CHAPTER-2
REVIEW OF LITERATURE

The literature review explores the three dominant themes of the research questions: symbolic representation of concepts, impact on academic achievement, and respondents’ attitudes, behaviours, and interactions. The scope of this literature review is expanded to include research that examines the dominant themes of the research questions regarding the parameters of the research area.

In recent years, there has been a dramatic increase in the prevalence of obesity in the India as well as in other regions of the world. During the last few decades, the greatest increase in obesity is observed in populations that have been undergoing rapid modernization. Thus, obesity is both a pandemic as well as an epidemic. The pandemic is so great that, it has even spawned a new word, ‘Globesity’. The World Health Organization (WHO) recognized obesity as a major public health epidemic worldwide, in developed as well as in some developing countries.

A systemic review of literature has been done on how and why obesity develops which involves in integration of social, behavioural, cultural, physiological and metabolic factors. Several other factors have been implicated as the causes of obesity like age, gender, activity level, dietary preferences, pregnancy & psychological factors. A substantial body of information is available in many research studies from various obesity journals, search engines etc.

2.1 Prevalence of Obesity

Rosenbaum and Liebel (1998) emphasised that humans have evolved as a species from hominids that were well-equipped to survive and reproduce in environments that yield an unsteady supply of readily available foods. Survival and reproduction were dependent on energy stores of the individual and the species. For evolutionary reasons, human physiology is predisposed to conserve and store weight, not to shed excess amounts. However, in the modern industrial environment that provides easy access to calorically-dense foods and encourages a sedentary lifestyle, the metabolic consequences of these genes are mal-adaptive. The prevalence of childhood obesity has increased by more than 30% over the past decade. The rapid increase in the prevalence of obesity
emphasizes the role of environmental factors, because genetic changes could not occur at this rate.

Radhakrishna and Ravi (2004) discussed the chronic energy deficiency suffered by the individuals on the basis of BMI. The study found that 39.4% of all adult women in India are underweight for their age and almost 37.4% of adult males in India are underweight for their age due to low BMI. The study further showed that 36% of ever-married women aged 15-49 has chronic energy deficiency. About 50% of the adult population had a BMI below 18.5 kg/m² while only negligible proportions were overweight or obese. Therefore, CED (expressed as low BMI for age) was found to be higher for tribal populations than non-tribal populations.

Jyothi and Nayak (2010) examined the prevalence and risk factors of abdominal obesity among women working in a selected institution of South India. The study was done among women working in Manipal University, Karnataka. A descriptive survey was done to find the prevalence of abdominal obesity among 340 women using waist to hip ratio. The result of the findings revealed that Majority of the study participants (82.35%) were having abdominal obesity with a waist-to-hip ratio more than 0.8. Physical activity was found to be significantly associated with abdominal obesity. The study concluded that working women need to increase the physical activity to prevent abdominal obesity.

Kaur et al. (2010) conducted a study with a view to explore the prevalence of overweight and obesity. A cross-sectional study on 600 women (300 each belonging to urban and rural areas of Punjab) in the age range of 50-80 years were taken. The prevalence rates are calculated according to the critical limits of body mass index (BMI) and waist hip ratio (WHR). Urban women of present study are found to be obese than their rural counterparts. Urban women have registered more waist circumference (96.25 cm) and hip circumference (95.58 cm) than rural women, who have these parameters 88.87 cm and 89.05 cm respectively. The mean values for BMI and waist hip ratio (WHR) are more for urban women (26.92 Kg/m² and 1.007 respectively). According to body mass index (BMI), the prevalence of grade-2-overweight and grade-3-overweight is 29.33%; 1% and 17%; 0.66% in urban and rural women, respectively. Similarly the prevalence of central obesity according to waist hip ratio (WHR) cut-offs is 56.66% in urban and 47% in rural women.
Khokhar et al. (2010) examined the prevalence of Obesity in Working Premenopausal and Postmenopausal Women of Jalandhar District, Punjab. The study covered 595 women (330 premenopausal and 265 postmenopausal) were selected. The study found more prevalence of obesity in postmenopausal women as compared to premenopausal women. According to BMI, the prevalence was 70.30% and 75.09% in pre- and postmenopausal women. Similarly the prevalence of central obesity according to WC was 75.15% and 89.05% whereas according to WHR, 74.54% and 87.92% in premenopausal and postmenopausal women respectively.

Singh and Sylvia (2011) aimed to determine the prevalence of obesity and overweight among Indian women living in Punjab, India and in Vienna, Austria. A series of 115 women ageing between 17 and 80 years was enrolled in the present study. 65 women lived in the district of Jalandhar in Punjab, 50 Punjabi women lived in as migrants in Vienna, Austria. Data collection comprised an anthropometric analysis including stature height, body weight and the body mass index (BMI). For classification of the weight status the Indian BMI cut-offs defined by the WHO for Asian Indians were used. Among both subgroups overweight and obesity were highly prevalent. Underweight (18.5%) was significantly more prevalent in Punjab than in Vienna (6.0%), while overweight and obesity were more frequently found among Punjabi women in Vienna (26.0%; 54.0%) than among Punjabi women in India (9.2%; 24.6%).

Sudhera and Sidhu (2012) made an attempt to report the prevalence of obesity on the basis of various anthropometric variables among young adult Jat-Sikh females of Punjab, ranging in age from 18-25 years. For the assessment of obesity, height, weight, waist circumference and hip circumference were taken on 150 young adult females. The prevalence of obesity was calculated according to Body Mass Index (BMI), Waist Circumference (WC), Waist Hip Ratio (WHR) and Waist-Stature-Ratio (WSR). The observations revealed that the prevalence of under nutrition, overweight and obesity according to BMI in young adult females was 21.3%, 20% and 10.7%, respectively. The prevalence of abdominal obesity according to the WC, WHR and WSR was 34%, 57% and 37%, respectively. The results of the comparative analysis showed that absolute prevalence of obesity vary according to the parameter used.
Kalra and Unnikrishnan (2012) reviewed the weight of the problem of obesity in India. The results of studies among adolescents from parts of Punjab, Maharashtra, Delhi, and South India revealed that the prevalence of overweight and obesity was high (11%-29%). In Ludhiana, Punjab, urban children in the age group of 11-17 years of age were more overweight (11.6%) than their rural counterparts (4.7%). In Pune, Maharashtra, studies among 1228 boys in the age group of 10-15 years indicated that 20% were overweight, whereas 5.7% were obese. A study carried out in Ludhiana, Punjab, on school children in the age group of 9-15 years revealed that the overall prevalence of overweight and obesity were 11% and 14%, respectively. Another study carried out in Delhi, India; among 5000 private school children in the age group of 4-18 years in 2002 by the Nutrition Foundation of India revealed that the prevalence of overweight was 29%. A similar study conducted in Chennai, South India, showed that the prevalence of overweight was 17% and of obesity was 3%. It had also concluded that the Indian metabolic community has woken up to the need to achieve a healthy weight, in order to ensure health of the country. Innovative, yet simple and low-cost suggestions, such as yoga, meditation, and folk dance, can be used to maintain optimal weight of our country men and women.

Kamath et al. (2012) assessed the prevalence of overweight and obesity among school going children and the factors responsible for the same. The study was conducted on children at studying in the private schools of Bangalore aged 12-15 years. The overall prevalence of overweight was 10% and obesity was 5% among 761 adolescents studied. The prevalence of overweight and obesity was 11% and 4% among boys and 9% and 5% among girls respectively.

Siddiqui and Bose (2012) aimed to assess prevalence of obesity amongst children of different socioeconomic class. A survey was conducted in randomly selected 2158 (1038 boys & 1120 girls) school children from government and private schools. Obesity was assessed using Body Mass Index (BMI) criteria, those having their BMI>95th percentile for age and sex were considered obese. The results of the findings revealed that overall prevalence of obesity was found to be 14.97% (6.817% Boys 8.16% Girls). Higher values of mean weight, height, BMI and blood pressure was found in obese children as compared to non-obese. A highly significant relationship was observed for SBP and BMI (p<.0001) between obese and non-obese groups. Prevalence of obesity was found
significantly higher in children belonging to higher class (35%) as compared to lower (13%) and middle class (15.7%) (Chi-square value 9.748; & p< .001). The study concluded that Prevalence of obesity is on rise in Indian children, highlighting the possible role of change in the dietary pattern and physical activities with increase in income levels.

Marwah et al. (2013) assessed the prevalence of obesity among affluent school children in Patiala, Punjab and identify its associated risk factors. A cross-sectional study was conducted in five private schools in Patiala, India. A total of 1250 school children in the age group of 6-15 years were selected using stratified random sampling. Weight and height of each student was measured using standard measures and body mass index (BMI) was calculated. Overall obesity was seen in 95 (7.6%) children with 61 (9.4%) girls and 34 (5.7%) boys affected (p=0.20). Family history of obesity, intake of high calorie foods, physical inactivity and television or computer viewing for more than 3 hours a day were found to be significant risk factors of obesity (p<0.001 respectively). It was concluded that Obesity as an emerging health problem among affluent children in Patiala, India due to an increasing sedentary lifestyle and faulty dietary habits.

