

# Causes and Psychological Consequences of Childhood Obesity

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## ABSTRACT

Childhood obesity is one of the emerging issue concerning health domain worldwide, which children are made to face with associated complexities while performing their everyday activities of life. According to WHO report in 2015 the toll of obese children was over 42 million worldwide. As per WHO's definition, obesity in general is an abnormal or enhanced fat accumulation i.e., BMI of more than 30. The problem has a wide global extant. The incidence has exceedingly increased since last couple of decades and is constantly on rise. Some key factors that contribute towards the onset of obesity in children include injudicious intake of sugary beverages, high intake of fast food and snacks, individual psychology, dietary habits, physical activity, socio-cultural factors, family, environmental factors, metabolism, genetics and short sleep patterns. Beside the increased risk of multiple acute and chronic medical problems obese children are also faced with hostile psychological in terms of mental and emotional experiences as compared to their normal weight age fellows and peers, which have the probability to persist into adulthood age and therefore affecting quality of life in childhood as well as adulthood. Obese children are more likely to fall a victim to various psychological consequences, anxiety and depression, having low self-esteem, bullying and teasing, stigmatization and ostracizing and other untold emotional problems. In order to avoid negative consequences and implications arising from obesity, necessary preventive actions must start during early phases of life. Without intervention, obese children will likely continue to be obese during adulthood. Obesity is preventable by supportive policy making, environments, schools and communities, regular physical activity and by increasing awareness.

**Keywords:** Childhood obesity, psychological effects, anxiety, depression, policy, awareness

## INTRODUCTION

The childhood obesity is a serious concern and one of the key challenges of 21<sup>st</sup> century. This global problem is increasingly affecting both developed and under developed countries, particularly in urban setup. According to World Health Organization's (WHO) definition, childhood obesity is an abnormal or excessive fat accumulation that may damage health. The problem has global pervasiveness and has increased at an alarming rate. It has been reported that Globally, in 2015, the total number of under five years of age overweighted children were predicted to be more than 42 million<sup>1</sup>. The results from the National Health and Nutrition Examination Survey (NHANES) in 2011-12 indicate in United States the percentage of children and adolescents obesity aged 2-19 was 16.9%, representing a threefold increase since 1970<sup>2</sup>. According to Hales, Carroll, Fryar, Ogden<sup>3</sup>, this percentage is likely to increase up to 18.5%. A study conducted by the Centre for Disease Control and Prevention (CDC), reported that 19.8% of children having ages from 6 to 11 years are obese in the United States<sup>4</sup>. This depicts a drastic increasing trend from the 7% prevalence rate reported back in 1980.

There are a number of key factors which contribute in the childhood obesity such as individual psychology, dietary habits, physical activity, environmental factors, metabolism and genetics.<sup>5-7</sup> The principal cause of the weight gain is the excessive food and beverages intake exceeding the requirement of balanced diet. In addition lack of physical activity and active life style are causes of growing obesity dilemma<sup>8,9</sup>. Therefore, the energy imbalance (triggered by disproportion diet and inactive lifestyle) plays a crucial role in weight gain and obesity among people across the globe<sup>10,11</sup> making it leading preventable cause of death worldwide, with increasing rates in adults and children. The physical activity and dietary habits are directly dependent on the environment provided to the child. The families, friends, social circle, school, caretakers and above all the parents are equally responsible for providing a healthy environment to the child. The children are required to be educated about the harmful effects of bad eating

habits. Awareness about healthy food should be given from time to time with changing dietary needs as children age. Furthermore, the government is also required to launch media campaigns that educate about the harmful effects of sweetened beverages and fast food<sup>12,13</sup>. Leading authorities and organizations working on curtailment of childhood obesity have recommended that in order to have treatment to be long-term and effective, parents shall also be made to act as active participants in children's weight loss.<sup>14</sup> Some other changes like creating a positive healthy environment where children spend most of their time for instance: home and schools can bring a huge difference in the obesity patterns all around the globe. Moreover, the children must be encouraged for a physical activity for at least 60 minutes per day in addition to prompting them to have nutritious food. Eating nutritious food help in the mental and physical growth of a child.<sup>15</sup> In order to avoid negative consequences and implications arising from obesity, necessary preventive actions must start during early phases of life.<sup>16</sup>

The standard calculations to categorise public health depends on Body Mass Index (BMI) system. It is a simple index of weight-for-height, is commonly used to classify underweight, overweight and obesity in adults. As per the Table 1, obesity is defined as people who are overweight and having BMI of 30 or above. "Obesity is a medical condition in which excess body fat accumulate to the extent that it may have a negative effect on health."<sup>1</sup> It is further evaluated in terms of fat distribution via the waist-hip ratio and total cardiovascular risk factors. Based on these calculations by WHO in 2014, the distribution of Obesity across the globe is shown in Fig.1.

