

# Childhood Obesity

Qazi Iqbal Ahmad, Charoo Bashir Ahmad, Sheikh Mushtaq Ahmad

Department of Neonatology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, India

### ABSTRACT

Obesity is increasing at an alarming rate throughout the world. Today it is estimated that there are more than 300 million obese people world-wide. Obesity is a condition of excess body fat often associated with a large number of debilitating and life-threatening disorders. It is still a matter of debate as to how to define obesity in young people. Overweight children have an increased risk of being overweight as adults. Genetics, behavior, and family environment play a role in childhood overweight. Childhood overweight increases the risk for certain medical and psychological conditions. Encourage overweight children to expand high energy activity, minimize low energy activity (screen watching), and develop healthful eating habits. Breast feeding is protective against obesity. Diet restriction is not recommended in very young children. Children are to be watched for gain in height rather than reduction in weight. Weight reduction of less than 10% is a normal variation, not significant in obesity. [IJEM 2010;14(1):19-25]

**Key words:** Obesity, overweight, skin fold thickness, body mass index, WHO

### Introduction

Obesity is increasing at an alarming rate throughout the world. Today it is estimated that there are more than 300 million obese people world-wide(1). Obesity is a condition of excess body fat often associated with a large number of debilitating and life-threatening disorders(2). It is still a matter of debate as to how to define obesity in young people(3). Weight exceeding 125% of the median weight for height is obesity. Overweight persons have a body-fat proportion intermediate between normal and obese(4). weight tables, measurement of skin fold thickness and Body Mass Index(5).

Weight alone is not a good index of fatness as it does not consider height. The most acceptable definition given by World Health Organization (WHO) and IOTF is in terms of BMI(6, 7). This is a measure derived from dividing body weight in kilograms by the square of height in meters. Objective measures used to estimate the degree of obesity are average weight tables, ideal Individuals with a body mass

index between 18.5 and 25 are regarded as being of normal weight. Those between 25(85th percentile) and 30(95th percentile) are regarded as overweight, and obesity is defined as a body mass index equal to or greater than 30. BMI can be easily assessed at low cost, and beyond a value of 19 it has a strong correlation with body fatness and health risks. However, as an indirect measure of adipose tissue, BMI has a number of limitations; it does not differentiate between muscles mass and fat mass, however most researchers advocate the same classification(8). In children today, obesity is the most common metabolic and nutritional disease, where as thirty years ago, obesity was rarely seen in children. Cole *et al* published a set of sex- and age-specific BMI cutoffs, which had been developed based on data collected in six countries, and the reference has been recommended for international use(9). Recently, several researchers have raised concerns regarding this international reference. It has been argued that population-specific standards should be used due to biological differences between populations. In adults to take into account the risk difference between abdominal obesity and deposition of fat around buttocks other ways of assessing obesity have been developed. These include measuring the ratio of circumference at the waist to the circumference at the hip or simply measuring the abdominal circumference, with obesity being defined in males as a waist circumference of

*Address for correspondence:*

Dr. Qazi Iqbal Ahmad  
Department of Neonatology  
Sheri-Kashmir Institute of Medical Sciences, Srinagar, J&K India.  
Email:

greater than or equal to 102cm and females of greater than or equal to 88cm(10). Obesity occurs when energy intake exceeds energy expenditure(11). Genetic factors environmental factors, lifestyle preferences, and cultural factors seem to play major role in the rising prevalence of obesity worldwide(12, 13). The effects of obesity on children have a huge impact and can range from low self-esteem to increased risk of cardiovascular diseases. The most effective cure for childhood obesity is prevention(14).

### **Importance of childhood obesity**

Eighty percent of overweight 10-14 year old adolescents are at risk of becoming overweight adults compared to 25% of overweight preschool children (<5 years old) and 50% of 6-9 year old overweight children (15). Obesity in childhood and adolescence has been related to an increase in mortality in adulthood on follow up. Hoffman et al observed almost twice the risk of death in adolescents (> 18 year olds) with BMI > 25 kg/m<sup>2</sup> (compared to subjects with BMI <25kg/m<sup>2</sup>) during 20 year follow up(16).