WHO (2013) reported worldwide obesity which has nearly doubled since 1980. In 2008, more than 1.4 billion adults, 20 and older, were overweight. Of these over 200 million men and nearly 300 million women were obese. 35% of adults aged 20 and over were overweight in 2008, and 11% were obese. 65% of the world's population live in countries where overweight and obesity kills more people than underweight. More than 40 million children under the age of 5 were overweight or obese in 2012. More than 1.4 billion adults, 20 and older, were overweight. Of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, more than 10% of the world’s adult population was obese.

Gouda and Prusty (2014) by using data of the third round of the National Family Health Survey (NFHS)-3, their study examined the prevalence of overweight and obesity among women from different economic strata in urban India. The result shows that prevalence of overweight and obesity is very high in urban areas, more noticeably among the non-poor households. Furthermore, overweight and obesity increase with age, education, and parity of women.
Marie et al. (2014) estimated the global, regional, and national prevalence of overweight and obesity in children and adults during 1980—2013. The study obtained data for prevalence of obesity and overweight by age, sex, country, and year (n=19,244) with a spatiotemporal Gaussian process regression model to estimate prevalence with 95% uncertainty intervals (UIs). The results of the study revealed that prevalence has increased substantially in children and adolescents in developed countries; 23·8% of boys and 22·6% of girls were overweight or obese in 2013. The prevalence of overweight and obesity has also increased in children and adolescents in developing countries, from 8·1% to 12·9% in 2013 for boys and from 8·4% to 13·4% in girls. In adults, estimated prevalence of obesity exceeded 50% in men in Tonga and in women in Kuwait, Kiribati, Federated States of Micronesia, Libya, Qatar, Tonga, and Samoa. The study concluded that obesity has become a major global health challenge.

Slack et. al. (2014) found that the prevalence of county-level obesity varied from 13.5% to 47.9% with a mean of 30.3%. Obesity prevalence across counties was not spatially random: 15.8% belonged to high-obesity regions and 13.5% belonged to low-obesity regions. Obesity was positively associated with unemployment, outpatient healthcare visits, physical inactivity, female-headed families, black populations, and less education. The findings demonstrate the importance of local-level factors in explaining geographic variation in obesity prevalence.

Anuradha et al. (2015) tried to assess the prevalence of overweight and obesity and its association with social and environmental determinants among the adolescent school children of Tirupati town of Andhra Pradesh, India. Data was collected by interviewer-administered method from school children aged between 12 to 16 years. The sample consisted of 2258 subjects (1097 boys and 1161 girls). In the present sample, 11.2 percent and 4.8 percent of boys and 10.3 percent and 4.8 percent of girls were overweight and obese respectively. The literacy level of parents, family income and child sleep duration significantly associated with overweight.

2.2 Obesity: Factors and Assessment

Atkinson (1993) studied the assessment of obesity under various characteristics. The study discussed the body weight alone is not a very sensitive indicator for defining obesity and using percentage of excess body weight is not an accurate indicator of
desirable healthy weight status of mainly white, middle class Americans, and may not yield an accurate assessment of other populations. The study found the body fat content and BMI are the most accurate assessment of obesity. Furthermore, the study found that the most accurate assessment of obesity is body fat content. It also inferred that inferred that the BMI is a desirable measurement of the tendency towards obesity.

Davis and Sherer (1994) found that body weight alone is not a very sensitive indicator for defining obesity. Factors such as age, sex, height, lean muscle mass and body fat percentage are all unaccounted for when using weight alone to measure healthy body weight on an individual level. Thus, weight alone should be avoided as a standard for assessing a person’s relative risk for overweight and obesity. Ideal body weight is an unscientific measure, and can provide only an estimate of appropriate weight. He also emphasised that a simple way to calculate ideal body weight for women is as follows: 100 lbs. for the first 60 in (5 ft.) + 5 lbs. for every additional inch.

Anderson et al. (1995) examined the fiber intake of normal and obese adults and found that the total fiber intake in grams was significantly higher in the lean group. A high fiber diet may help to promote a negative energy balance by causing early satiety secondary to gastric distention.

Helen et al. (1998) found that body mass index was significantly associated with health status. Physical well-being deteriorated markedly with increasing degree of overweight and was limited in subjects who were obese.

Lyznicki et al., (2001) stated that in adults, overweight and obesity defined as BMI levels at which adverse health risks increase. The BMI is an accurate and cost effective alternative to more expensive and invasive tools to evaluate body fatness. The BMI is a desirable measurement of the tendency towards obesity, and helps to identify those at risk for overweight and obesity.

Dalton & Watts, (2002) stated that defining overweight in the paediatric population is difficult, because a child’s BMI changes dramatically with age during childhood and adolescents. Therefore defining overweight in children and adolescents is done so by determining “BMI-for-age” in children aged 2-20 years old. Children at or above the 85th to 95th BMI percentile are defined as “at risk of becoming overweight”; children at or above the 95th percentile are defined as “overweight”. Defining overweight or obesity is
difficult using the percentile method, since as the average weight of children continues to increase, then so does the percentile. Hence although, compared to their peers, a child may be at a “normal” weight by the charts, they are heavier and at increased health risk. The “normal” values increase as society is getting progressively overweight, making it difficult to assess this population adequately by the standard percentile method.

Calonge, (2004) emphasised that healthcare providers should screen for obesity using the body mass index. Those with a BMI between 25 and 29.9 are considered overweight and those with a BMI above 30 are considered obese. The U.S. Preventative Services Task Force found good evidence that body mass index (BMI) is reliable and valid for identifying adults at increased risk for mortality and morbidity due to overweight and obesity.

You et al. (2004) investigated whether aerobic fitness, body composition, body fat distribution, and inflammation were different in obese postmenopausal women with and without the metabolic syndrome (MS), and whether the severity of MS is associated with these characteristics. The study was conducted on Fifty eight women with respect to maximal aerobic capacity, body composition, body fat distribution, inflammation (MS components). The study discussed the number of MS components was directly related to weight, body mass index, fat mass, lean mass, visceral fat area, and plasma soluble. The study concluded that obese older women with the MS are characterized by high lean mass, high visceral fat, and the severity of the MS is associated with body composition, visceral adiposity, and inflammation.

Meenakshi et al. (2007) analysed the impact of maternal body mass index on obstetric outcome. The purpose of the study was to correlate effect of maternal body mass index (BMI) on obstetric outcome. The studies conducted so far are from Western developed countries and there is a paucity of data from developing countries. A prospective evaluation was carried out of 380 women in one unit of a tertiary care teaching hospital in North India from May 2005 to June 2006 on the effect of maternal BMI on pregnancy outcome. BMI was calculated as weight (kg) divided by height (m²). BMI was used to characterize women as lean, normal, overweight or obese. Forty-six women (12.1%) out of 380 were underweight, 99 (26.1%) were overweight, 30 (7.9%) were obese and the remaining 205 (53.9%) had normal BMI. Anemia and low birth weight was
significantly present among lean women. Obese women had a significant risk for gestational diabetes, pre-eclampsia, caesarean delivery and macrosomia. The study concluded that both lean and obese women carry a risk for adverse pregnancy outcome, therefore pregnant women should maintain a normal BMI to achieve a healthy pregnancy outcome.

Assuncao et al. (2009) investigated the effects of dietary supplementation with coconut oil on the biochemical and anthropometric profiles of women presenting waist circumferences. The study consisted the randomised, double-blind, clinical trial 40 women aged 20–40 years were instructed to follow a balanced hypo-caloric diet and to walk for 50 min per day. The study based on the data was collected 1 week before (T1) and 1 week after (T2) dietary intervention. The study found that energy intake and amount of carbohydrate ingested by both groups diminished over the trial, whereas the consumption of protein and fibre increased and lipid ingestion remained unchanged. Further, there was no significant difference in biochemical or anthropometric characteristics between the groups (T1 and T2). Therefore, the study discussed that dietetic supplementation with coconut oil does not cause dyslipidaemia and seems to promote a reduction in abdominal obesity.

Parimalavalli et al. (2009) made an attempt to study the various factors like socio economic status, anthropometric measurements and nutritional profile among the obese women. The study included 77 household adult women from Mecheri, Salem District, and Tamil Nadu. Women with risk of obesity and obese women were recruited for conducting the study. The results of the study revealed that overall, 65 % of the adult women identified as overweight and obesity. It was found that age, small family and income status were found to be risk factors of Obesity. Further, it was observed that there has been a positive significant correlation between the Body Mass Index and Waist Hip Ratio. The study indicated that the nutrient intake was significantly higher than RDA. However, there was an insignificant relation between nutrient intake and anthropometric measurements like weight, waist and hip circumference and waist/hip ratio except body mass index.

Leonore et al. (2010) examined the association between depressive and anxiety disorders and obesity, physical activity, and social activity, and examines whether social and physical activity are potential influencing factors in the association between depressive
and anxiety disorders and obesity. A total of 1,854 women and 955 men aged 18–65 years were recruited from the community, general practices, and specialised mental health care. Depressive and anxiety disorders were determined with the Composite International Diagnostic Interview. Body mass index (30 kg/m²) was used to determine obesity. The results of the finding revealed that odds of obesity adjusted for covariates was significantly higher among those with a current pure Major Depressive Disorder (MDD; odds ratio OR: 1.43; 95%) compared to controls. Physical activity and social activities were lower among persons with depressive and anxiety disorders compared to controls. The association between MDD and obesity was influenced by social and physical activities. This study confirmed a link between depressive disorders and obesity that was influenced by lower social and physical activities among the depressed.