Another survey showed in 2015, 600 million adults (12%) and 100 million children were obese in 195 countries. Looking into these surveys the most vulnerable victims are obese children, marking a long-term impact on their social life, physical activities and mental health<sup>17</sup>. Moreover, the obesity in the early years of life can cause major health issues including chronic cardiovascular disease, blood pressure, diabetes, sleep disorders, knee joints problem, asthma and cancer.<sup>17,18</sup> As the obese children are faced

with an increased risk of becoming obese adults therefore, obese adults are always at an increased risk for developing medical conditions including *inter alia* hypertension, Type 2 diabetes, stroke, and cardiovascular disease, which are highly likely to shorten the lifespan. At times, the social circle of the obese children also reacts abnormally and the children may end up in undue teasing and bullying by their peers<sup>19</sup> leading to low self-esteem, depression, anxiety and might end up on ultimate social isolation.<sup>20</sup> The loss of confidence hinders in the mental and physical growth of the children showing their reluctance to participate actively in both curricular and extra-curricular activities. Childhood obesity is also strongly dependent on the socioeconomic factors. A study reported family income as a major factor in comparison to race or ethnicity. Family income is usually foreseen while analysing childhood obesity.<sup>21</sup>

### Literature review

There are a number of researchers extensively putting efforts to bring down the percentage of childhood obesity across the globe.<sup>22</sup> The first step is to identify the group of children facing the key challenges of obesity. There are different organizations carrying out surveys in various countries and report the estimation of current problem. These surveys are more authentic and supported with correct data reporting in developed countries as compared to the surveys carried out in under developed countries.

According to NHANES, the childhood obesity has reached to 18.5%.<sup>23</sup> The distribution of obesity varies from 13.9 to 18.4% among 2 to 11 years old children, as shown in Figure 3. It has been observed that if the children aged from 2 to 19 are divided into three age groups, the trend is always relative i.e. the children who are overweight in early years of life are likely to be overweight in their latter part of life. It is understandable for the age group 2 to 5, for having the lowest percentage of obesity due to their dependence on parents for food. However, changes in the life style of modern world lead to a busy life and lesser healthy practices as before. Therefore, the use of precooked food and decreasing breast-feeding rate is playing a major role in increasing obesity in this age group of 2 to 5. In addition to the obesity variation based on age, variation in percentages can also be observed due to racial and ethnic disparities. It has been reported that the percentage of Hispanic children is worst to almost 25.8% while 22% of black children, are facing obesity issues too.<sup>23</sup> A report by NHANES in addition to showing obesity percentages, highlighted a rapid increase in the child obesity among children ages 2 to 19. It is also important to highlight that as the childhood obesity is increased to 18.5%, the obesity among adults also increased to an alarming percentage of 39.6%.

The family and the environmental factors are the key factors that are contributing in the childhood obesity. The lack of physical activity, poor diets, an increase in sugary beverages and television timings are resulting in the obesity among children. According to a survey, almost 91% of the American children have bad diet habits and have less than recommended 60 minutes of daily physical activity.<sup>24</sup>

An increase in sugary beverages contributed in two-thirds of American youth obesity.<sup>25</sup> Almost 25% of school going students are watching more than three hours of television.<sup>26</sup> In addition, the reduction in extracurricular activities and recess time at schools is also effecting the physical health of the children.<sup>27</sup>

According to Organization for Economic Co-operation and Development (OECD)<sup>28,29</sup>, the state of obesity around the globe has worsen to one in two adults and nearly one in six children on average, around the globe. Among children aged 3 to 17, the obesity rate of France is lowest among England and United States. Moreover, males have more tendency towards obesity as compared to females as shown in Figure 5. The graph also explains that the childhood obesity rate in France is relatively stable up to 2012, while an upward trend is observed for both genders in England and United States in 2012 and 2011, respectively.

The obesity rates are highest in the United States, Mexico, New Zealand and Hungary, while lowest in Japan and Korea as depicted in

Figure 6. The main reason is the food intake and the lifestyle of the children at school and home. The parents encourage healthy food intake and strict policies are implemented by the government to avoid children from overweight and obesity. However, a huge increase in the United States, England and Mexico is due to easy access of the children to the fast-food chains, sugary beverages and lack of physical activities.

The obesity among the children with 15 years of age ranges from 10% in Denmark to 31% in United States as depicted in Figure 7. According to the Health Behaviour in School-aged Children survey. Despite of various measures and policies adopted by OECD countries to curb the situation, there has been constant gradual increase in the childhood obesity percentage over the last two decades. However, the rate of increase of the childhood obesity varies among various countries as shown in Figure 7.

A number of countries such as in Belgium, Chile, Finland, France, Hungary and Mexico have taken serious steps to address childhood obesity and adopted various policies such as increasing the price of unhealthier products to encourage healthier diet. Certain school-based interventions like banning the sale of sugary beverages especially carbonated soft drinks (CSDs) in schools are being made by various countries such as the Punjab Food Authority of Pakistan has decided to ban sales of all type of soft drinks at educational institutions or near premises of 100 m radius across Punjab from 14<sup>th</sup> August, 2017. More informed food labelling and mass media campaigns are being carried out to increase the public awareness and promote healthy living style.

