

## OBESITY – CHALLENGES AND TREATMENT: A REVIEW

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### ABSTRACT

Important progress has been made in the past few years concerning the Obesity which is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century. The economic, social, and cultural factors that influence the distribution of body mass index in a population are the topics studied here. Future research needs Public health research aimed at defining realistic goals and strategies to improve health in an environment conducive to high levels of overweight and obesity. Overweight children are more likely to have cardiovascular and digestive diseases in adulthood as compared with those who are lean. Consequently, both over-consumption of calories and reduced physical activity are involved in childhood obesity. Prevention may include primary prevention of overweight or obesity, secondary prevention or prevention of weight regains following weight loss, and avoidance of more weight increase in obese persons unable to lose weight. Prevention may be achieved through a variety of interventions targeting built environment, physical activity, and diet. Some of these potential strategies for intervention in children can be implemented by targeting preschool institutions, schools or after-school care services as natural setting for influencing the diet and physical activity. All in all, there is an urgent need to initiate prevention and treatment of obesity in children.

**KEY WORDS:** Obesity, overweight (pre-obese), fat, body mass index, morbid obesity

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## INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems<sup>1-2</sup>. Body mass index (BMI) is the most common measure used to gauge body fats in adults. BMI takes into account a person's weight and height. "Obesity" is defined as an excessively high amount of body fat or adipose tissue in relation to lean body mass (BMI > 30.0). By comparison, "Overweight" is defined as increased body weight in relation to height, when compared to some standard of acceptable or desirable weight (BMI = 25.0 to 29.9). Morbid obesity is diagnosed when the patient weighs two or more times the ideal body weight, when the patient is more than 100 pounds above the ideal body weight, or when the BMI is 40 or more. It is called "morbid" obesity because it is associated with so many life-threatening diseases. The higher the BMI, the higher the risk of associated disease. Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, breathing difficulties during sleep, certain types of cancer, and osteoarthritis. Obesity is most commonly caused by a combination of excessive dietary calories, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications or psychiatric illness. Evidence to support the view that some obese people eat little yet gain weight due to a slow metabolism is limited; on average obese people have a greater energy expenditure than their thin counterparts due to the energy required to maintain an increased body mass. There are also several methods to measure the percentage of body fat<sup>3</sup>. In research, techniques include underwater weighing (densitometry), multi-frequency bioelectrical impedance analysis (BIA) and magnetic resonance imaging (MRI). In the clinical environment, techniques such as body mass index (BMI), waist circumference, and skin fold thickness have been used extensively

## BMR CALCULATOR

BMR, or Basal metabolic rate (metabolism), is the energy (measured in calories) expended by the body at rest to maintain normal bodily functions. This continual work makes up about 60-70% of the calories we use ("burn" or expend) and includes the beating of our heart, respiration, and the maintenance of body temperature. BMR is influenced by a number of factors, including age, weight, height, gender, environmental temperature, dieting, and exercise habits. Because of the increased activity of cells undergoing division, the younger the person, the higher (faster) the metabolism. And the taller and heavier a person is, the faster their metabolism. Because of the greater percentage of lean muscle tissue in the male body, men generally have a 10-15% faster BMR than women. And Person on restrictive, traditional diets, experiences BMR drop by 20%. People living in tropical or very cold environments generally have BMR's 5-20% higher than those living in more temperate climates. In general, depending on the intensity and duration, consistent exercise can also increase BMR. Obesity in children and adolescents is defined not as an absolute number, but in relation to a historical normal group, such that obesity is a BMI greater than the 95th percentile. The reference data on which these percentiles are based from 1963 to 1994, and thus have not been affected by the recent increases in weight<sup>4</sup>.

<b>BMI</b>	<b>Classification</b>
< 18.5	underweight
18.5–24.9	normal weight
25.0–29.9	overweight
30.0–34.9	class I obesity
35.0–39.9	class II obesity
≥ 40.0	class III obesity

## **EFFECT ON HEALTH**

### **Mortality**

In Western countries mortality rate is high than Asian and Africal countries. On average, obesity reduces life expectancy by six to seven years: a BMI of 30–35 reduces life expectancy by two to four years, while severe obesity (BMI > 40) reduces life expectancy by 10 years<sup>5</sup>.