Joshi et al. (2011) made an attempt to find the prevalence of under-nutrition among school children in 4 – 14 year age group and the role of socio-demographic characteristics of mother on child nutrition in developing countries. The study was conducted in schools of Kaski district of Western Nepal from January 2007 to June 2007 by anthropometric measurements. The result of the findings showed the highly significant association of maternal factors like literacy, occupation, diet knowledge and monthly per-capita income respectively with child nutrition. The study concluded that maternal education status, socio-economic status, occupation and dietary knowledge are important determinants of nutritional status of school children. Further, besides poverty, there are other factors that directly or indirectly affect the nutritional status of children.

Hooper et al. (2012) examined the relation between total fat intake and body weight in adults and children. The study was based on randomised controlled trials and cohort studies of adults or children that compared lower versus usual total fat intake and assessed the effects on measures of body fatness (body weight, body mass index, or waist circumference) after at least six months (randomised controlled trials) or one year (in cohorts). Random affects meta-analyses, subgroups, sensitivity analyses, and meta-regression was done. Meta-analysis of data from the trials suggested that diets lower in total fat were associated with lower relative body weight. The study discussed in detail that lower weight gain in the low fat arm compared with the control arm was consistent across trials, but the size of the effect varied. Meta-regression suggested that greater reduction in
total fat intake and lower baseline fat intake were associated with greater relative weight loss, explaining most of the heterogeneity. The significant effect of a low fat diet on weight was not lost in sensitivity analyses (including removing trials that expended greater time and attention on low fat groups). Lower total fat intake also led to lower body mass index and waist circumference. Hence, the study concluded that lower total fat intake leads to small but statistically significant and clinically meaningful, sustained reductions in body weight in adults in studies with baseline fat intakes of 28-43% of energy intake and durations from six months to over eight years.

Gulati et al. (2013) tried to assess knowledge of, attitude towards and practice of nutrition, physical activity and other lifestyle practices in a nationally representative sample of urban children and mothers in India. A cross-sectional observational study of 1,800 children aged 9-18 years and their mothers, using qualitative (focus group) and quantitative (semi-structured survey) data. It was found that the overall prevalence of overweight/obesity among the children was 19.2% in males and 18.1% in females; 64.8% of mothers were either overweight or obese. Household family income, related socioeconomic factors, and overweight in mothers were most significantly associated with obesity in children. Dietary consumption patterns (snacking, fast food etc.) showed a marked association between mothers and children. Focus group discussion revealed several interesting attitudes and misconceptions among children ('home-cooked food is old fashioned') and mothers ('a child with chubby cheeks is healthy, not fat'). This study further highlights the poor knowledge, faulty attitudes and practices of urban Asian Indian mothers and their children in a highly correlated manner. These knowledge gaps must be addressed to formulate effective strategies for the prevention of obesity and related metabolic disorders.

Sabin et al. (2014) emphasised that Waist circumference (WC) measurement is a useful tool in the assessment of overweight/obese individuals, but standard measures may miss an apron of 'overhanging' fat (termed 'panniculus'). The objective of this study was to assess whether, in clinically overweight/obese youth, 'pannicular' WC better correlates with fat mass than a standard WC measurement. Standard and pannicular WC, alongside body composition (BC) measures, were collected from 181 consultations on 127 overweight and obese children/adolescents (52% male; mean (standard deviation) age 12.5
(3.4) years). The findings of the study gave good evidence that Standard and pannicular WC were highly correlated \((r = 0.95)\). Correlation coefficients with measures of BC were generally greater for pannicular than standard WC.

### 2.3 Causes of Obesity

Forbes (1987) reviewed studies done on human subjects who were overfed under controlled conditions for periods ranging from 2 to 12 weeks. They showed that the energy cost of induced weight gain is a function of initial body weight and of lean body mass, body fat and percentage body fat. Therefore, bigger and fatter people need to eat more to gain a given amount of weight than those who are thin. A likely explanation is that obese individuals tend to put on a large proportion of fat, a high energy tissue, whereas thin people tend to gain more lean, a low energy tissue.

Barrier (1989) revealed that highly palatable but categorically concentrated foods i.e. high in fat and sugar, low in bulk and fibre are readily available and when consumed regularly may promote obesity. There is evidence that eating a diet high in fat or sugar will result in obesity even when the calories consumed are not excessive.

Kayman and Stern (1990) interviewed obese women who regained weight after successful weight reduction (relapsers) and formerly obese, average weight women, who maintained their weight (maintainers). The study found that only 34% of the relapsers exercised, 70% rate in response to emotions and only 10% confronted problems directly.

Leibel et al. (1992) concluded that diets rich in fat may promote obesity by leading to a greater deposition of adipose tissue triglycerides than do iso-energetic diets with less fat.

Anderson (1993 e) provided theory that a strong, pleasant, sweet taste and at the same time deliver energy when ingested. Their effects on food intake and selection may therefore be a result of both their hedonic and their physiologic features. The theory that appetite signals arising from sugars are different from those arising from other carbohydrates because of sugars' sweetness has led to the hypothesis that sugars are a cause of excessive energy intake and obesity.

Gold (1993) concerned with subjects of Binge Eating Disorder consumed a greater percentage of energy as fat and a lesser percentage as protein than did subjects without
Binge Eating Disorder. There were no differences in macronutrient composition of food choices between groups in the normal meal.

Herman et al. (1994) confronted with an anxiety-producing threat to self-esteem, dieters increase their food consumption. The study suggested that increased eating temporarily counteracts or masks dysphoria for the dieter; externality or stimulus sensitivity theories propose that distress shifts the dieter's attention to external stimulus properties (e.g., taste) and to activities stimulated by such external cues.

Wurtman (1994) reported that elevated preferences for sugar or high fat foods were linked with obesity and weight gain. Frequency of meals also affects nutrient utilization i.e. frequent small meals increase the deposition of calories in the body, hence leading to overweight.

Anderson et al. (1995) examined the fiber intake of normal and obese adults and found that the total fiber intake in grams was significantly higher in the lean group. A high fiber diet may help to promote a negative energy balance by causing early satiety secondary to gastric distention.

Devlin et al. (1996) laid stress upon genetic effects, some mediated by eating behavior, contribute importantly to the potential for obesity, the expression of which is promoted by environmental factors that increase the availability of calorically dense foods and discourage activity. There appear to be behaviourally distinct subsets of obese persons who display particular patterns of disordered eating and elevated rates of psychopathology. Although successful obesity treatment is associated with clear health benefits and available treatments offer benefit to some, relapse remains the rule.

Morel (1996) made an attempt to study the dietetic treatment which is often sufficient in patients with moderate to severe overweight (BMI > 27 to 39 kg/m2). This includes identification of bad habits by evaluation of nutritional behavior over 3 or 7 days. The most frequent mistakes are the jumping of a meal (mostly breakfast) and nibbling of snacks rich in fat between meals and omission of hypo-caloric and voluminous food like fruit and vegetables. The lacking sensation of saturation which is fostered by rapid and automatic food intake, may also contribute to the maintenance of overweight.

Drewnowski (1997) examined sensory responses to the taste, smell, and texture of foods help determine food preferences and eating habits. There are multiple links between
taste perceptions, taste preferences, food preferences, and food choices and the amount of food consumed. Taste responses are influenced by a range of genetic, physiological, and metabolic variables. The impact of taste factors on food intake further depends on sex and age and is modulated by obesity, eating disorders, and other pathologies of eating behavior.

Lissner (1997) undertook a study in order to describe dietary intakes of obese and non-obese women (age 20-40 years); to assess dietary restraint, disinhibition, and hunger and determine which of the factors are independently associated with obesity. In absolute and relative terms, fat intake was higher and alcohol intake was lower in the obese subjects. Disinhibition is associated with both obesity and high-energy intakes and is therefore an important factor to consider in the treatment of women with obesity.

Cox et al. (1998) establish the difference between lean subjects and subjects with obesity in subjective reports of predominant taste and texture attributes of common foods. It was found that lean subjects assigned higher scores to fruits and vegetables, to foods self-classified as sweet and as salty /savory. The study found that subjects with obesity associated coarse, slippery, tough, and fatty textures with "dislike extremely," whereas lean subjects associated grainy, moist, doughy, and fibrous texture with "like extremely."

Cachelin et al. (1998) conducted a study to examine beliefs regarding reasons for weight gain, likely responses to weight loss relapse, notions of reasonable weight loss, and correlations between beliefs and attitudes in a large nonclinical sample of men and women with obesity.

Straub, Brandau (1998) described overeating episodes of overweight women, who weight cycle, were compared with women of normal weight. Repeated overeating can be a major source of excess calories that may lead to weight gain in women who have weight cycled.

Heitmann and Lissner (1998) showed a greater underreporting of energy than of protein, this was most common in the obese subjects. Snack-type foods may be preferentially forgotten when obese people omit food items in dietary reporting. These results seem to agree with the general assumption that obese people tend to underreport fatty foods and foods rich in carbohydrates rather than underreport their total dietary intake.
Cutting et al. (1999) seen that obese parents are more likely to have obese children. Parents provide both the genes and eating environment for their children and familial patterns of adiposity are the result of gene-environment interactions. Among children whose both parents have healthy weights, only 14% become obese. But in families where both parents are obese, nearly 70% of children follow in the footsteps of the adults.

