc. This kind of emotional overeating can also lead to obesity. How parents relate to their children also affects the youngster’s way of dealing with food. Sometimes children may associate food with maternal love (Caprio and Held, 1997).

**Genetic factors:-**

There is increasing evidence that genetic inheritance influence a person’s chances of becoming fat. Fat parents tend to have fat children and the dependence seems to be stronger on the mother (Caprio and Held, 1997). More than 300 genes, markers, and chromosomal regions have been associated or linked with human obesity phenotypes (Chagnon et al., 2003).
Within the family, if one parent is obese, a child has 40% chances of becoming obese. This chance becomes 80% if both the parents are obese and only 7% if neither parent is obese (Williams, 1989).

1:2 OBESITY: ITS EMPIRICAL STATUS

Reviews of relevant literature formulate a base for any scientific research. It provides the investigator an insight for deeper exploration on the subject and open new ways for the
study. The review makes the researcher aware about the methods and content the problems already investigated and present a diagnostic approach and prepare a solid foundation for the new to be undertaken.

Obesity has reached epidemic proportion globally, the overweight at least 300 million of them clinically obese and is a major contributor to the global burden of chronic diseases and disability, affecting virtually all age groups and socioeconomic groups.

1:2: a Global scenario:-

Prevalence of obesity:-

The prevalence of obesity is increasing globally, with nearly half a billion of the world’s population now considered to be overweight or obese (Rossner, 2002). The obesity epidemic is related both to dietary factors and to an increasing sedentary lifestyle. Obesity has significant co-morbidities and these are associated with substantial health care and social costs.

Kopelman. (2000) suggests that obesity is now so common within the world’s population that it is beginning to replace
under nutrition and infectious diseases as the most significant contributor to ill health. It is estimated that, at the beginning of the century, more people will die from complications of overnutrition than of starvation.

The pandemic of obesity is so great that it has even spawned a new word “globesity” (Speakman, 2003a).

The increasing prevalence of childhood and adolescence obesity through the past two decades has been emphasized in many western countries.

Ogden cl et al. (2000) find out the prevalence rates of obesity (BMI exceeding the 95th percentile) among U.S children and adolescent aged 6-11 and 12-19 years, respectively were 4.2 and 4.6% in 1963-1970, 4.0 and 6.1% in 1971-1974, 6.5 and 5.0% in 1999-2000, an alarming rate of increase. Obesity (weight corrected for height >95th percentile) among U.S. children increased 1988-1999 from 7 to 10% among those aged 2-5 years.

Mc carthy HD, et al. (2003) suggest that in Britain youth has increased more rapidly than BMI over the past two decades, with 14 and 17% of boys and girls, respectively exceeding the
98th percentile in this measure in 1997, while 10 and 8% exceed the 98th percentile for BMI; both measures exceeded the 98th percentile only in 2.3% of adolescents between 1977 and 1987. These considerations suggest that the phenomenon of increasing obesity and particularly increasing central obesity.

Booth HL et al. (2003) studied in Australia, 5% children are currently obese and an additional 16% overweight (BMI 85th to 95th percentile). Their prevalence has doubled over the past decade after being nearly stable around 10% from 1969 to 1985.

In USA Hedley et al. (2004) updated the US prevalence estimation among children and adults (children were defined as a person aged 2 through 19 years; adult are persons aged 20 years or older). National Health and Nutrition Examination Survey (NHANES) was the source of data. A complex multistage probability sample of the US non institutionalized 9 civilian population was done. The subjects were 4,115 adults and 4,018 children (1999-2000) and 4,390 adult and 4,258 children (2001-2002). Height and weight measurements were obtained. Obesity in adults was defined according to WHO cut-off-points. For children, the 2000 CDC growth charts were
used. A person is defined as at risk of overweight if his BMI for age and sex are at or above the 85th percentile, but less than the 95th percentile. After classification, children were identified to determine who should be referred for a second level of screening to determine if they are any additional health risks that would warrant intervention. Overweight was defined as at or above 95th percentile for the sex specific BMI for age growth chart. There was an indication that the prevalence of obesity among USA children was continuously increasing. In 2001-2002, it reached 31.5% were at risk for overweight or overweight, 16.5% were overweight.

A study was conducted by Jackson et al. (2007) for comparison of prevalence of overweight adolescent girls in three countries in Eastern Mediterranean Region (Egypt, Kuwait, and Lebanon). The sample was drawn from studies conducted previously in these countries. Different cut off-points were used (Cole et al. points, CDC 2000 charts, and Must et al). Anthropometric measurements were taken and BMI was calculated.

**Socio-economic situation:-**
Abdul Rahim et al. (2003) reported on the prevalence of obesity in both rural and urban areas in Palestine. He found that it was more prevalent in urban areas. The prevalence of obesity was 36.8% in women and 18.1% in men in rural areas as opposed to 49.1% and 30.6% in urban women and men, respectively.