### **Morbidity**

Health consequences fall into two broad categories: those attributable to the effects of increased fat mass (such as osteoarthritis, obstructive sleep apnea, social stigmatization) and those due to the increased number of fat cells (diabetes, cancer, cardiovascular disease, non-alcoholic fatty liver disease). These comorbidities are most commonly shown in metabolic syndrome<sup>6</sup>.

## **CAUSE**

At an individual level, a combination of excessive caloric intake and a lack of physical activity is thought to explain most cases of obesity<sup>7</sup>. A 2006 review identified ten other possible contributors to the recent increase of obesity: (1) insufficient sleep, (2) endocrine disruptors (3) decreased variability in ambient temperature, (4) decreased rates of smoking, because smoking suppresses appetite, (5) increased use of medications that can cause weight gain (e.g., atypical antipsychotics), (6) proportional increases in ethnic and age groups that tend to be heavier, (7) pregnancy at a later age (which may cause susceptibility to obesity in children), (8) epigenetic risk factors passed on generationally, (9) natural selection for higher BMI, and (10) assortative mating leading to increased concentration of obesity risk factors (this would not necessarily increase the number of obese people, but would increase the average population weight).

### **Diet**

Consumption of Carbohydrate is major factor for increased calories rather than fat consumption<sup>8</sup>. The primary source of these extra carbohydrates are sweetened beverages, Consumption of sweetened drinks is believed to be contributing to the rising rates of obesity. Increasing use of Junk food and Spicy food are also other factors.

### **Sedentary lifestyle**

A sedentary lifestyle plays a significant role in obesity<sup>9</sup>. Worldwide there has been a large shift towards less physically demanding work, and currently at least 60% of the world's population gets insufficient exercise. The World Health Organization indicates people worldwide are taking up less active recreational pursuits. A 2008 meta-analysis found 63 of 73 studies (86%) showed an increased rate of childhood obesity with increased media exposure, with rates increasing proportionally to time spent watching television. Particularly in India children are not going to playgrounds; they become addict of computer games and TV.

### **Genetics**

Obesity is the result of interplay between genetic and environmental factors. Studies that have focused upon inheritance patterns rather than upon specific genes have found that 80% of the offspring of two obese parents were obese, in contrast to less than 10% of the offspring of two parents who were of normal weight. Genetic syndromes associated with childhood obesity include the following: Prader-Willi syndrome, Pseudohypoparathyroidism, Laurence-Moon-Biedl (Bardet-Biedl) syndrome, Cohen syndrome, Down syndrome, Turner syndrome.

### **Medical and psychiatric illness**

Medical illnesses that increase obesity risk includes several rare genetic syndromes (listed above) as well as some congenital or acquired conditions: hypothyroidism, Cushing's syndrome, growth hormone deficiency, and the eating disorders: binge eating disorder and night eating syndrome.

### **Social determinants**

Among developed countries, levels of adult obesity, and percentage of teenage children who are overweight, are correlated with income inequality. Whereas In undeveloped countries the ability to afford food, high energy expenditure with physical labor, and cultural values favoring a larger body size are believed to contribute to the observed patterns. Malnutrition in early life is believed to play a role in the

rising rates of obesity in the developing world Attitudes toward body mass held by people in one's life may also play a role in obesity.

### **OBESITY RELATED DISORDERS**

Weight-related health problems can cause symptoms, such as shortness of breath, difficulty breathing during activity, snoring, skin abnormalities including acne, and joint and back pain. Obesity increases the risk of the following: High cholesterol levels, High blood pressure, Metabolic syndrome, Coronary artery disease, Heart failure, Diabetes or a high blood sugar level (insulin resistance or prediabetes), Cancer of the breast, uterus, ovaries, colon, prostate, kidneys, or pancreas, Gallstones and other gallbladder disorders, A low testosterone level, erectile dysfunction, and reduced fertility in men, Menstrual disorders, infertility, and increased risk of miscarriage in women, Skin abnormalities, including acne and facial hair in women, Varicose veins, Fatty liver, hepatitis, and cirrhosis, Blood clots (deep venous thrombosis and pulmonary embolism), Asthma, Obstructive sleep apnea, Kidney disorders, including nephrotic syndrome, Arthritis, gout, low back pain, and other joint disorders, Depression and anxiety.