Education and socio-economic background affect obesity. It has been reported that the tendency of overweight or obese among women with a higher level of education is two to three times lesser than the ones with lower level of education as shown in Fig. 8. The gap between gender-based obesity has grown sharply among various countries. It has been observed that obesity is lesser in educated group of society as they are more aware and cautious. However, there is an increase in obesity among educated people. The obese people have poorer job prospects and face more difficulty in entering the labour market. Obesity also affects the efficiency of an individual and most of them are less productive at work due to more sick leaves.

**Reasons of childhood obesity:** The ecological model for childhood weight gain is presented in Fig. 9. Several factors are affecting a child's health, among which the most reported reasons are as follows:

**1. Sugary beverages :** A study conducted in 2006 depicted that children aged 9-14 in the duration of 1996-1998 had history of increasing BMI over the years although changes are gradual yet impactful.<sup>30</sup> Many studies regarding establishing a connection between sugary drink consumption and weight proves it is one of the fundamental factors of weight gain. It has also been studied and concluded that sugary drinks are less filling than food due to more digestible sugars and lack of fibre. They are consumed quickly, resulting in a higher caloric intake and leading to obesity.<sup>31</sup> It has been observed in the surveys that almost 75% of the obese people are having beverages at least once in a day. In an analysis of 30 studies, it was concluded that the consumption of beverages is positively associated with obesity indices in children and adults.<sup>32,33</sup>

**2. Fast food and snacks:** There are three major dietary patterns comprising mixed, western and traditional diet. Mixed pattern consisting of all foods excluding rice and beans; traditional diet consists of rice and beans. Whereas, Western diet includes major portion of fat and sodas. The traditional diet was found to be lesser responsible for weight gain and developing obesity. In a study conducted by Anderson it was found that prevalence of obesity increased consistently with frequenting fast-food restaurants. The study showed that 24% of people who went less than once a week developed less obesity as compared to 33% of those going 3 or

more times in a week. However, if nutritional information regarding calories intake at fast-food restaurants in menu is clearly stated then it may facilitate the consumers in selection of healthy food. In another study, the consumption of fast foods has been reported to contribute in enhancement of obesity.<sup>34</sup>

**3. Skipping breakfast:** In another study, it was revealed that skipping breakfast is the main reason, which was found out to be source of irregular meal patterns and triggers obesity. A study was conducted to the timing of meals and obesity, which was largely, based on analyses of physical measurements, serum biochemical markers, nutrient intake, and lifestyle factors. The study revealed that skipping breakfast had a greater influence on BMI. It is found 34 patients which makes 68% in our case where the breakfast is skipped and home food is not preferred and mostly the obese people are eating from outside.

**4. Portion size:** Portion sizes have elevated considerably in different communities in the last ten years.<sup>35,36</sup> Communities consuming large portions along with recurrent habitual snacking on highly caloric foods and beverages, leads to caloric intake in excessive amount as compare to amount of energy expended on daily life chores. Such sort of energy imbalances in energy intake and energy expenditure may lead to weight gain, and consequently obesity.<sup>30</sup>

**5. Activity level:** One of the key factors that is found to be associated significantly to obesity is a sedentary lifestyle. Obesity in children has also enhanced due to massive increase in usage of media related games and hand-held portable devices, also by the large scale marketing of junk food products on several electronic and print media, and absence of caring parenting at home.<sup>16</sup> A study proved that by spending each additional hour of television per day increased the prevalence of obesity by 2% in individuals.<sup>30</sup> The trend of watching television among young children and adolescents has increased dramatically and drastically in recent years leading to decrease the amount of time spent in physical activity culminating in a sedentary life style. Another drastic development of behaviour in children is also due to the way sweetened goods, beverages and salty snacks are advertised which contains very low nutritional value.<sup>13</sup> The Over-indulgence of children in indoor nature of leisure activities, entertainment packages (e.g., watching television programmes, surfing internet and YouTube shows, and gaming on computer) in discrete or in association with other aspects, for instance, insecure and unhealthy surrounding areas for walking, exercising and similar outside and open air engagements, absence of open ground spaces for sports in schools and societies amid increased pressure on young children to perform good in academic field thereby indirectly reducing their emphasis on sports and physical activities, contribute to childhood obesity.<sup>37</sup> Sedentary life styles of all types have an undeniable important role in turning walking and cycling into obsolete habits during the last decades.<sup>38</sup>

**6. Environmental factors:** Other crucially important causes include peri-natal factors, size at birth, catch-up growth, status of breast-feeding, use of antibiotics, environmental chemicals and negative/emotional experiences and occurrences of life.<sup>39</sup> The relationship between obesity and physical activity in children is strongly related.<sup>40,41</sup> A study conducted in 2002 found that 53% of parents were driving their children to educational institutes due to multiple reasons. The study was conducted to figure out the reasons behind parents driving them to school or letting them go on their own. 66% parents gave the reason that they drove their children to school because their homes were too far away from the school. Whereas in a survey done in 2002, 53% of parents were those who used to drive their children to school. Out of them, 66% claimed that they drove their children to school since their homes were too far away from the school and their children had to go a long way.<sup>30</sup>