### **Epidemiology and global scenario of childhood obesity**

Obesity has reached epidemic proportions in the developed part of the world with as many as 30-40% of adults being already obese and the incidence in children and adolescent is rising(17). World health organization has declared obesity as one of the most neglected diseases of significant public health importance. The 2002 World Health Report lists overweight as the fifth most serious risk factor for both developed countries and low mortality developing countries(18). According to the report of International Obesity Task Force (IOTF), in the year 2000 about 10% (a total of 155 million) of the young people aged 5-17 years globally were overweight; among whom 2-3% (30-45 million) were obese, a further 22 million younger children are also affected according to previous IOTF global estimates based on WHO data for under fives(18,19).

A consistent increase in the prevalence of childhood obesity has been observed since 1971 in developed countries, however, its prevalence is increasing in developing countries as well. In Scandinavian countries the prevalence of childhood obesity is lower as compared with Mediterranean countries, nonetheless, the proportion of obese children is rising in both regions(20). The prevalence of childhood obesity is high in the Middle East, Central and Eastern Europe(21). Iran has been reported as one of the seven countries with the highest prevalence of childhood obesity(22). In a recent review from developed countries, prevalence of overweight youth (10-16 years) was > 15% in North America (Canada, USA), Great Britain and some South Western European Countries (Greece, Italy, Malta, Portugal, Spain), and between 10-15 % in Nordic (Denmark, Finland, Norway, Sweden) and other European countries. Data from developing countries is limited especially for older children (> 5 years old) and adolescents. In Egypt 14% of adolescents and in Cyprus 25% of 6-11 year old children were

reported to be overweight or obese. Obesity is increasingly being reported from countries that have acquired affluence in the recent times such as Taiwan and Saudi Arabia. In Saudi Arabia, one in every six children aged 6 to 18 years old is obese(23). The incidence of obesity at all ages is on the rise in the developing countries including India. According to a report from urban South India, 21.4 % of boys and 18.5% of girls aged 13-18 years were overweight or obese(24). The prevalence of obesity among School children in India has been reported between 5.74% and 8.82%(25,26).

During last two decades, the prevalence of overweight in older children and adolescents almost doubled in USA (from 15.4 % to 25.6% )(27), but tripled in Canada (from 11% of boys and 13% of girls in 1981 to 33% and 27% respectively in 1996). Between 1974 and 1997, the prevalence of overweight and obesity in 6-17 year age group more than tripled (from 4.1% to 13.9%) in Brazil, a fast growing developing country. Among urban Chinese children within a 6-year period (1991 and 1997) the prevalence of overweight and obesity increased from 7.7 to 12.4 % though such a trend was not observed among rural children(28).

### **Tendencies and projections**

It is predicted that the levels of obesity will continue to rise unless action is taken now. WHO has warned “the growth in the number of severely overweight adults to double that of underweight during 1995-2025” (WHO 1998)(29). From existing data it has been projected that by the year 2030 levels of obesity could be as high as 50-80% in the USA, between 30-40% in Australia, England and Mauritius and over 20% in some developing countries(30).

### **Key patterns associated with obesity**

Factors, including age, gender and socio-economic status have been linked to obesity. Clear gender difference is seen in most countries with more women than men being obese(22). Patterns have also emerged across socio-economic groups. In developed countries levels of obesity are higher in the lower socio-economic groups. In developing countries this relationship is reversed(31). The transition from a rural to an urban lifestyle is associated with increased levels of obesity, which has been linked with dramatic changes in lifestyles (e.g. increased consumption of high energy dense foods and decrease in physical activity)

### **Cause of Obesity**

Although the mechanism of obesity development is not fully understood, it is confirmed that obesity occurs when energy intake exceeds energy expenditure. Childhood obesity can be brought on by a range of factors which often act in combination(32,33).

### **Social and environmental factors**

Changes in environmental and social factors are likely the main explanation for doubling of severe childhood obesity over the last 30 years. Obesity is encouraged by such “obesogenic environmental conditions that promote overeating. “Passive over consumption” due to changes

taking place in food marketing, consumer behavior (e.g., increases in consumption of food and beverages) and targeted marketing of high calorie dense foods with low nutrients(34). Consumers respond positively to changes in their environment. Numerous environmental factors that facilitate or limit physical activities have been identified Urban housing design and land use influence the physical activity of the residents of that area. Studies have shown that increasing access to physical activity in an organized, structured and supervised manner is effectively beneficial for youth(35).