### **PREVENTION**

Preventing obesity is one of the main things that we need to focus on with obesity being the world biggest health epidemic at the moment! Obesity is on the rise and with obesity comes a lot more health problems, things like arthritis, heart disease, diabetes, poor eyesight, high cholesterol, blocked arteries. Obesity can be prevented by consuming a varied diet and getting plenty of exercise. Prevention may include primary prevention of overweight or obesity itself, secondary prevention or avoidance of weight regains following weight loss, and prevention of further weight increases in obese individuals unable to lose weight. Children are often considered the priority population for intervention strategies because, firstly, weight loss in adulthood is difficult and there are a greater number of potential interventions for children than for adults. School and the wider community, plays an important role in shaping children's physical activity, the smaller scale of the home environment is also very important in relation to shaping children's eating behaviors and physical activity patterns. It appears that gains can be made in obesity prevention through restricting television viewing. Food prices have a marked influence on food-buying behavior and, consequently, on nutrient intake. A small tax (but large enough to affect sales) on high-volume foods of low nutritional value, such as soft drinks, confectionery, and snack foods, may discourage their use.

### **PATHOPHYSIOLOGY**

During childhood and adolescence, excess fat accumulates when total energy intake exceeds total energy expenditure. This energy imbalance can result from excessive energy intake and/or reduced energy expenditure, the latter is usually a consequence of a sedentary lifestyle. This is particularly associated with excessive television viewing, excessive computer use, and insufficient physical activity. In infancy, excess fat deposition occurs when excess energy is provided, especially when protein-to-energy ratio is altered. In individuals who are obese, dysfunction in the gut-brain-hypothalamic axis via the ghrelin/leptin hormonal pathway has been suggested to have a role in abnormal appetite control and excess energy intake. Studies indicate that dysfunction in this hormonal axis may be the causative factor in as many as 10% of obese subjects, with emphasis particularly on those individuals who appear to manifest familial morbid obesity. In these families, several reports have shown a dramatic, weight loss response to hormone replacement therapy in patients with leptin deficiency. Reductions in energy expenditure characterize other hormonal deficiency states, including hypothyroidism and growth hormone deficiency. Increases in energy intake are observed in genetic syndromes, such as Prader-Willi syndrome, Cushing syndrome, and drug-induced obesity. Concordance rates for obesity and type 2 diabetes mellitus are higher in monozygotic twins than in dizygotic twins, and measures of TBF correlate nearly as strongly in monozygotic twins reared apart ( $r = 0.61$ ) as in monozygotic twins reared together ( $r = 0.75$ ). Still, genetic factors cannot explain the increased prevalence of obesity observed among American adolescents over the past generation.

The accumulation of body fat, particularly in a visceral distribution, reduces the sensitivity to insulin in skeletal muscle, liver tissue, and adipose tissue; this "insulin resistance" predisposes to glucose

intolerance and hypertriglyceridemia. Low levels of high-density lipoprotein (HDL) observed both genetically and in association with a sedentary lifestyle, likely contribute to the increase of premature coronary artery disease observed in adults with obesity. Increases in circulating levels of insulin and insulin-like growth factor I may increase blood pressure (BP) and may stimulate the production of androgens from ovarian and adrenocortical cells, with consequent dysmenorrhea and virilization in females. Aromatization of adrenal androgens to estrone leads to gynecomastia in males. The insulin resistance, dyslipidemia, and hypertension predispose to type 2 diabetes and cardiovascular disease, reducing life expectancy.

### **CHILDHOOD OBESITY**

Childhood obesity has reached epidemic levels in developed countries. Twenty five percent of children in the US are overweight and 11% are obese. About 70% of obese adolescents grow up to become obese adults. The prevalence of childhood obesity is increasing since 1971 in developed countries. The World Health Organization project monitoring of cardiovascular diseases (MONICA) reported Iran as one of the seven countries with the highest prevalence of childhood obesity. The prevalence of BMI (in percentage) between 85th and 95th percentile in girls was significantly higher than that in boys (10.7, SD = 1.1 vs. 7.4, SD = 0.9). A child who is obese at age 6 has a 25% chance of being obese as an adult, and a child who is obese at age 12 has a 75% chance of being obese as an adult. Obesity genes offer survival advantages, with those who had these genes depositing more fat when food was available to survive longer during periods of starvation. Now that food is plentiful and exercise minimized, these genes are expressing themselves. The only successful weight loss therapy available for children is behavior modification accompanied by diet and exercise. The most effective treatment of obesity, whose roots lie in childhood, is prevention.