Furthermore, it has also been seen that a higher degree of obesity in parents is also related significant with an elevated risk of culminating obesity in their respective children. Additionally, several environmental parameters also influence this association,

for instance, dietary consumption habits and behaviour patterns of parents have been found to replicate in their children. This highlights the complicatedness of obesity ad gluttony, wherein interaction of manifold genetical and non-genetical aspects resultantly affect an increasing number of families and communities, and therefore under these circumstances a need for an intervention strategy which integrates and takes into account the whole family is highly suitable.<sup>42</sup>

**7. Hobbies and physical activity:** Lack of interest in children regarding involvement in physical activity can be the reason of increased weight and obesity problems in children. Participation in physical goings-on and activities is very significant for childhood and teenage loop because it may lead to beneficial impact on body weight, skeletal strength and blood pressure and etc. Children with more physical activity involvement are likely to retain the same level of physical activeness across their adolescence period into adulthood time later on.<sup>43</sup> In a study, Hemmingsson, Ekelund<sup>44</sup> measured physical activity association with obesity through accelerometry for 7 consecutive days during free-living conditions in 85 severely obese outpatients whose mean BMI was 42.7 kg/m<sup>2</sup>. A weak association was found in non-obese individuals as compared to a strong association in obese people.

**8. Socio-cultural factors:** Socio-cultural factors have also been found responsible for influencing the development of overweight and obesity in children. The main dilemma is that societies have trends to practice food as a reward to acknowledge sense of accomplishment, and as part of socializing in societies.<sup>45</sup> Such unhealthy practices of food consumption increase the risk of rising obesity many folds.

**9. Family factors:** Many family related factors have also been linked with evolvement of obesity since ages. The food preference of family members can influence the foods that their children eat and later on develop a lifelong habit. Since childhood is the most effective period of learning and developing socio and cultural habits, it is important to be careful of food choice at this stage. In addition, the family life styles and physically actives also influence the child as they develop and later on pass to the next generations.<sup>45</sup> The financial condition of parents is playing decisive role in the choices they make in respect of food and activities for their children, and it has been observed that the parents of overweight children are not only facing financial and economical constraints but also having a sub-optimal literacy level.<sup>46</sup> Studies have also exhibited that children with overweight mothers have more tendency to develop childhood obesity. Similarly, common trend of obesity has been observed for the children living in a single parent household.

**10. Short sleep pattern:** Miller, Lumeng, LeBourgeois<sup>47</sup> reported a relation between short sleep patterns through early childhood ages (3-7 years) leading to same time or later development of obesity. Furthermore, a practice of chronic short sleep originating from very younger age across school age was found to be related with the enhancement of obesity including very short or interrupted sleep duration, poor value sleep, and going late to bed were correlated with developing habit of emotional eating and repetitive restrained eating respectively. Following the habit of regular, consistent sleep schedule in early childhood ages may have an impact in enhancing metabolic regulation and inducing healthy quality sleep with prime healthy eating behaviours in future.

**11. Genetic factors:** Genetics influence the probability of developing obesity in children amid other factors. Furthermore, increased incidence of childhood obesity is inherited and has shown to have an association with an existing obesity in family. Among *inter alia*, parental obesity is one of the prime factors impacting obesity during childhood. Multiple obesity related are known for ample increase in fat-cells numbers. Fat cell theory postulates that percentage of body fat in an individual can be determined by the count of fat cells in the whole body, which is somewhat estimated by inheritance and moderately by habits of eating. Whereas, the impact of environmental influences is also not neglectable. It is pertinent to consider that nobody is completely

fated to gain obesity merely on the basis of one's genetic makeup and inheritance<sup>38</sup>.

**Aftermaths of obesity:** The childhood obesity results in a number of diseases at the later stage of life such as high blood pressure, diabetes, heart disease, joint problems, sleep apnoea, cancer, metabolic syndrome, psychological effects, depression, medical consequences and academic consequences. It is also established that the non-communicable diseases such as diabetes mellitus, hypertension, cardiovascular diseases, cancer and other dental diseases are as a result of overweight and obesity in the early years of age<sup>48</sup>.

**1. Psychological consequences of childhood obesity:** Obesity in childhood can intensely disturb children's physical well-being, social, and emotional comfort, and self-worth. Obese children have to experience adverse psychological challenges as compared to their normal body weight fellows; these include sensitive, societal, emotional and mental issues. Bullying, teasing and stigmatization in educational institutes and society are the key causes for psychosocial complications in overweight children. In a study conducted in Spain on the model of longitudinal cross-sectional model in which sample was based on children from ages 3, 4 and 5 years depicted that a significant relation exists between peer relationship problems and overweight.<sup>49</sup> At times these effects exhibit in adulthood behaviours although they have been developing during the childhood phase. Such psychological issues may cause poor academic performance and a lower quality of life experienced by the child not only in childhood rather later in adulthood. The food intake in terms of nutrition contents is also varying due to an increased dependency on fast food and canned products. Starting from the very basic, the breast feed till the food intake in the early years are getting more and more packaged. These packaged foods are low in nutrition contents and comprises majorly of unhealth carbohydrates, resulting in child's obesity.<sup>50</sup> These problems are shown to be related with overweight problem in children, and the overweight children owing to their obese appearance may have narrow social circles in school. Few children may not find any other thing to do in such situation rather than to resort to food as a coping mechanism in order to deal with such glitches or negative emotional reactions like anxiety, stress, or development of disinterest in daily life activities. Younger children age is a highly challenging phase of development and growth of individual's stature. Children with history of obesity in childhood are with a higher probability to develop poor body image conception and thus have little amount of self-assurance towards their physique appearance. These psychosocial issues may have far extending implications in their lives.<sup>51</sup>