Huerta et al. (2006) investigated the effect of parental education and smoking on the child's BMI. They found that it was highly associated with the educational level of parents. The more educated the parents were, the more decline there was in the child's BMI. A positive association was found between smoking and the increase of risk for overweight. There were 8,623 school children, aged 8-13 years old involved in this study taking 85th percentile, 95th percentile cut-off-points for overweight and severe overweight.

Chakar et al.(2006) in Lebanon, they explain the high overweight prevalence due to socioeconomic status.

Khader et al. (2008) study in Jordan, the daily pocket money was associated with overweight, while family monthly income was found to be associated with obesity. The study results could
be explained by the fact that mothers with higher education mostly will have a job leaving their children for longer times enabling them to take several unhealthy snacks. It is important to note that children could gain more weight after purchasing several unhealthy snacks that are available in school’s canteens and groceries.

**Eating habit and obesity:-**

*Ludwig et al. (2001)* found an association between BMI and sugar-sweetened drinks. The dependence on highly dense food, salty snacks, and avoidance of fruits and vegetables, has led to overweight.

*Nielsen et al. (2003)* indicated that the portion size of food increased when children were eating fast food whether at home or in restaurants.

*St-Onge et al. (2003)* confirmed this. He found that there was about 300% increase in fast food consumption, when
compared with other types, and an increase in soft drinks and beverages.

Liebman et al. (2005) to assess the association between BMI and dietary intake-eating behavior, and physical activity. The study consisted of 883 men and 1,030 women aged 18-96 years. This prevalence was associated with supersized portion, eating while doing another thing, consuming soft drinks and consuming fast food, in parallel with a decrease in physical activity.

Kerbs et al. (2007) pointed out the effect of taking breakfast. Skipping breakfast showed a positive relationship with BMI. A follow-up study of children, aged 9-14, found that “overweight children who never ate breakfast had a greater decline in BMI than did overweight children who ate breakfast. Normal-weight children who never ate breakfast, however, had weight gains comparable to those of normal weight children”. Meal frequency and snacking demonstrate inverse relationship with BMI.

Physical activity and obesity:-
Kruger R et al. (2005) study, conducted in Thusabana, South Africa, showed that overweight/obese children were least active at all times. They spent time sedentary mainly watching TV. Likewise, Jordanian children viewed TV more than 2 hrs/day. This habit was significantly associated with obesity.

WHO/HBSC forum (2006) studied that; there was strong association between TV viewing, physical inactivity and obesity. In this study, great variation in activity was found between different countries, and differ gender. It was higher in boys.

Boyce (2007) study reviewed the relationship between media and obesity. It was found that the prevalence of obesity increased by 2% in 12-17 year-olds for each additional hour of TV viewed. This research mainly sought to identify the relationship between incidence of obesity and television viewing. It was found that it was associated with obesity. Obesity incidence was the lowest in children who viewed less than one hour/day of television, and highest in those who viewed more than 4 hrs/day. This research also discussed the effect of media in increasing sedentary, increasing
consumption of unhealthy food either because of advertisements for different kinds of food, or because of the increasing consumption of snacks that are high in energy, fat, salt, sweetener, and carbonated beverages while watching TV.

*Rey-López. (2007)* made a review to determine the effect of sedentary behavior and obesity development in children and adolescents. He reported a positive association between television watching and obesity in children younger than 10 years. TV viewing seemed to be the most sedentary behavior affecting overweight.

*Rey-lopez JP et al. (2008)* studies that the increasing information Communication technology, such as TV, video, and computer, as well as, living in apartments, coupled with motorized transportation, and modern conveniences in homes, with broken relationships on family/community levels all have led to increase in sedentary lifestyle, making people less active all over the world.

**1:2: b Indian scenario:-**

*Prevalence of obesity:-*
The growing prevalence of overweight and obesity has received attention in many developing countries; there is a dearth of data for Indian. This could partly be because of under nutrition in country. Small-scale studies conducted in the 1990s, based mainly on urban samples, suggest that the proportion of the overweight population in Indian towns and cities is large and increasing, ranging from 33 to 51%.

At national level the representative data on obesity in India is scarce, with very few reports on the prevalence of obesity among children as shown in below table.

**Table 1.2 : Obesity in India:-**

<table>
<thead>
<tr>
<th>Author(y)</th>
<th>Age group(y)</th>
<th>N</th>
<th>Location in INDIA</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharma et al (2007)</td>
<td>4-17</td>
<td>4000</td>
<td>Delhi (north)</td>
<td>Overweight, 22; obesity 6</td>
</tr>
<tr>
<td>Gupta et al* (1990)</td>
<td>5.15</td>
<td>3861</td>
<td>Uttar Pradesh (north)</td>
<td>Obesity, 7.6</td>
</tr>
</tbody>
</table>

*Obesity was calculated using the criteria of BMI greater than or equal to 22.6kg/m² as cut off point.