Greenberg (1999) analyzed the frequency of consuming restaurant food has been positively associated with increased body fatness in adults. The increasing incidence of dining may therefore help explain the rising prevalence of obesity.

Grundy (1999) analyzed a high proportion of fat energy to total energy favors the development of several chronic diseases. Among these are obesity, coronary heart disease, diabetes, and cancer. The theory that a high proportion of fat relative to other nutrients promotes the development of obesity is founded on research with experimental animals and in human population surveys. The results of the findings revealed that beyond the change, a balanced ratio of unsaturated fatty acids to carbohydrate leading to fat intake of approximately 30% of total energy seems appropriate for the average adult.

McCrorry et al. (1999) suggested that a high variety of sweets, snacks, condiments and carbohydrates coupled with a low variety of vegetables promotes long-term increases in energy intake and body fatness.

Heini (2000) discussed that weight gain, even within the range of normal weight, is detrimental for health. The claimed long-term benefit of intentional weight loss is mainly based on a few observational trials, confounding intentional and non-intentional weight loss. The few data on obesity-related diseases prevented by intentional weight reduction have not been replicated. There is no intention to question the increased risk of overweight on morbidity and the need for preventing weight gain in our population. Besides well-known consequences secondary to rapid weight loss, e.g. gallstones and electrolyte disorders, some new aspects or more debated issues are discussed. Hence, there is no conclusive evidence of adverse pathophysiological effects from weight cycling. Repeated dieting has been associated with eating disorders, although the cause-effect relationship has not been well established.

Dyck (2000) studied the consumption of high-fat diets appear to be strongly implicated in the development of obesity. Evidence that fat oxidation does not adjust
rapidly to acute increases in dietary fat, as well as a decreased capacity to oxidize fat in the postprandial state in the obese, suggest that diets high in fat may lead to the accumulation of fat stores.

Krause (2000) based on refeeding which is associated with a supra-normal tissue response to nutrients. This response is characterized by “repletion reaction” that includes generalized increased substrate utilization with adaptive hyperlipogenesis in adipose tissue and liver. In adipose tissue, this hyperlipogenesis is characterized by a marked production of triglycerides and carbon dioxide from glucose. The rapid transfer of glucose into the tissues, enhanced by increased insulin levels plus greater tissue insulin sensitivity, may increase lipogenesis and lower blood glucose levels, which may enhance hunger and stimulate greater food intake.

Lyznicki et al. (2001) found that increasing evidence suggests that obesity is not a simple problem of will power or self-control, but a complex disorder involving appetite regulation and energy metabolism that is associated with a variety of co-morbid conditions. Although its etiology is not clearly established, genetic, metabolic, biochemical, cultural and psychosocial factors contribute to obesity. In most cases, the increasing prevalence of overweight and obesity reflects changes in society and behaviours over the past 20-30 years.

Jahns et al. (2001) noted that the prevalence of snacking has increased in all age groups. The average size of snacks and energy per snack remained relatively constant; however, the number of snacking occasions increased significantly, therefore increasing the average daily energy from snacks. Compared with non-snack eating occasions, the nutrient contribution of snacks decreased in calcium density and increased in energy density and proportion of energy from fat.

Jeffery and Story (2001) examined obesity which has increased dramatically over the past two decades. The current epidemic of obesity is caused largely by an environment that promotes excessive food intake and discourages physical activity. The study discussed the recent trends in food supply, eating out, physical activity, and inactivity, as well as advertising and promotion of food items are at contributory factors.

Ebbeling et al. (2002) made an attempt to study the obesity measures and its impact on children. In the study, obesity in childhood causes a wide range of serious
complications, and increases the risk of premature illness and raising public-health concerns. The Results of study showed new insights into the physiological basis of bodyweight regulation. However, treatment for childhood obesity remains largely ineffective. Further, the study viewed that the childhood obesity epidemic could be primarily attributed to adverse environmental factors.

Jones G Spence (2003) studied that while caloric consumption has steadily increased, daily physical activity has significantly declined for several reasons. First, there has been an increased reliance on motor vehicles for transportation. In addition, more workers now have sedentary jobs because of the continual decline in manufacturing and other physically demanding types of labour. The proliferation of modern technology, such as video games and computers, the increase in number of hours people watch television, and our propensity for convenience all contribute to our sedentary lifestyles.

Luke et al. (2004) analysed that Americans live in an environment that promotes obesity. Food is in abundance and portion sizes have increased. US studies showed that of children between 7 and 14 years of age, only 46% met the recommended daily intake for grain, 20% for vegetables, 5% for fruit, 9% for dairy, and 26% for meat. Moreover, a large proportion of total caloric intake came from fat and added sugar, accounting for more than 46% of the total calories. Another trend in nutrition that have attributed to the overconsumption in calories are the increased consumption of soda and juice. Only 2% of school-aged children currently meet the number of servings suggested in the Food Guide Pyramid. These poor dietary habits follow these children into adolescence and adulthood, leading to overweight and obese adults.

Ribisl, (2004) described that the distribution of body fat has significant implications for health. Central or visceral adiposity increases the risk for cardiovascular and other diseases, independent of obesity. Individuals with this characteristic are at the highest risk for developing type II diabetes, metabolic syndrome, and subsequent cardiovascular complications, including retinopathy, nephropathy, neuropathy, macular degeneration, and cardiovascular disease.

Agrawal (2005) examined the changes in BMI status of women according to lifestyle and dietary habits and impact of BMI on their health status. The study was based on primary data collected from 329 women on BMI, WHR, dietary habits, lifestyle, and
health problems as a follow-up of NFHS-2 Delhi sample. Information was collected. The findings of the result revealed that women who are less involved in physical activities and frequently consumes more sugary and fatty items had experienced significant increase in BMI status and perceived worst health status but found significantly higher among obese women than overweight and normal women. Therefore, the study concluded that there was need to recognize the gravity of problem and incorporate obesity in the general health system.

Peterson (2005) investigated that the rise of global obesity is thought to be a by-product of environmental and behavioural changes linked to economic development, modernization, and urbanization. Paradoxically, obesity often coexists with a substantial level of malnutrition.

Barbara et al. (2005) revealed that individuals who were undergoing weight gain by definition have an energy imbalance. This imbalance could be caused either by a problem in the regulation of food intake or by defective or diminished energy expenditure, resulting in a more efficient use of calories. Thus, a low rate of energy expenditure may contribute to weight gain.

Odom et al. (2006) highlighted the current literature on the theories of causes, contributing factors, assessment and diagnosis, comorbid conditions associated with, and current treatments for overweight and obesity. Further, study assessed and identifies those who are or are at risk for overweight and obesity on the basis of BMI characteristic. The study found the prevalence of overweight and obesity among women in the United States has reached the point where it is more common than a normal body weight. The combined prevalence of overweight and obesity in women over the age of twenty years is about 51%. Therefore, the study showed that many overweight and obese patients are not counselled to lose weight and Obesity has become a growing epidemic that affects women more often than men. Further, current treatment options include lifestyle modification; behaviour therapy, pharmacologic treatment, and surgery are taken into consideration for the study. The study suggested all healthcare providers should assess all women for overweight and obesity using the BMI, and offer appropriate counselling as needed at each patient encounter, regardless of the presenting problem.
Bleich et al. (2011) examined the factors related to energy intake, energy expenditure and obesity among children and adolescents and various unique determinants of energy imbalance among demographic groups at higher risk for obesity. For the purpose, the study reviewed 26 studies. Cross-sectional and longitudinal studies suggest that the primary determinant of energy imbalance at both the population and the individual levels is not definitive. The results of the study found the relative contribution of energy intake and energy expenditure to obesity in the paediatric population and there is no consensus on the main driver of secular trends on weight gain among US children and adolescents. Further, the study considered that energy intake or expenditure is the dominant contributor to childhood obesity. The findings suggest that there is wide variation in data quality between studies and should aim to improve the accuracy of measures of energy intake, expenditure and their net balance over time.

Misra et al. (2011) reviewed secular trends in food groups and nutrient intake, and implications for DR-NCDs in India so as to understand optimal choices for healthy diets for the prevention of DR-NCDs. The literature search was carried out in PubMed (National Library of Medicine, Bethesda, MD, USA) and Google Scholar search engines up to April 2011. Nutrition transition over the past 30 years (1973–2004), has resulted in a 7% decrease in energy derived from carbohydrates and a 6% increase in energy derived from fats. Further, a decreasing intake of coarse cereals, pulses, fruits and vegetables, an increasing intake of meat products and salt, coupled with declining levels of physical activity due to rapid urbanization have resulted in escalating levels of obesity, atherogenic dyslipidemia, subclinical inflammation, metabolic syndrome, type 2 diabetes mellitus, and coronary heart disease in Indians. The study suggested that adverse perinatal events due to maternal nutritional deprivation may cause low-birth weight infants, which, coupled with early childhood “catch-up growth”, leads to obesity in early childhood, thus predisposing to NCDs later in life.