In a study conducted by Griffiths, Dezateux, Hill<sup>52</sup> in United Kingdom, wherein longitudinal cross-sectional model was adapted with the sample size of 11202 Of children ranging between 3 and 5 years in age and with the gender ratio of 50% male and 50% female, it was found that high scores of conduct problems existed in overweight individuals (both males and females) including hyperactivity, inattention, total difficulties and emotional problems, similarly, overweight girls scored even higher for total difficulties and peer relationship problems. In a study conducted by Suglia, Duarte, Chambers, Boynton-Jarrett<sup>53</sup> based on cohort model study, conducted in United States of America with the sample size of 1589 comprising of Children with between 3 and 5 years having a gender ratio of 49% female and 51% male children showed that Externalizing behavioural problems were found to correlated with obesity among both genders of Children.

**2. Depression and anxiety:** Depression is considered to be as both a reason and also an aftermath of obesity. Children are very sensitive to depression, which adversely affects their performance. Majority of studies find a prospective relationship between eating disturbances and development of depression in individuals.<sup>54</sup> However, this relationship is not always proved to be unidirectional as interesting fact found is that depression may be a cause and it can be other way around as it may be a consequence of obesity.<sup>55</sup> A study conducted on a clinical sample of obese adolescents; it

was found that there was a higher life-time prevalence of anxiety disorders among them as compared to non-obese controls selected for study.<sup>56</sup> However, we also find insignificant relationship between increased BMI and increased anxiety symptoms.<sup>57</sup> Obesity in adolescence stage of life may cause depression problems in adulthood and middle ages, the expression of depression symptoms in daily life activities, especially in girls, may also pose a risk of obesity onset in individuals especially far along on in their lives.<sup>58</sup>

**3. Self-esteem:** In literature, mixed type of association was found between obesity and self-esteem issues of the children.<sup>59</sup> Whereas, some studies show that obese children have lower self-esteem as compare to normal weight children.<sup>60</sup> However, a relevant consensus is found in the literature narrating that the global approach towards self-esteem measurement with children who are obese is deceptive as the physical and societal spheres of self-image and self-confidence seem to be where these children are most susceptible.<sup>61</sup>

In another research, an evaluation was carried out regarding obesity in people with mood disorders and vice versa. It was revealed that children with mood disorder, bipolar disorder are more inclined towards overweight and similar is the case for vice versa. Thus, the mental health and environment plays a key role in the development of obesity and mood disorders.<sup>62</sup>

**4. Bullying and teasing:** Teasing of children by their peer group due to obesity and overweight poses a significant risk factor instigating development of psychosocial consequences in the victimized children, including weight-based teasing, social stigmatization and rejection by peers in daily leisure's and activities, this later turned into eating disarrays and unhealthy weight-regulator behaviour patterns. Major sources in relation of stigmatization of children and adolescents were reported to include class fellows, parents, siblings, family members, educators, and health care providers. Obese children facing bullying and teasing may also show low community affinity, i.e., societal participation when compared with their normal-weight peers. Obese and overweight children between ages of 6 and 13 years were likely to be teased and bullied by 4–8 times more than normal weight children.<sup>61</sup>

**5. Stigmatization:** Obese children often suffer from high risk of stigmatization and peer victimisation which eventually have an impact on social, psychological and behavioural faculties and functioning of the children. The following Three cross-sectional studies analyzed the relation between stigmatization of children and their overweight at preschool age. In a study conducted in USA based on cross-sectional model, where sample size of 49 with children ageing between 3 and 6 years and in a gender ratio of 43% female and 57% male children it was found that for the obese figures the normal children depicted fewer positive adjectives, as compared to the average or thin figure. BMI of children was not associated with their ratings.<sup>63</sup> In another study conducted by Kornilaki<sup>64</sup> in Greece on cross-sectional model of study having a sample size of 85 comprising of children with 4 to 5 years of age and a gender-ratios of 51% males and 49% females, it was observed that Obese figures were lowest preferred playmate. Both Normal and obese children attributed the positive affinity mostly to the thin and average figure children and majority of children attributed negative characteristics to obese figure children. Still another study is pertinent to mention, which was conducted in Australia on cross-sectional pattern comprising of sample size of 118 (ages between 3 and 5 years with a female to male ratio of 3:2), it was shown that negative characteristics were associated to obese figured children.<sup>65</sup>