**Socioeconomic situation:-**

Ramachandra et al (2002) studied children from six schools, two each from high, middle and lower income groups in Chennai. The prevalence of overweight (including obese) adolescents ranged from 22% in better off schools to 4.5% in lower group schools.

M.Mehta et al (2007) studied that the prevalence and type of obesity in affluent school girls aged 16 and 17 years. The prevalence of obesity and overweight in school going girls is 5.5% and 15.2% respectively International obesity task force (IOTF). Out of the 22 obese girls central obesity was present in 21 girls (95.4%) [WC >= 80cm] and 12 girls (54.5%) [WHR >0.85].

Subramanyan et al. (2003) have reported that the prevalence of overweight and obesity among the affluent adolescent school children in Chennai, Tamil Nadu was 15%. There is evidence that children and adolescent of affluent families are
increasingly becoming overweight and obese in recent times, possibly because of decreased physical activity and sedentary life styles and change in dietary habits.

**Kaur S et al. (2005)** studied that socio economic gradient in the Prevalence of overweight and obesity in school going children. It has been reported that the rise in sedentary behavior such as increased use of vehicular transport and decreased physical activity lead to increased prevalence of overweight and obesity. Sedentary life styles in the higher socioeconomic group influence the weight gain. The Study found out that the prevalence of overweight and obesity was marginally higher in the age group of 12, 13 and 17 year student, which was not statistically different.

**Marwaha et al. (2006)** assess differences in socioeconomic situation and its relationship with overweight/obesity among school children in Delhi. They classified government schools (non-fee paying) as having low socioeconomic status (LSES), and those in private schools (fee-paying) as having high socioeconomic status (HSES). About 8,840 children were randomly chosen from government schools (3,566 boys, and
5,274 girls) and 12,645 from private schools (6,197 boys and 6,448 girls). They found significant differences between socioeconomic status and BMI. The prevalence of overweight and obesity in HSES children was 16.75% and 5.59% in boys, and 19.01% and 5.03% in girls, respectively.

**Eating habits and obesity:**

*B Mohanty et al. (2008)* studied that central obesity is predominantly higher among girls of both urban and rural schools as compared to boys. The study suggest that under nutrition rates remain high both in urban and rural children. It is predominantly felt in rural school children, in some case the total body fat % is much below the prescribed limit. In spite of increasing per capital income and reduce poverty and dietary diversity under-nourishment are also seen among the affluent children. The malnutrition in urban children is mainly due to poor Eating habits, poor selection of food and other life style modification.

*Ramesh K Goyal et al. (2009)* study carried out in 5664 school children of 12-18 yrs of age and having different socioeconomic status in Ahmadabad. Age adjusted prevalence
of overweight was found to be 14.3% among boys and 9.2% among girls where as the prevalence of obesity was 2.9% in boys and 1.5% in girls. The prevalence of overweight among children was higher in excess eating habits like junk food, chocolate, eating outside at weekend and physical activity like sleeping habit in afternoon.

**Physical activity and obesity:**

*Umesh kapil et al. (2002)* conducted a study among another affluent public school children in new Delhi, revealed prevalence of overweight (BMI >= 30) of about 25% and 7% respectively. They found that lack of physical activity with sedentary life style increases the prevalence rate in school going girl.

*Shah C et al. (2008)* studied the relationship between obesity with physical activity and sleeping hours in school going girl of Bhavnagar city. Spending more time on TV and computer may be considered as predisposing factor for overweight and obesity.

*D. R. Bharati et al. (2008)* study was carried out in 10 to 17 years old children of Wardha city. The age ranging from 10 to
17 years, 1196 (46.8%) were boys and 1359 (53.2%) were girls. Overall, 79 children were overweight while 32 were obese. Therefore 4.3% of the children were overweight/obese. Final model of the multivariate logistic regression showed that the important correlation between overweight/obese and urban residents, English medium school going children playing outdoor games for less than 30 min.

*M. Shashidhar Kotian et al. (2010)* conducted a study on 900 adolescents 12 to 15 years age in the city of Mangalore, Karnataka, a south state of India. The overall prevalence of overweight among adolescents was 9.9% and obesity was 4.8%, boys (5.2%) are more obese than girls (4.3%). However according to the BMI cut off value, 23.9% (215) were underweight (<18.5), 60.9% (546) were normal (18.5-24.9), 11.4% (103) were overweight (25-29.9) and 4% (30) were obese (30 and above). The risk of overweight was 2 times higher among the adolescents of high socioeconomic status, 21 time higher among those participating < 2 hours/week in any type of physical activity, 7.3% time higher among those who reported watching television and playing games on computer.
for >=4 hours/day, 5.6% time higher among those who eat chocolates daily in addition to a normal diet.