### **Diet**

Over the last decades, food has become more affordable to larger numbers of people as the price of food has decreased substantially relative to income and the concept of 'food' has changed from a means of nourishment to a marker of lifestyle and a source of pleasure. Clearly, increases in physical activity are not likely to offset an energy rich, poor nutritive diet. It takes between 1–2 hours of extremely vigorous activity to counteract a single large-sized (i.e.,  $\geq 780$  kcal) children's meal at a fast food restaurant. Frequent consumption of such a diet can hardly be counteracted by the average child or adult(35).

**Calorie intake:** Total energy intake is difficult to measure accurately at a population level. However, a small caloric imbalance over a long period of time is sufficient to lead to obesity. The result of a survey carried out during the past few decades in the UK suggested that average energy intakes, for all age groups, are lower than they used to be(36). Some small studies also found similar energy intake among obese children and their lean counterparts which clearly suggests that Physical inactivity is evidently more important cause of obesity than increased calorie consumption(37).

**Fat intake:** Although fat eaten in excess leads to obesity. There is not strong enough evidence that fat intake is the chief reason for the ascending trend of childhood obesity. Many studies have demonstrated rise in the prevalence of obesity in spite of the decrease in mean dietary fat consumption in both males and females(38).

**Physical activity:** It has been hypothesized that a steady decline in physical activity among all age groups has heavily contributed to rising rates of obesity all around the world. Low participation rates in sports and physical education, particularly among adolescent girls, are also associated with increased obesity prevalence(35). In urban areas parents prefer having their children watch television at home rather than play outside unattended. Watching television and playing computer games are associated with increased prevalence of obesity(39).

**Genetics:** Childhood obesity is often the result of interplay between many genetic and environmental factors. Polymorphisms in various genes controlling appetite and metabolism predispose individuals to obesity. Obesity is a major feature of a number of rare genetic conditions that often present in childhood(40). Prader-Willi syndrome is

characterized by hyperphagia and food preoccupations which lead to rapid weight gain in those affected. Bardet-Biedl syndrome, MOMO syndrome, Leptin receptor mutations, Congenital leptin deficiency, Melanocortin receptor mutations are other genetic disorders characterized by obesity(41,42,43). In children with early-onset obesity (onset before ten years of age and body mass index over three standard deviations above normal), 7% harbor a single locus mutation(40). Offsprings of two obese parents are likely to become obese in contrast to the offspring of two parents who are of normal weight(44). The percentage of obesity that can be attributed to genetics varies from 6% to 85% depending on the population examined(45).

**Home environment:** Children's food choices are also influenced by content of family meals. Families with Sedentary life style and non-vegetarian, calorie dense, high fat foods are more likely to have obese children(46).

**Developmental factors:** Various developmental factors may affects rates of obesity. Babies fed on formula feeds are likely to have higher BMI as children and adolescents(47). A child's body growth pattern may influence the tendency to gain weight. Fat babies at four months were 1.38 times more likely to be overweight at seven years old compared to normal weight babies. Fat babies at the age of one were 1.17 times more likely to be overweight at age seven compared to normal weight babies(48).

**Medical/Endocrine diseases:** Cushing's syndrome (condition in which body contains excess amounts of cortisol), hyperinsulinism, Hypothyroidism and craniopharyngioma with hypothalamic involvement are the hormonal causes of obesity(49,50).

**Psychological factors:** A positive correlation between obesity and low self esteem has been established. Researchers discovered that decreased self esteem led to 19% of obese children feeling sad, 48% of them feeling bored, and 21% of them feeling nervous. In comparison, 8% of normal weight children felt sad, 42% of them felt bored, and 12% of them felt nervous. Stress can influence a child's eating habits(51). Feelings of depression can cause a child to overeat(52).

**Adiposity rebound and Puberty:** Adiposity rebound (AR) is the time at which children's adiposity or excess fat tissue declines to its lowest level and then begins to increase as the child, children who experience an early AR have elevated BMIs or are more likely to develop obesity at older ages. AR of 6 years is a common observation in industrialized countries against 7 years or more in developing countries(53). Although the causality between SM and fatness remains controversial, a growing body of evidence suggests that SM has a more important effect on levels of fatness than fatness does on the timing of SM. Early SM was positively associated with obesity in American girls but the association was reverse for boys(50,53). Fatness and BMI correlate more closely with the maturation stage (or development age) than with chronological age.