**6. Emotional problems:** In one study of investigating the psychological influence of obesity in children there was a review of 10 published studies over a period of ten years (1995-2005) with sample sizes greater than 50, we found that all subjects showed emotional problems.<sup>66</sup> Factors like young age, being female, and perceived lack of control for assessment of over eating appeared to intensify the psychosocial costs. A very interesting study was

highlighted about children with the ethnic minorities<sup>23</sup> and a strong correlation is established among such children and obesity. Similarly, the quality of life is greatly affected among obese children as reported.<sup>61</sup>

The sexual quality of life also greatly effects with obesity and is also a source of depression.<sup>67</sup>

**Strengths and limitations of study:** An extensive review has been conducted. Different aspects in terms of reasons and then the aftermaths of obesity were described in detail. Overweight and obese children are expected to stay over weight even into their adulthood and more likely to attain both clinical i.e., non-communicable diseases like diabetes and cardiovascular diseases at a younger age and non-clinical consequences i.e., depression, anxiety etc. The mechanism of obesity development is supposed to be a disorder due to multiple aspects.

**SUMMARY**

It has been observed that the children with lower physical activity and sedentary lifestyle are more prone towards excessive gadget usage, video games, and closed indoor games. This results in an imbalance in the diet and physical activity ratio that eventually culminates into overweight and obesity. The children with high BMI are socially isolated as they are neglected by the peers. In adolescence, the child obesity exponentially increases and ends up in various medical conditions.

School health nutrition programs are essential for the proper education of the diet intake and the advantages associated with the physical activities. In addition, parental and teachers' awareness should be conducted via seminars and workshops. The schools may charge in the fees but healthy meals are required to be provided by the school during break time. Sports and other extracurricular activities should also be encouraged in addition to curriculum. Due to an increase threats of child abduction and assaults, the parents are feared for the safety of their children and thus prefer indoor games. In this lieu, the government should ensure to provide proper security at parks via cameras and necessary guards with controlled entrance to ensure health open air physical activity. The nutritional values on the packaged food available in the market should be made mandatory by the government. The government may take initiatives via media campaign to encourage healthy living and food. In addition, the community related filter clinics are required to be setup to screen the overweight children and identification of children with possible obesity in future. Obesity treatment clinics should be made part public hospitals for the timely handling of the childhood obesity. Being not overweight or obese certainly does not establish the fulfilment of nutritious diet plan among children and malnutrition is required to be investigated to estimate the health children. Thus, in-depth qualitative interviews are required to understand the reasons of undesired increase in the weight among children of various age groups.

**RECOMMENDATIONS AND FUTURE DIRECTIONS**

Although first school is home but even this homely educational centre can be strengthened by the coping governmental policies. Obesity leading life style patterns initiated and adopted from childhood so enhancing public awareness both at community and school level can really help in modification of life styles. School health nutrition programs are essential for the proper education of the diet intake and the advantage associated with the physical activities. Seminars and workshops should be conducted. Government should ensure to provide proper security at parks via cameras and necessary guards with controlled entrance to ensure healthy open-air physical activities. Initiatives via media campaign to encourage healthy living and food. Community related Obesity Filter Clinics and Obesity Treatment Clinics should be constituted. It is reported that school based intervention programs are very effective in curbing the obesity as an equal important aspect is the awareness of the nutrition value in the food intake at school level.

<sup>68</sup> Similarly, an educational program in the schools can help a child in the healthy selection of the food with nutrition. <sup>69</sup> Interventions targeting the dietary patterns, if possibly supervised by a dietician, is necessary for curtailing obesity. <sup>42</sup> Children must have an involvement of 180 minutes in any physical activity or they may take part in unstructured free play daily. Children engagement in screen time (watching television and playing media games) should not exceed more than 2 hours per day. Interventions in lifestyles including healthy eating, regular exercise, and reduction in sedentary activities, are the important requisites in order to treat obesity problem in childhood and adolescence. <sup>70</sup> Modifications in life style act as corner-stones in prevention of childhood and adolescent obesity development. Children are chiefly vulnerable due to emotional problems during critical development period. <sup>71</sup> Solely the exercise programs, without any diet alteration are unlikely to be effective, because the increased energy expenditure is likely to trigger a response of excessive energy intake. It appears to be the responsibility of all family members to play their active role by choosing healthier foods and more physical exercises. The approach taking into account the "whole family" also appears imperative, if the parents are engaged in the process, or at the least are even lead the process, at least for children such as to encourage healthful diets and abundant physical activities will be beneficial for the health of all the children, whether at risk of obesity or not. <sup>43</sup> It becomes necessary that a special importance is given to interventions in the cases of childhood obesity as the obesity during childhood has a potential to cause significantly more serious and morbid health consequences in later parts of life, and it has also been observed that successful intervention against obesity at a young age is predicts the maintenance of a healthy body weight in adult age as well. <sup>72,73</sup> In addition to what has already been stated above, obese children have more probable to become obese adults in adulthood. Targeting obesity in children pays off well in the end when weighted in cost-benefit terms because is interventions to tackle childhood obesity are much more effective and success meeting than adulthood obesity interventions. In a study based on 113 families which were undergoing family-based behavioural interventions, it was observed that the interventions were more effective on children than their parents at each time point in order to have a percentage overweight decrease greater than 20%, as with children it was seen that over 20% of the children had a weight decrease as compared to less than even 1% of the parents which depicted such a great change in their weight under same interventions<sup>14</sup>. The nutritional values on the packaged food available in the market should be made mandatory by the government. The government may take initiatives via media campaign to encourage healthy living and food. In addition, the community related filter clinics are required to be setup to screen the overweight children and identification of children with possible obesity in future.