Bansal et al. (2013) reported lifestyle factors being the important determinant of the obesity. Cross-sectional study involving randomly selected 580 students in five affluent schools of Jaipur. It was found that Prevalence of obesity was high in girls. Overall prevalence among girls and boys was 6.57% and 5.11% respectively. Life style factors (dietary habits) increases the risk of obesity. The study showed that reduced opportunities
for physical work and playtime could explain higher risks of getting obese among girls. The two significant factors were having regular meals outside home and watching of TV/being on computer for more than 3 hours daily. Foods normally available in restaurants are spicy and oil rich and contribute in overweight and obesity. It was demonstrated that this factor was a significant risk factor for obesity. The study concluded that changing lifestyle factor is leading to an increased incidence of overweight and obesity in children and adolescents which leads to continued risk during the adulthood predisposing to an array of diseases and disorders.

Ghosh et al. (2015) community-based study was undertaken for better perception of the prevalence and correlates of obesity in an adolescent urban community in Katihar, Bihar. A cross-sectional study was conducted among urban adolescents. The study out of 400 adolescent participants found that 21% were overweight or obese showed that there was a significant association between less consumption of vegetable foods, fruits, meals cooked outside the home, alcohol consumption, yoga practice, socioeconomic status, and the occurrence of overweight/obesity in the adolescents. Community-based studies are required to highlight the problem of obesity among urban adolescents by a comprehensive approach.

Kar SS and Kar SS (2015) described in their study that overweight and obesity are caused by numerous social and environmental factors that influence people's food habit and physical activity. Role of primary or secondary prevention is the mainstay plan for controlling this epidemic.

2.4 Implications of Obesity

Saether (1994) showed that women with eating disorders scored higher in anxiety, hostility and detachment, and lower in socialization than the women without eating disorders.

Kawachi (1995) suggested that weight gain itself, even if persons remain within the "normal" weight range, also increases the risk of medical illnesses and premature death. Persons who gain 5.0 to 7.9 kg as adults are 1.9 times more likely to develop type II diabetes mellitus and 1.25 times more likely to develop coronary heart disease than those who lose weight or maintain a stable weight after age 18 years. Gaining 11 to 20 kg or more in adulthood increases the risk of ischemic stroke 1.69 to 2.52 times. In addition to its
adverse effects on disease outcomes, weight gain also impairs physical functioning, reduces quality of life, and is associated with poor mental health.

Matsuzawa et al. (1995) noted that the incidence of metabolic complications among equally obese subjects differs depending on their physique and there has been more scientific assessment in recent years that complications such as diabetes mellitus or hyperlipidemia are related to adipose tissue distribution. It was found that the patients with accumulation of fat in the abdominal cavity have a higher incidence of complication. Disorders of glucose and lipid metabolism (like hypertension) were found to be more marked in the visceral fat obesity than subcutaneous fat obesity.

Mertens (1995) showed an association between body mass index and blood pressure in normal weight and overweight patients. Weight gain in adult life especially seems to be an important risk factor for the development of hypertension. Weight loss has been recommended for the obese hypertensive patient and has been shown to be the most effective non-pharmacological treatment approach. In recent years, a modest weight loss, defined as a weight loss of 5% to 10% of baseline weight, has received increasing attention as a new treatment strategy for overweight and obese patients. A modest weight loss can normalize blood pressure levels even without reaching ideal weight.

Nagata et al. (1999) stated that the prevalence of personality disorders (PD) was assessed in patients with eating disorders, where 51% met the criteria for at least one Personality Disorder. The patients with personality disorders had more severe clinical features in terms of bulimic behaviors, concurrent depressive, anxious, and obsessive-compulsive symptoms, and psychopathology related to eating disorders compared to the patients without any personality disorder.

Head and Hamilton et al. (1995) assessed the effects of weight on various areas of life in people with varying weights. The results of the study indicated that the impact of weight generally worsened as the patients' size increased. There were significant gender differences, with women showing greater impact of weight on self-esteem and social life compared with men.

Carpenter et al. (1997) Relative body weight was found to be associated with major depression, suicide attempts, and suicide ideation. Among women, increased Body Mass Index was associated with both major depression and suicide ideation. Disturbance in body
image has long been noted as one of the most distressing psychological factors for obese individuals.

Lissner (1997) undertook a study in order to describe dietary intakes of obese and non-obese women (age 20-40 years); to assess dietary restraint, disinhibition, and hunger and determine which of the factors are independently associated with obesity. In absolute and relative terms, fat intake was higher and alcohol intake was lower in the obese subjects. Disinhibition is associated with both obesity and high-energy intakes and is therefore an important factor to consider in the treatment of women with obesity.

Spring and Garfield et al. (1997) showed similar rates of obesity, women more frequently engage in weight loss efforts, with potentially adverse health consequences. Results indicate that, for both genders, satisfaction with bodyweight and shape decreased BMI increased. Women, however, showed significantly greater body and weight dissatisfaction than men at most weight categories. As body mass index increased, women became disproportionately more dissatisfied: both normal-weight and overweight women expressed greater dissatisfaction than comparable men.

Rosmond (1998) mentioned that abdominal obesity is associated with serious, prevalent diseases in both men and women. Body Mass Index (BMI) was associated with use of anxiolytics, anti-depressive drugs, various sleeping disturbances, and a low degree of life satisfaction. The Waist-Hip Ratio correlated with dyspepsia, sleeping problems, and use of anti-depressive drugs. Therefore, elevated BMI (obesity) and elevated Waist-Hip Ratio (central fat distribution) are associated in different ways with symptoms of psychiatric ill-health in women.

Rosmond and Lapidus (1998) suggested that psychiatric symptoms are associated with obesity and abdominal distribution of body fat in women. Registrations of symptoms of depression and anxiety, sleep disturbances, psychosomatic disease as well as degree of life satisfaction increased with increasing body mass index (BMI) and the waist/hip circumference ratio (WHR).

Berino (1998) assessed whether an energy-restricted or fat-restricted diet was more effective at promoting weight loss, improving eating behaviors, and reducing barriers to dietary adherence. Results showed that subjects in the energy-restricted condition lost over twice as much weight as those in the fat-restricted group (11.5 kg vs. 5.2 kg). Additionally,
subjects in the low-energy condition had greater improvements in eating behavior scores, enhanced feelings of well ness, a greater distaste for dietary fat, and no more pronounced feelings of deprivation than did those in the fat-restricted condition.

Mulrow (1998) made an emphasis that the people who are more than 20% overweight have prevalence of hyperlipidemia, hypertension, and diabetes that are between 1.5 and 3.5 times higher than those people whose weight is normal. Other complications associated with obesity include osteoarthritis, joint pain, gall bladder disease, sleep apnea, respiratory impairment, diminished mobility and psychosocial distress.

Rand (1999) found that 87% of the subjects considered their own body size socially acceptable. This finding applied to both genders in all age groups and subjects. Even among obese subjects, 48% considered their own body size socially acceptable, though it did not match their ideal.

Cargill et al. (1999) conducted to examine the relationships between binge eating, depression, body image, and self-efficacy. Based on related research, it was hypothesized that depression and negative body image would be greater for binge eaters whereas weight self-efficacy would be lower. The study also indicated that increased perceptions of poor body image were significantly related to binge eating. Body image, particularly characterized by a sense of shame and concern with public appearance, had the strongest relationship to binge eating among all the factors examined in this study.

Masheb and Grilo et al. (2000) examined the associations among onset of obesity, body dissatisfaction, and psychological functioning in women with Binge Eating Disorder (BED). It was found that patients with earlier onset of obesity reported more dissatisfaction with body size than patients with later onset of obesity.

Greenberg (1999) analyzed the frequency of consuming restaurant food has been positively associated with increased body fatness in adults. The increasing incidence of dining may therefore help explain the rising prevalence of obesity.

Strein (2000) correlated personality with overeating and his results were consistent with psychosomatic theory, which focuses on emotional eating as the result of confusion and apprehension in recognizing and accurately responding to emotional and visceral states related to hunger and satiety. Subjects with obesity scored significantly higher for reported emotional eating (Cox et al., 1998).
Frank et al. (2001) examined individual dietary and lifestyle factors in relation to type II diabetes, but the combined effects of these factors are largely unknown. The study was based on 84,941 female nurses from 1980 to 1996 and these women were free of diagnosed cardiovascular disease, diabetes, and cancer at base line. Information about their diet and lifestyle was updated periodically. The study found the results that overweight or obesity was the single most important predictor of diabetes. Lack of exercise, a poor diet, current smoking, and abstinence from alcohol use were all associated with a significantly increased risk of diabetes, even after adjustment for the body-mass index. Further, as compared with the rest of the cohort, women in the low-risk group (3.4 percent of the women) had a relative risk of diabetes of 0.09. At last, it was concluded that the majority of cases of type II diabetes could be prevented by the adoption of a healthier lifestyle.

Thakur et al. (2001) stated that hypertension occurs more commonly in obese than in lean persons at virtually every age. A variety of endocrine, genetic, and metabolic mechanisms have been linked to the development of obesity hypertension. Weight loss, even in modest decrements, is effective in reducing obesity- hypertension, possibly by ameliorating several of the proposed pathophysiological mechanisms.

Castro and Avina (2002) studied that physiological studies have documented that obesity decreases chest wall compliance and increases airway resistance and the work of breathing. Respiratory studies in obese individuals have shown a decrease in forced vital capacity and forced expiratory volume at one second compared with normal weight controls.