**Mechanism of Obesity:** During growth, fat cells increase in

number and when energy intake exceeds expenditure, fat cells increase in size. When fat cells have reached their maximum size and energy intake continues to exceed energy expenditure, fat cells increase in number again. With fat loss, the size of the cells shrinks, but not the number. When fat loss occurs, none of the cells decrease in number they only decrease in size. There are few fatty acids that occur in food or in our body and are often incorporated in the form of triglycerides. Triglycerides have recently become popular, since they extend the shelf life of many food products by protecting them against oxidation. A disadvantage of triglycerides is that they make poly-saturated fats more saturated. Therefore, any health advantages of using poly-saturated fats are lost during the process of hydrogenation and textures of foods are also altered. Research has shown that obesity is also associated with increased levels of a hormone called leptin. Leptin is secreted from adipose (fat) tissue and is involved in the regulation of food intake, energy expenditure and energy balance in humans(54).

**Body fat estimation and Risk assessment:** a) Direct methods: Dual-energy X-ray absorptiometry (DXA). b) Indirect methods: Anthropometry (Weight, Height, BMI, Waist circumference, Waist-Hip ratio, Skin fold thickness). c) Clinical parameters: Blood pressure. d) Biochemical parameters: Lipid profile; Lipoprotein, Apo-lipoprotein; Blood glucose, Insulin levels; HbA1C (fasting samples) FFA levels, hepatic transaminases. The triglycerides, HDL, fasting hyperglycemia and hypertension do not seem to have association with metabolic syndrome in children as seen in adults. Therefore, it is proposed that the diagnostic parameters of metabolic syndrome should be redefined in children with population-based values of these new biochemical parameters(55).

**Effects On Health, Social And Economic Interests:** Obesity has unending negative health, social and economic consequences. Mortality and morbidity rates are higher among overweight and obese individuals than lean people. The first problems to occur in obese children are usually emotional or psychological including low self esteem(56). Childhood obesity however can also lead to diabetes, high blood pressure, heart disease, sleep problems, cancer, liver disease, early puberty or menarche, eating disorders such as anorexia and bulimia, skin infections, and asthma and other respiratory problems(57). Atherosclerosis is documented more frequently among overweight adolescents. Overweight children have 2.4-4.5 times higher risk for developing hypertension and 2.4-8.0 fold rise in prevalence of dyslipidemia as adults aged 27-31 years, compared to children with normal BMI. Frequency of type-2 diabetes is more in overweight and obese adolescents. Metabolic syndrome especially hyperinsulinemia has been documented among Asian adolescents at lower BMI compared to the Caucasians, probably due to higher body fat and greater central obesity. Obesity has been recently identified as a major independent risk factor for CHD by the American

Heart Association (1997). Obese children have their carotid arteries prematurely aged by as much as thirty years as well as abnormal levels of cholesterol(58). Obesity during adolescence has been found to increase mortality rates during adulthood(59). Modest weight reduction can significantly reduce the risk of these serious health conditions. Obese children often suffer from teasing by their peers, some are harassed or discriminated against by their own family(60). In addition to the physical consequences on health, obesity creates a massive social burden. Obesity has been described as the "last remaining socially acceptable form of prejudice" which seriously impedes the treatment of overweight and obese patients(61). Often overshadowed by the health and social consequences of obesity is the economic cost to society and to the individual(62). In several developed countries obesity has been estimated to account for 2-7% of the total health care costs. In addition to the direct costs of obesity are costs in terms of impaired school performance(61).

**Management and Global Action Plan:** Obesity a growing serious medical condition demands a preventive management. Single most important way to control the onset and development of obesity is by limiting the dietary intake(63). In June 1997 the WHO, together with the IOTF, held an expert consultation on obesity, that resulted in the publication of an interim report: "Obesity - preventing and managing the global epidemic" (WHO 1998) and the subsequent WHO Technical Report Series 894. The International Obesity Task Force (IOTF) was established in May 1996 to tackle the emerging global epidemic of obesity. The IOTF is a part of the International Association for the Study of Obesity (IASO), an organisation that represents 43 National Obesity Associations across the globe. The Task Force is composed of world experts in the field of obesity and related diseases from around world, including China, Japan, Chile, Australia, Brazil, the USA, Canada and Europe. IASO is an NGO in formal relations with WHO. The IOTF collaborates closely with the WHO and is engaged with other international health organizations, including the Commonwealth, and national governments to raise awareness and help develop solutions to the global epidemic of obesity.