1:2: c Obesity risk factors and health consequences:-

*Freedman D S et al. (1999)* elucidated the adverse effect of overweight in the 17 years follow up study and reported that an average increase of 0.5 Kg/m2 of BMI in children increase the risk for hypertension, dyslipidemia and diabetes (type II) a decade later.

*Freedman et al. (2001)* there is a weak relationship between childhood BMI and adult levels of lipids, insulin, and blood pressure and Type 2 diabetes mellitus which had been primarily a disease of adulthood. However, it now occurs in adolescents typically with a BMI >30 kg/m2 26. Onset of diabetes in children and adolescents can result in advanced complications such as CVD and kidney failure.

*Hakim (2002)* found that waist-to-hip circumference (waist: hip ratio) are useful to estimate the proportion of abdominal adipose tissue and abdominal obesity is associated with insulin resistance, hyperinsulinaemia and glucose intolerance.
WHO, Report (2002) found that approximately 58% of diabetes and 21% of heart disorder and 8-42% of cancers globally were attributable to excess weight.

Again similar study done by Baron (2003) showed a progressive increase in the incidence of hypertension, diabetes mellitus, and coronary heart disease, sleep apnea syndrome and certain cancers in obese persons.

Sung et al, (2003) studied in a cross-sectional survey of children’s in Hong Kong, 38% of girls and 57% of boys were overweight, with overweight children of both the sexes showing higher systolic blood pressure, triglyceride and lower HDL cholesterol than the normal weight group.

Bhargava et al, (2004) studied 1400 adults followed in Delhi, India, revealed that children at risk to become glucose intolerant as young adults often are at low birth weight and have rapid gain of BMI in early childhood.

Del-Rio-Navarro et al. (2007) explored how overweight, obesity and abdominal obesity are related to the presence of high blood pressure, high triglyceride level and high glucose level in the population of Mexico; they found that
overweight/obese children were associated with higher blood pressure and triglyceride, an increase of glucose level among overweight and abdominal obesity.

Other consequences of obesity are psychosocial. Obese children are exposed to social stigmatization which may cause low self-esteem. Further, they may become targets of early and systematic social discrimination (CDC, 2000).

Impaired glucose tolerance was highly prevalent among severe obese children and adolescents (Sinha et al, 2002). Additional health risks, asthma, hepatic steatosis, atherosclerosis, inflammation, obstructive sleep apnea are also associated with obesity in children and adults (Daniels et al, 2005; U.S Department of health and human service, 2001).
1:3 OBESITY: RATIONALE OF THE PRESENT STUDY:

Available evidence show that one of the effective ways to prevent obesity in the adult life may be prevent and management of childhood and adolescent overweight and obesity.

A fundamental step in the preventing and control of obesity is the identification of risk factors contributing to the rapid increase of obesity. Relevant research in this area, in India is minimal and the data available is mostly inconsistent and often based on statistically inadequate sample size, making it difficult to assess the prevalence of overweight and obesity at country as well as state level, in relation to a wide age range of children (13-17 years).

Therefore, it was proposed to carry out a study to assess and identify the prevalence and determinants of overweight and obesity among urban school going children covering statistically adequate sample in Chhattisgarh, Bhilai city which is one of the economically, industrially and culturally fast growing state. Obesity prevalence depended on many factors. During the scanning of relevant literature not a single study
was found in impact of obesity in school children has been examined in Chhattisgarh. So, it was considered to study the impact of the three variables on obesity/overweight (i.e. socioeconomic status, eating habits and physical activity of the children as a variable.

However, in the light of the studies cited above it can be said that studies pertaining to the investigation of obesity and its determinant in relation to the above mention three variables are still scanty. Therefore an attempt has been made in the present investigation to study the problem of obesity in the light of socioeconomic status i.e. high economic status group and low economic status group, eating habits i.e. excess food consumption and less food consumption and physical activity i.e. physically active and physically inactive of the school going children of Bhilai city. The finding of the study will help in formulation of strategies to prevent and control the problem among the target groups.

The present study was carried out in public and B.S.P school of Bhilai city with the following objectives:

1. **General objective** :-
The general objective of the study was to assess the prevalence of overweight and obesity among school children in the age group of 13-17 years in Bhilai city.

2. **Specific objectives**:-

a) To assess the prevalence of overweight and obesity among the boys and girls in the Bhilai city.

b) To assess the prevalence of obesity/overweight among children of different socioeconomic status groups.

c) To assess the relationship between BMI of students and physical activity and eating habits.