Castro and Avina (2002) discussed that excess weight gain in pregnancy can be difficult to shed postpartum, and is an additional contributing factor in parous women. Many women tend to become overweight or obese during pregnancy, and many are already obese when they become pregnant. In the study, obesity increases morbidity for both the mother and the foetus. Overweight pregnant women have higher incidences of hypertension, pre-eclampsia, toxaemia, gestational diabetes, urinary infections, caesarean delivery and subsequent wound infections, endometritis, and increased hospitalization. Overweight pregnant women also have an increased risk of venous thromboembolic disease and respiratory complications. Obese women have a 70% increase in postpartum haemorrhage. Surgical procedures compound these risks.
Klauer and Aronne (2002a) investigated the disease control estimates that obesity and related lifestyle issues caused 3,000,000 deaths in 2002. In a study to predict years lost due to obesity, the results showed that as compared to a group of normal 38 weight participants, the overweight group had 4 to 5 more deaths per 100 people, and the obese group had 10-11 more deaths than the normal weight group per 100 people. This represents a 115% (women) and 81% (men) increased risk for death in the obese group. The decreases in life expectancy were reflected in increased probabilities of premature death (defined as death before the age of 70 years). The probability of death increased with each higher category of BMI group (i.e. normal weight, overweight, and obese).

Klauer and Aronne (2002b) stated that The American Heart Association has cited obesity as a major modifiable risk factor for coronary heart disease. Compared with their lean counterparts, obese women have an increased mortality risk that rises in proportion to the degree of obesity. The risk of developing coronary heart disease is increased threefold in women with a BMI greater than 29 compared to BMI less than 21.

Klauer & Aronne, (2002c) found that risk for disease progression is caused by excess visceral adipose tissue; simply being overweight is not the culprit. It is not the total amount of body fat that creates this problem, but the location of the body fat. The Gothenberg, Sweden, longitudinal study showed that increased waist size was positively correlated with an increased incidence of myocardial infarction, angina, and stroke independent of age and BMI.

Klauer and Aronne (2002d) studied that women are disproportionately stigmatized by the disease, given society’s premium of female physical attractiveness.

Pasquali et al. (2003) found the significant associations are seen in reproductive endocrinology between excess body fat and irregular menstrual cycles, reduced spontaneous and induced fertility, increased risk for miscarriage and hormone-sensitive carcinomas. Distinct changes in circulating sex hormones appear to underline these abnormalities. The study also discussed that 43% of women affected by various menstrual disorders, infertility and frequent miscarriages were either overweight or obese. It is also known that the presence of an ovulatory cycles, oligo-amenorrhea and hirsutism, either separately or in association, were significantly higher in obese than in normal-weight women.
Peeters et al. (2003) found that among 40-year-old non-smokers without previously diagnosed cardiovascular disease, overweight was associated with a 3-year decrease in life expectancy and obesity was associated with a 7-year decrease in life expectancy for women and a 6-year life expectancy decrease in men.

Felson (2004) reviewed that studies have shown that obese women are at a higher risk of osteoarthritis of the hand than women who are thinner. This suggests that the effect of obesity on osteoarthritis is mediated not only by excess loading on the joints, but also by metabolic or inflammatory factors that may accompany obesity. These metabolic factors may have deleterious effects on the joint. Arthritis, which typically appears in older persons, is attributed in large to the cumulative effects of wear and tear on the joints. It is reasonable to assume that the greater the body burden of fat, the greater the trauma to the joints with passage of time.

Pikholz et al. (2004) estimated the level of under-reporting of energy intake by gender, age, ethnicity and body size (normal, overweight, obese) in the 1997 National Nutrition Survey (NNS97) in New Zealand. Data were from 4,258 participants (1,808 men and 2,450 women aged 15 years and over) who completed the 24-hour diet recall. Under-reporting was assessed using the ratio of reported energy intake to estimated resting metabolic rate. The findings showed that there were no significant differences in mean EI: RM Rest between ethnic groups for men. Mean EI: RM Rest for women were: Maori 1.46, European 1.29, and Pacific 1.37 (p<0.01). A larger body size was associated with a significantly lower EI: RM Rest especially for women. Percentages of 'definite' under-reporters (individual EI: RM Rest <0.9) were as follows: men 12%, women 21%; Europeans 16%, Maori 23% and Pacific 26%; normal weight (11%), overweight (19%) and obese (27%) participants; and from 10% in the youngest to 23% in the oldest age group (p<0.001 for all results). The study concluded that women, older people and obese people under-reported more than men, younger people and non-obese people.

Rogge et al. (2004) found that obesity is regarded as the most preventable causes of morbidity and mortality, primarily because of the links to hypertension, coronary artery disease, stroke and diabetes. Obesity is a risk factor for major causes of death, including cardiovascular disease, numerous types of cancer, and diabetes. It is also linked with markedly diminished life expectancy. It is further found that obese women, who are at a
higher risk of breast and endometrial cancer, undergo screening for breast and cervical cancer less frequently than non-obese women. Obese patients may choose to forego early or preventative healthcare so as to avoid oppressive encounters with clinicians.

Powell et al. (2004) investigated that obesity has been identified as the main preventable risk factor for developing osteoarthritis. People who are overweight have a higher prevalence of osteoarthritis of the knee than those who are not. The risk for osteoarthritis increases by 35% for every 5 kg of excess weight. The relation of osteoarthritis of the knee to obesity is stronger in women than in men for reasons that are unknown.

Shepard (2004) analysed the various consequences of childhood obesity include a prevalence of atherosclerotic plaques, hypertension, and an adverse lipid profile, with poor self-image that limits participation in physical activity. The study was conducted between the ages of 2 and 39 years of age. The study found that the obese child suffered from long-term risk of cardiovascular, Type II diabetes mellitus, hyperlipidemia, and hypertension, along with a growing prevalence of atherosclerotic lesions in the aorta and coronary blood vessels, hyperinsulinemia, polycystic ovarian syndrome, hypothalamic state, and growth hormone deficiency. Therefore, various remedies have given by the use of behavioural modification.

Shepard (2004) discussed risk factors associated with childhood and adolescent overweight and obesity include high birth weight, maternal diabetes, and a family history of obesity. If one parent is obese, there is a three-fold increase for the child to become obese in adulthood. If both parents are obese, the risk is ten times greater. Before age 3, parental weight is more of a risk factor for developing obesity that the child’s actual weight. Low income, low education, absence of family meals, and sedentary behaviour are also linked with the development of overweight and obesity in children.

Kumar et al. (2005) assessed that cholelithiasis is six times more common in obese than in lean subjects. The mechanism is mainly an increase in total body cholesterol, increased cholesterol turnover, and augmented biliary excretion of cholesterol in the bile, which in turn predisposes to the formation of cholesterol-rich gallstones, techniques and changes in the urban environment that encourage and active lifestyle and less sedentary behaviour. Further, the study discussed treatment of obesity by reducing in the number of
calories consumed with emphasis on consumption of raw fruits and vegetables, protein, fibre, and should be sufficient in nutrients and vitamins and decreasing intake of processed foods, sugars, salts, fats, oils, and nutritionally-dense foods should be encouraged.

Peterson (2005) stated that more than 4,000,000 deaths and one in five cancer deaths can be attributed to obesity annually.

DeMattia and Denney (2008) focussed on community characteristics that interact with children’s weight status. In the study, obesity is linked to increased risks of diseases such as type II diabetes, liver disease, hypertension, and heart disease. The study was based on the ecological model of Childhood Overweight allows one to consider how an individual child’s weight is influenced by characteristics ranging from the individual to the society. Further, the study reviewed community based programs and whether they are successfully slowing the rate of childhood obesity, including demonstrations of recipe preparation, community gardens, and school-based curricula. However, it is concluded that intervention efforts and funding priorities focusing on high-risk populations of low-income overweight women which might be true primary prevention of childhood obesity.

Singh (2011) made an attempt to study the level of anxiety among prospective teachers and its relationship with gender and educational background of prospective teachers. From the study, the author found the problems related with fast changing social structure, communal and racial prejudices, the dangers of war economic hardships, ecological imbalance etc. Further, these problems had led to stress, anxiety and unknown fear in the human mind.

Guedes et al. (2013) investigate the relationship between body composition and the severity of anxiety/depressive symptoms in overweight and obese individuals with Metabolic Syndrome (MS). Fifty patients, 18–50 years old, overweight or obese and with the diagnosis of MS based on the International Diabetes Federation (IDF) criteria were selected for this study. It was found that no correlation was found between depressive symptoms and BMI, WC and WHR. Additionally, no correlation was found among anxiety symptoms and BMI, and WHR. In contrast, a significant correlation was found between percentage of total fat and anxiety. At last, a study concluded that in individuals with MS, the percentage of body fat, and not central fat, BMI, WC, or WHR, was associated with an increased severity of anxiety and depressive symptoms. In contrast, total lean mass was
strongly associated with fewer anxiety/depressive symptoms, suggesting that body composition might be related to psychiatric comorbidity in overweight individuals with MS.