The IOTF initiative on the prevention and management of obesity has four main goals:

1. To increase the awareness among governments, health care professionals and the community that obesity is a serious medical condition and a major health problem with substantial economic costs.
2. To provide evidence and guidance for the development of better prevention and management strategies.
3. To secure the commitment of policy makers to action.
4. To foster the development of national, regional and international structures that will enable and support the implementation of action on overweight and obesity.

The IOTF aims to achieve action on the prevention and

management of overweight and obesity and endeavours to create an environment that encourages and supports the development of appropriate public and health policies and programmes for prevention and management of obesity. Their principal strategy is prevention through changing the environment in such a way to make it less 'obesogenic' to the individual. The focus has been on how to tackle childhood obesity now a major issue in many parts of the world(64).

**Medications:** There are no medications currently approved for the treatment of obesity in children. Orlistat and sibutramine may however be helpful in managing moderate obesity in adolescence. Sibutramine is approved for adolescents older than 16. It works by altering the brain's chemistry and decreasing appetite. Orlistat is approved for adolescents older than 12. It works by preventing the absorption of fat in the intestines(65). Adolescents with BMI of more than 40 with associated complications are considered for bariatric surgery(66).

## Discussion

The current consensus is that BMI is a valid and feasible indirect measure of body fatness, useful in clinical and epidemiologic studies, but it suffers from a number of limitations. Health professionals should be aware of these limitations. More efforts are needed to develop other valid and feasible measures of body composition. Further research on the applications of waist circumference, bioimpedance, or other forms of weight-for-height index remains valuable. It has been argued that population-specific standards should be used due to biological differences between populations. To assist international comparisons, in epidemiologic studies, the IOTF reference is superior. The most significant finding of this review of the literature on pediatric obesity is that there is a paucity of evidence-based research on effective interventions. The existing research has found that most methods of weight loss are unsuccessful over time. Prevention is clearly the best way to deal with pediatric obesity. Prevention should begin as early as possible. Prevention should start with proper training in terms of breastfeeding, weaning, and diets for toddlers. Children nine years old and younger may have the most to gain from primary obesity prevention, but little is being done in the health care system, the school system or in the community to push the message of obesity prevention. Population-based approaches to the prevention of obesity, like those aimed at smoking prevention, may prove to be the most effective method for creating a significant change in trends of obesity in children.

All available evidence points to the fact that families must be included in childhood treatment of obesity. Clinicians should obtain a history for the whole family of both active and sedentary behaviors. Obese children and their parents feel socially comfortable by using term "overweight" instead of "obese". It is important for parents to understand, that cause of obesity is often a combination of

three factors including genetic causes, overeating and not enough exercise. Very rarely, perhaps only 1 % cases are due to a so-called "glandular" problem (hormonal cause). Impressing the fact on the parents, who controls the food preparation, that diet control and family participation in physical activities will all aid in the treatment of obesity in children.

Changing the trend of childhood obesity is truly a laudable effort for many reasons. Control of obesity in children is associated with long-term favorable changes in the serum-lipid profile, and also reduced hyperinsulinemia. It has also been reported that successful weight loss in children contributes to overall improvements in "total problems" and psychological health. Clearly, weight loss in children is more successful than in adults over the long-term, and the health benefits of preventing adult obesity are enormous. The future may see more group models of treatment attempted in clinical settings. Additionally, the amelioration of reimbursement problems will probably be successful when managed care and private insurance companies come to realize that they will be saving money in the long-term by treating obesity in its earliest stages. Treating obesity in small steps with family support should lead the way to find working and long-term solutions to the growing epidemic.

## Conclusion

- Breast feeding is protective against obesity.
- Diet restriction is not recommended in very young children.
- Children are to be watched for gain in height rather than reduction in weight.
- Weight reduction of less than 10% is a normal variation, not significant in obesity.
- Overweight children have an increased risk of being overweight as adults.
- Genetics, behavior, and family environment play a role in childhood overweight.
- Childhood overweight increases the risk for certain medical and psychological conditions.
- Encourage overweight children to expand high energy activity, minimize low energy activity (screen watching), and develop healthful eating habits.

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