### **MANAGEMENT**

The main treatment for obesity consists of dieting and physical exercise. Diet programs may produce weight loss over the short term, but keeping this weight off can be a problem and often requires making exercise and a lower calorie diet a permanent part of a person's lifestyle. A recent review concluded that certain subgroups such as those with type 2 diabetes and women show long term benefits in all cause mortality, while outcomes for men do not seem to be improved with weight loss. A subsequent study has found benefits in mortality from intentional weight loss in those who have severe obesity. The most effective treatment for obesity is bariatric surgery; however, due to its cost and the risk of complications, researchers are searching for other effective yet less invasive treatments.

#### **Dietary therapy**

Diets to promote weight loss are generally divided into four categories: low-fat, low-carbohydrate, low-calorie, and very low calorie<sup>10</sup>. A meta-analysis of six randomized controlled trials found no difference between three of the main diet types (low calorie, low carbohydrate, and low fat), with a 2–4 kilogram (4.4–8.8 lb) weight loss in all studies. Very-low-calorie diets produce greater short-term weight loss, but weight regain is common.

#### **Physical Exercise**

Modest physical activity has undoubted health benefits and can contribute to weight loss with use, muscles consume energy derived from both fat and glycogen. To maintain health the American Heart Association recommends a minimum of 30 minutes of moderate exercise at least 5 days a week<sup>11</sup>. Even though exercise as carried out in the general population has only modest effects, a dose response curve is found, and very intense exercise can lead to substantial weight loss<sup>12</sup>.

#### **Weight loss programs**

Weight loss programs often promote lifestyle changes and diet modification. This may involve eating smaller meals, cutting down on certain types of food, and making a conscious effort to exercise more.

### **Combined approaches**

Lifestyle interventions: A number of large-scale clinical trials have demonstrated the effectiveness of lifestyle interventions in specific groups of patients, particularly those with impaired glucose tolerance, but there is also some evidence for benefits in those with hypertension and dyslipidaemia. In general, weight loss with these approaches is modest (about 4 kg or 4% of body weight on average).

### **Medication**

The two most commonly used medications to treat obesity: orlistat (Xenical) an inhibitor of gastrointestinal lipases and sibutramine and Rimonabant (Centrally acting drugs). They are currently approved by the FDA for long term use. Orlistat (Xenical), reduces intestinal fat absorption by inhibiting pancreatic lipase, the other is sibutramine (Meridia), which acts in the brain to inhibit deactivation of the neurotransmitters norepinephrine, serotonin, and dopamine (very similar to some anti-depressants), therefore decreasing appetite. Their use has also been associated with improvement in risk factors, such as dyslipidaemia, hypertension and diabetes control. Medications that may cause weight gain in children and adolescents include the following: Cortisol and other glucocorticoids, Megace, Sulfonylureas, Tricyclic antidepressants, Monoamine oxidase inhibitors (MAOIs), such as phenelzine, Oral contraceptives, Insulin (in excessive doses), Thiazolidinediones, Risperidone, and Clozapine.

### **Surgery**

Bariatric surgery ("weight loss surgery") is the use of surgical intervention in the treatment of obesity. As every operation may have complications, surgery is only recommended for severely obese people (BMI >40) who have failed to lose weight following dietary modification and pharmacological treatment. Weight loss surgery relies on various principles: the two most common approaches are reducing the volume of the stomach (e.g. by adjustable gastric banding and vertical banded gastroplasty), which produces an earlier sense of satiation, and reducing the length of bowel that comes into contact with food (gastric bypass surgery), which directly reduces absorption. Band surgery is reversible, while bowel shortening operations are not. Some procedures can be performed laparoscopically. Complications from weight loss surgery are frequent. A marked decrease in the risk of diabetes mellitus, cardiovascular disease and cancer has also been found after bariatric surgery. Surgeons use one of three techniques to help patients reduce their weight:

**Laposcopic Gastric Banding** – This is the simplest procedure in which an adjustable Silicon band around the top portion of the stomach is installed which allows the patient to feel full after eating a smaller amount. The average weight loss is around 15–20% of body weight.

**Roux-en-Y Gastric Bypass** - Creating a small stomach pouch that attached directly to the small intestine restricts food intake and causes malabsorption of fats. Weight loss is generally greater than with the band.