Table 1: Obesity classification based on WHO, 1995, WHO, 2000 and WHO 2004 reports

Classification	BMI (kg/m <sup>2</sup> )	
	Principal cut-off points	Additional cut-off points
Underweight	< 18.50	< 18.50
Severe thinness	< 16.00	< 16.00
Moderate thinness	16.00 – 16.99	16.00 – 16.99
Mild thinness	17.00 – 18.49	17.00 – 18.49
Normal range	18.50 – 24.99	18.50 – 22.99
		23.00 – 24.99
Overweight	≥ 25.00	≥ 25.00
Pre-obese	25.00 – 29.00	25.00 – 27.49
		27.50 – 29.99
Obese	≥ 30.00	≥ 30.00
Obese class I	30.00 – 34.99	30.00 – 32.49
		32.50 – 34.99
Obese class II	35.00 – 39.99	35.00 – 37.49
		37.50 – 39.99
Obese class III	≥ 40.00	≥ 40.00

Figure 1: Age-standardized prevalence of obesity in men aged 18 and over (BMI >30 kg/m<sup>3</sup>) (WHO, 2014)

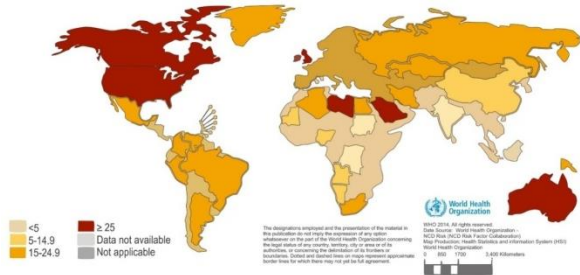


Figure 4: Trends in the childhood obesity in US<sup>3</sup>

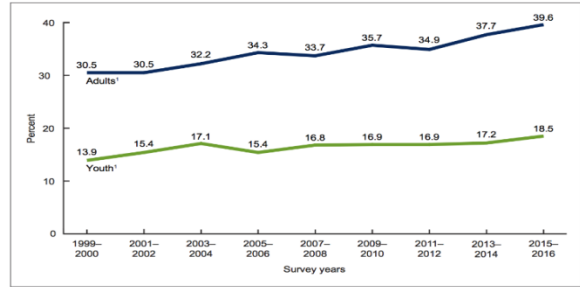


Figure 2: Growth reference charts<sup>1</sup>

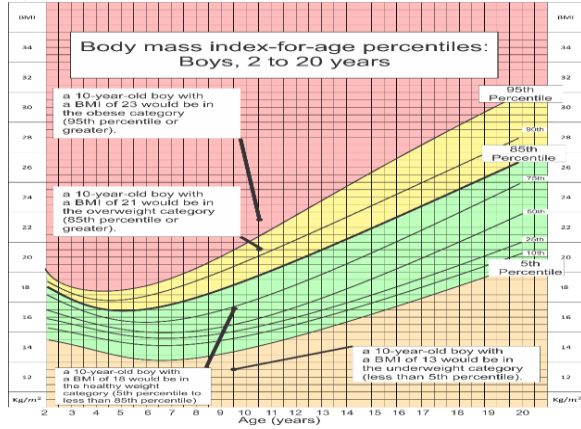


Figure 5: Obesity in children aged 3-17<sup>28</sup>

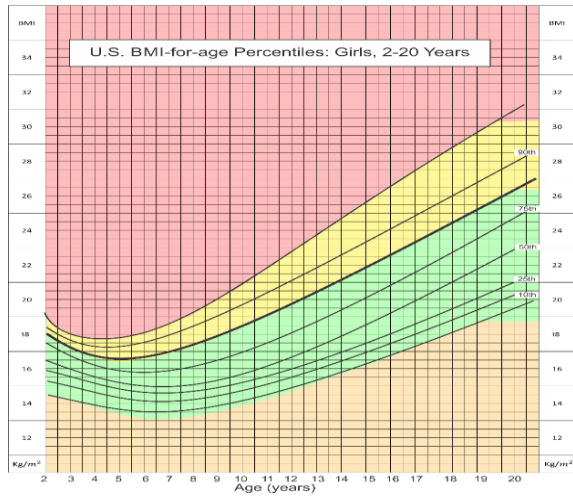
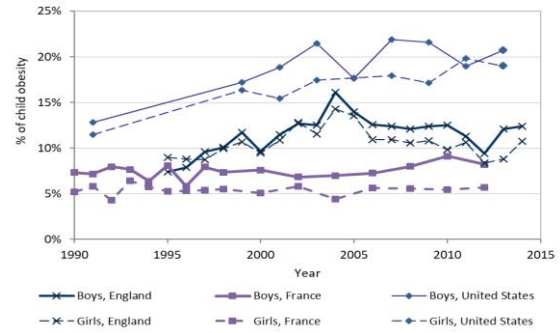