Buchmueller and Johar (2015) made an attempt to investigate the relationship between obesity and health care expenditure in Australia, where the rate of obesity has tripled in the last three decades. It was found that one in four Australians is considered obese, defined as having a body mass index (BMI, kg/m2) of 30 or over. The analysis is based on a random sample survey of over 2,40,000 adults aged 45 and over that is linked at the individual-level to comprehensive administrative health care claims for the period 2006-2009. They found that the health expenditures of those with a BMI between 30 and 35 (obese type I) are 19% higher and expenditures of those with BMI greater than 35 (obese type II/III) are 51% higher. The obesity-related health expenditures are higher for obese type I women than men. Furthermore they found that obesity impacts health expenditures not only through its link to chronic diseases, but also because it increases the cost of recovery from acute health shocks.

Narouze and Souzdalnitski (2015) substantiated in their study that the combination of obesity and pain may worsen a patient's functional status and quality of life. The prevalence of combined obesity and pain was substantial. Good evidence shows that weight reduction can alleviate pain and diminish pain-related functional impairment. This article examines specific pain management approaches for obese patients and reviews novel interventional techniques for treatment of obesity.

2.5 Physical Activity and Energy Expenditure

Exercise is an extremely important part of a weight management program. By increasing lean body mass (LBM) in proportion to fat, exercise helps to balance the loss of lean body mass and reduction of resting metabolic rate (RMR) that inevitably accompany even a well-managed weight reduction program. By lowering glycogen stores, aerobic exercise promotes the use of fat as fuel. Numerous positive side effects include strengthening cardiovascular integrity as well as increasing sensitivity to insulin. The most valuable contributions of exercise are the relief of boredom, increased sense of control and improved sense of well-being.
Coyle et al. (1986) found that the duration of exercise also changes substrates use. As duration of exercise increases (e.g., from 60 to 120 min), muscle glycogen becomes depleted, causing the body to draw on circulating blood glucose as a source of carbohydrate. If blood glucose cannot be maintained within physiological range during exercise, the ability to perform intensity exercise will decrease.

Hill (1987) combined diet and exercise which have shown there is no increase in weight loss in the exercising group over diet alone, an increased loss of body fat does occur. A decrease in body fat does not necessarily mean a decrease in body weight. Initially, physical exercise increases muscle mass, and because lean body mass is denser than the fat it replaces, body weight may not change. With continued exercise, the limited capacity of muscle mass to increase is overcome by the decrease in fat, resulting in a net decrease in body weight. A minimum of two months is needed to obtain any reduction of adipose tissue with adequate training programs.

Bray et al. (1992) increased exercise can result in an energy deficit, and even without diet, exercise alone can be expected to lower weight around 2.5 kg depending on the intensity, duration and type of exercise.

Lichtman, (1992) investigated that some obese persons who fail to lose weight on a diet they state is low in calories actually consume more energy than they report and overestimate their physical activity levels.

Swinburn and Ravussin (1993) examined that the active individuals need more energy (calories) each day than their sedentary counterparts – assuming individuals are the same age, body size and participate in similar non-physically active daily activities. Exercise requires energy to fuel and repair the muscles, thus, meeting one’s energy needs to maintain body weight should be a priority for any athlete or active individual. Energy balance is achieved when the energy consumed (sum of energy from food, supplements and fluids) equals energy expenditure (sum of all the energy expended by the body in movement or to maintain body functions).

Saether (1994) showed that women with eating disorders scored higher in anxiety, hostility and detachment, and lower in socialization than the women without eating disorders. The findings in this study also support the hypothesis that participating in physical activity can have some positive psychological effects. The studies conducted by
Brooks & Mercier, (1994); Brooks & Trimmer, (1995) found that the mix of fuel (protein, fat, carbohydrate) burned during exercise depends primarily on the intensity and duration of the exercise performed, one’s level of fitness, and prior nutritional status. All other conditions being equal, as exercise intensity increases the use of carbohydrate for energy will also increase.

French et al. (1995) Although both overweight and body weight fluctuation are related to chronic disease risk, little is known about the history of and reasons for body weight change in the general population. Women, who had intentionally lost 10 kgs or more, were more likely to report weight losses due to low-calorie diets, exercise and weight loss groups, while women who had unintentionally lost 10 kgs or more, were more likely to report weight losses due to depression or stress.

Darga et al. (1995) examined a physical activity survey. Subjects were grouped by reported exercise levels: low active (850 kcals per week), moderate active (850-1575 kcals per week) and high active (> 1575 kcals per week). Walking accounted for the greatest calorie expenditure (65%). At follow-up, high active patients’ maintained significantly greater weight loss, had a lower percent regain and a significantly greater decrease in total cholesterol than less active patients. The high active group walked more miles than the low and moderate active groups and exercised more days per week.

El-Khoury et al. (1997); Phillips et al. (1993) assessed that protein can also be used for energy at rest and during exercise; however, in well-fed individuals it probably provides <5% of the energy expended.

Gonzalez-Bono (2002) stated that exercise helps us to come" down" from the stress-alert state by lowering the level of adrenal hormones in the blood stream and cutting down their effects on the rest of the body. In one study, researchers found out that letting a moderately depressed patient get out and run relieved the depression as much as psychotherapy would have done.

Bergman and Brooks (1999) made an attempt to study the amount of carbohydrate, fat and protein used for energy during exercise. According to the study, as the duration of exercise increases, the energy contribution of protein increase to maintain blood glucose. Further, the amount of carbohydrate, fat and protein used for energy during exercise depend on when exercise occurs relative to the last meal and the level exercise intensity
performed. In the study, individuals are tested after an overnight fast; the contribution of fat to the energy pool is greater than when the same individuals are tested after a meal. The study found higher intensity exercise (>65% of VO2max) neither prior feeding nor exercise training significantly altered fuel used.

Bergman et al., (1999) inferred fat can be used as a source of energy over a wide range of exercise intensities; however, the proportion of energy contributed by fat decreases as exercise intensity increases. In these circumstances, carbohydrate becomes the dominant fuel source while the contribution from fat decreases.

Skinner et al. (2000) suggests that the amount and distribution of subcutaneous fat strongly aggregates in families, whereas the response to exercise training is characterized by a moderate and more complex pattern of familial resemblance. Thus, it was concluded that familial/ genetic factors are more important in determining the amount and distribution of subcutaneous fat than their responses to exercise training.

Molnar and Livingstone (2000) addressed fitness and physical activity levels of children and adolescents. The three national surveys on large representative samples reported that 60% to 70% of all children were involved in sufficient physical activity according to various definitions. The study proved that children perform large volumes of activity in the lower heart rate zones. It is generally accepted that boys are more active than girls and physical activity declines by age (peak around 13 to 14 years of age). The difference between the physical activity of European and North American children or between children living in different European countries is difficult to judge due to the diversity of methodology and definitions. The study concluded that there is a need to identify more clearly the quantity and type of activity which improves the health and promotes the normal development of children and to improve the methods assessing physical activity.

Larson (2002) reported the physical activity, inactivity, and perception of ideal body size which have emerged as the most important contributory factors to obesity status. Obese adults had significantly lower levels of physical activity, higher inactivity, and a larger perception of ideal body size than the non-obese.

Lyznicki (2001) stated that according to the US Surgeon General, approximately 25% of American adults are completely sedentary, and approximately 70% of US adults
are not regularly physically active and fail to meet the minimal modest amount of exercise associated with disease prevention (at least 30 minutes of continuous or accumulated moderate intensity physical activity five days per week).

Mann et al. (2002) conducted on two groups of 15 female college students aged 16 to 20 years, selected from Punjab Agricultural University, Ludhiana, Punjab, India. The girls were either anaemic (haemoglobin 7.7 g/dl) but energy adequate (AEA), or anaemic (haemoglobin 7.4 g/dl) and energy deficient (AED). It was analysed that there was a significant ($p < .01$) increase in weight, body mass index, mid-upper-arm circumference, and body fat in the AED group after iron-energy supplementation. Haemoglobin, serum iron, transferring saturation, total iron-binding capacity, and unsaturated iron-binding capacity were below normal in both groups; however, after iron and iron-energy supplementation, there was a significant ($p < .01$) increase, and these indices were in the normal range. Furthermore, there was a significant ($p < .01$) increase in exercise time and maximum work load tolerance after iron and iron-energy supplementation. The study concluded that combined energy and iron deficiency had a greater adverse effect on physical work capacity than energy or iron deficiency alone.

Vermorel et al. (2002) assessed the adequacy of breakfast energy supply (BES) and energy expenditure (EE) in adolescents during a school day without or with 2 h of physical education lesson (PEL) in the morning. Sixty adolescents (four groups of 14–16 boys and girls aged 12–16 y) participated in a cross-sectional study. It was found that BES averaged 24.9% (s.d. = 6.1) of daily EE in the four groups of subjects. It covered the mean morning EE on a school day without PEL, but not in a school day with 2 h of PEL in any group. When PEL took place from 8–10 am the cumulative EE exceeded the cumulative pyloric energy flow after 105–150 min that is during the PEL session and the energy deficit increased until lunch. With a light breakfast (BES-1 s.d.) energy deficiency happened after 90 min. The results stressed the need for a heavy breakfast for children and adolescents on the days with PEL in the morning, and a carbohydrate rich snack at 10 am to improve attention, memory and willing participation in physical activities.