**Biliopancreatic Diversion** - Removing part of the stomach (gastrectomy) and attaching the remainder to the final segment of the small intestine restricts food intake and causes malabsorption of fats. Weight loss is greatest with this procedure, but malabsorption is more likely and patients need to pay very careful attention to their diet and require vitamin and mineral supplementation.

**Genetic testing leading to patient-** This is currently largely a research-based activity, and even the more common conditions are rarely encountered in routine clinical practice. There are a number of well-defined genetic abnormalities that directly lead to severe, early onset obesity, including MC-4 receptor mutations, pro-opiomelanocortin mutations, pro-hormone convertase- 1 mutations, defects in leptin or its receptor and several syndromic conditions, such as Prader–Willi syndrome. Only one of these, leptin deficiency, is amenable to specific treatment, but with dramatic clinic effect.

### **Behavior Therapy**

Behavior therapy involves changing diet and physical activity patterns and habits to new behaviors that promote weight loss.

Behavioral therapy strategies for weight loss and maintenance include:

- Recording diet and exercise patterns in a diary.

- Identifying high-risk situations (such as having high-calorie foods in the house), and consciously avoiding them.
- Rewarding specific actions, such as exercising for a longer time or eating less of a certain type of food.
- Changing unrealistic goals and false beliefs about weight loss and body image to realistic and positive ones.

## **RECENT STUDIES**

### **Exercise Keeps Dangerous Visceral Fat Away a Year After Weight Loss**

A study conducted by exercise physiologists in the University of Alabama at Birmingham (UAB) Department of Human Studies finds that as little as 80 minutes a week of aerobic or resistance training helps not only to prevent weight gain, but also to inhibit a regain of harmful visceral fat one year after weight loss

### **Obesity Rates Differ Among Racial/Ethnic Groups in Kids as Young as 4**

Obesity is twice as common in young American Indian/Native Alaskan children as it is in white and Asian children, according to new research offering the first nationally representative analysis of obesity prevalence among preschool-aged kids in five major racial/ethnic groups.

## **ONGOING STUDIES THAT MAY CHANGE PRACTICE**

### **Look Ahead study**

This is an ongoing trial of intensive lifestyle intervention aimed at weight loss in new onset type 2 diabetes, which is being conducted in the USA and funded by the National Institutes of Health. To date, 5144 participants have been recruited and the study has been running for nearly 2 years. The main outcomes are those related to vascular disease after 11.5 years' treatment. If this study shows some benefit, this will have very clear implications for the management of newly diagnosed patients with type 2 diabetes.

### **Swedish Obese Subjects study**

This is a case-control observational study comparing surgery to routine care in morbid obesity. Preliminary data have already been reported. Final outcomes, with effects on morbidity and mortality after 18 years of follow-up, were reported in abstract form in 2006, and showed significant reductions in overall and cardiovascular mortality. Once these results are widely disseminated, this is likely to lead to increased use of this treatment.

## **NEW DRUG TREATMENTS**

There are four broad areas that provide valid drug targets for the treatment of obesity:

- Drugs that inhibit absorption of nutrients;
- Drugs that mimic or enhance peripheral satiety or adiposity signals;
- Drugs that alter metabolic rate or substrate utilization;
- Drugs acting at central nervous system (CNS) targets that result in altered energy intake or energy expenditure.

## **CONCLUSION**

Obesity is a chronic disorder that has multiple causes. Overweight and obesity in childhood have significant impact on both physical and psychological health. In addition, psychological disorders such as depression occur with increased frequency in obese children. Overweight children are more likely to have cardiovascular and digestive diseases in adulthood as compared with those who are lean. It is believed that both over-consumption of calories and reduced physical activity are mainly involved in childhood obesity. Apparently, primary or secondary prevention could be the key plan for controlling the current epidemic of obesity and these strategies seem to be more effective in children than in adults. A number of potential effective plans can be implemented to target built environment, physical activity, and diet. These

strategies can be initiated at home and in preschool institutions, schools or after-school care services as natural setting for influencing the diet and physical activity and at home and work for adults. Both groups can benefit from an appropriate built environment. However, further research needs to examine the most effective strategies of intervention, prevention, and treatment of obesity. These strategies should be culture specific, ethnical, and consider the socio-economical aspects of the targeting population.

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