Figure 6: Projected rates of obesity among adults<sup>28</sup>

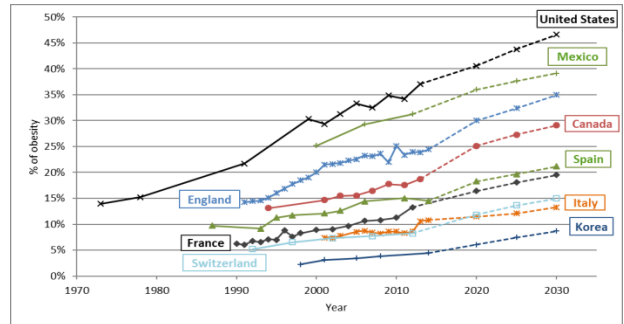


Figure 3: Status of child obesity by sex and age in US<sup>3</sup>

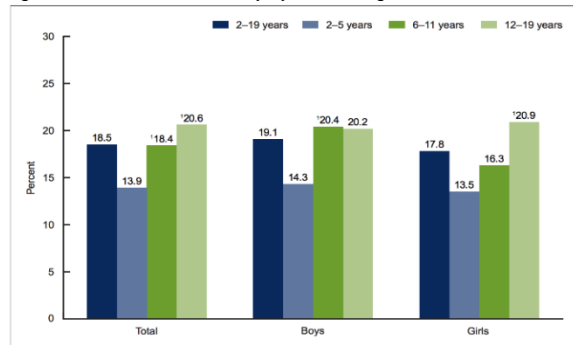


Figure 7: Self-reported overweight (including obesity) among 15-year-olds, 2001-02 and 2013-14 (or latest years)<sup>28</sup>

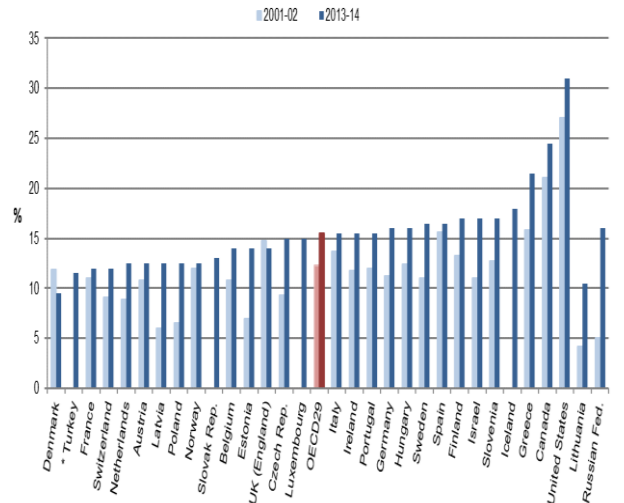




Figure 8: Education-related inequality in overweight<sup>28</sup>

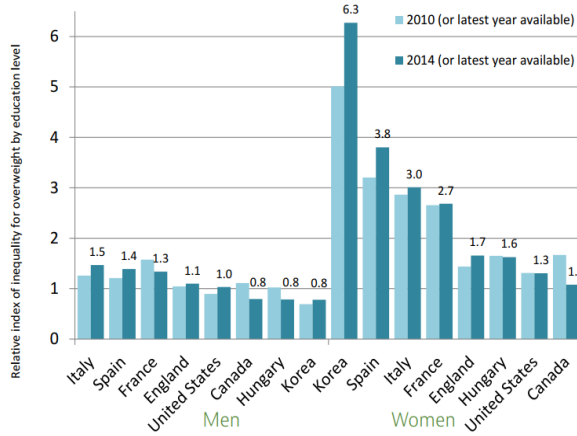
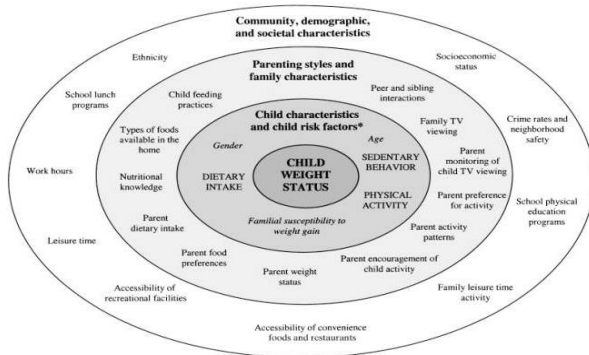


Figure 9: Ecological model for childhood weight gain<sup>74</sup>



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