Tennefors et al. (2003) measured total energy expenditure (TEE) and total body water (TBW) in healthy Swedish children 9 or 14 months of age. For the study, Total body fat (TBF), sleeping metabolic rate, activity energy expenditure and physical activity level
(PAL) were calculated. The findings revealed that at 9 months of age girls and boys contained 29.6±4.8 and 29.7±4.5% TBF, respectively. At 14 months the corresponding figures were 29.1±4.3 and 28.2±4.3%. There was a significant negative relationship between PAL and %TBF (r=−0.81, P<0.001, n=59). It was also analysed that measured TEE plus calculated energy cost of growth confirm previous estimates that the physiological energy requirements of children 9 and 14 months of age are 15–20% lower than current recommendations for energy intake. Furthermore, there is a relationship between PAL and %TBF is that children with a high TBF content are less physically active than children with less TBF.

McInnis (2003) found that the contributing further to children and adolescents’ inactivity is a decline in physical education in schools and recess. For example, in 1997, only 27% of high school students participated in physical education classes. Again, poor exercise habits tend to follow the child into adolescence and adulthood.

Kumar, Abbas and Fausto (2005) emphasized the pathophysiology of obesity was found in unless otherwise noted. Energy intake from food and energy expenditure from cellular metabolism and exercise are precisely matched over long intervals in healthy adults resulting in stable body fat stores. Energy is continuously expended, and the rate of expenditure varies among persons. The brain and the liver are efficient at controlling nutrient levels based on need. Following ingestion of food, nutrient levels move from the gut into tissues for immediate use or storage. Prior to initiation of a meal, there is a small decrease in plasma glucose of about 12%. The brain initiates a decline in plasma glucose by eliciting a small increase in plasma insulin via the vagus nerve to the pancreas, which precedes the pre-meal decline in glucose. Small physiologic fluctuations of glucose are hypothesized to provide important signals to the brain to elicit meals. There is also evidence that the liver responds to small fluctuations of fatty acids and their metabolites by sending signals to the brain via the vagus nerve, which in turn stimulates food ingestion.

Jakicic and Otto (2005) showed that physical activity is an important component on long-term weight control, and therefore adequate levels of activity were prescribed to combat the obesity epidemic. Although there is evidence that 30 min of moderate-intensity physical activity may improve health outcomes, the amount of physical activity that may be necessary to control body weight may be 30 min/d. There is a growing body of
scientific literature suggesting that at least 60 min of moderate-intensity physical activity may be necessary to maximize weight loss and prevent significant weight regain. Physical activity also appears to have an independent effect on health-related outcomes when compared with body weight, suggesting that adequate levels of activity may counteract the negative influence of body weight on health outcomes. Thus, it is important to target intervention strategies to facilitate the adoption and maintenance of an adequate amount of physical activity to control body weight.

Ma et al. (2005) describe seasonal variation in food intake, physical activity, and body weight in a predominantly overweight population. Most of the study participants were recruited from a health maintenance organization (HMO) in central Massachusetts, USA. Data from 593 participants, aged 20–70, were used for this investigation. The results of the study found that daily caloric intake was higher by 86 kcal/day during the fall compared to the spring. Percentage of calories from carbohydrate, fat and saturated fat showed slight seasonal variation, with a peak in the spring for carbohydrate and in the fall for total fat and saturated fat intake. The lowest physical activity level was observed in the winter and the highest in the spring. Body weight varied by about 1/2 kg throughout the year, with a peak in the winter (P<0.001 winter versus summer). Greater seasonal variation was observed in subjects who were male, middle aged, nonwhite, and less educated. Therefore, it is seen that there is seasonal variation in diet, physical activity and body weight, the magnitude of the change is generally small in this population.

Mahabir et al. (2006) assessed the extent of energy misreporting from the use of a self-administered 7-day diet record (7-DDR) and a widely used food frequency questionnaire (FFQ) compared to total energy expenditure from doubly labeled water (DLW) in a group of postmenopausal women. The study was based on 65 healthy postmenopausal women who were instructed to fill out the National Cancer Institute's (NCI) FFQ and a 7-DDR. Average total energy expenditure using the DLW method was also performed at baseline. The results showed that on average, the women underestimated total energy intake compared to total energy expenditure assessed from DLW by 37% on the 7-DDR and 42% on the FFQ. These findings suggested that the interpretation of findings from the 7-DDR- and FFQ-based energy-disease association studies in postmenopausal women needs further evaluation.
Dufour and Piperita (2008) emphasized on energy expenditure in farming populations living in developing countries, populations generally assumed to have high levels of energy expenditure. To facilitate comparison we express energy expenditure as physical activity level (PAL), i.e. the ratio of total daily energy expenditure to basal metabolic rate. The results indicated that most farmers have PAL values in the moderate physical activity range, but toward the high end of that range. PAL values of male farmers tend to be higher than female, and show greater seasonal variation. These differences are a function of differences in behavior related to social and cultural variables like the organization of work at the household level and perceptions of how food crops should be processed, as well as micro-level ecological factors.

Yunsheng et al. (2009) used to assess diet and to validate other diet assessment instruments. Seventy-nine middle-aged white women completed seven 24HRs over a 14-day period, during which energy expenditure (EE) was determined by the doubly labelled water method (DLW). Mean EE from DLW was 2115 kcal/day. The study found that adjusted 24HR-derived energy intake was lowest at call 1 (1501 kcal/day); significantly higher energy intake was observed at calls 2 and 3 (2246 and 2315 kcal/day, respectively). Energy intake on Friday was significantly lower than on Sunday. Averaging energy intake from the first two calls better approximated true energy expenditure than did the first call, and averaging the first three calls further improved the estimate (p = 0.02 for both comparisons). It was concluded that Energy intake is underreported on the first 24HR. Three 24HRs appear optimal for estimating energy intake.

Delany et al. (2012) threw weight with findings that high body weight in obese individuals leads to high total daily energy expenditure and high activity energy expenditure, which masks the fact that obese are less physically active, which can be influenced by duration or intensity of activity, than in lean individuals.

Golubic et al. (2013) investigated the relationship of body weight and its changes over time with physical activity. The research was based on Population-based prospective cohort study (Norfolk cohort of the European Prospective Investigation into Cancer and Nutrition, EPIC-Norfolk, United Kingdom). Weight and height were measured by standard clinical procedures at baseline and self-reported at 18-month and 10-year follow-ups (calibrated against clinical measures). The study found that Body weight and PA were
inversely associated in cross-sectional analyses. In longitudinal analyses, an increase in weight was associated with higher risk of being inactive 10 years later, after adjusting for baseline activity, 18-month activity, sex, baseline age, prevalent diseases, socioeconomic status, education, smoking, total daily energy intake and alcohol intake. At last, it was concluded that weight gain (during short-, medium- and long-term) is a significant determinant of future physical inactivity independent of baseline weight and activity.

Rowett Research Institute (2013) showed that absolute daily energy expended by obese is higher than that expended by the lean. The total amount of energy required by individuals depends on the level of activity and on their body weight. The more active and heavier they are, the more energy they require.

Bonomi et al. (2013) aimed at analysing the effect of weight loss on PA and AEE. The body weight and PA of 66 overweight and obese subjects were measured at baseline and after 12 weeks of 67% energy restriction. PA was measured using a tri-axial accelerometer for movement registration (Tracmor) and quantified in activity counts. The study discussed that after weight loss subjects were significantly (P<0.05) less sedentary (−26 min/d), and increased the time spent walking (+11 min/d) and bicycling (+4 min/d). However, AEE decreased by 0.6±0.4 MJ/d after weight loss. On average, a 2-hour/day reduction of sedentary time by increasing ambulatory and generic activities was required to restore baseline levels of AEE. In conclusion, after weight loss PA increased but the related metabolic demand did not offset the reduction in AEE due to the lower body weight. Promoting physical activity according to the extent of weight loss might increase successfulness of weight maintenance.

Trigueros et al. (2013) laid emphasis in their study that Pharmacotherapy provides reinforcement for obesity treatment, but should be an adjunctive support to diet, exercise, and lifestyle modification. Functional foods for obesity may also include bioactive fatty acids, phenolic compounds, soybean, plant sterols, dietary calcium, and dietary fibre. This review intends to offer an overview of the present situation of the anti-obesity agents currently used in dietary therapy as well as some functional food ingredients with potentially anti-obesity effects.

Singh et al. (2015) studied levels of physical activity and various measures of obesity and their association in an urban population. One thousand and forty-seven
indivuduals between the ages 25-64 years systematically sampled from a community-based population database were contacted through a house-to-house survey. Anthropological measures collected were height, weight, and waist and hip circumference. It was found that Physical Activity (PA) levels declined with age and the decline was greater among females. The Pearson's correlation coefficient for age against PA among males was found to be negative and weak (r = -0.104) and that among females was found to be similar (r = -0.206). The prevalence of obesity was higher among females (28.8 %) than among males (13.3 %) and the difference was statistically significant. There was a progressive increase in abdominal obesity with age in both genders. The prevalence of overweight and obesity was higher among individuals with low levels of PA as compared to those with high levels of PA. Sedentary behaviour is prevalent in more than half of the current study sample. This was more so with increasing age, female gender and increasing obesity. Habitual moderate physical activity may be beneficial in preventing excess accumulation of fat.

After consulting the available literature related to the present study, it was revealed that no study on evaluation of dietary pattern & physical fitness of working obese women has been done in Punjab.