OBESITY PANDEMIC: AN IRANIAN PERSPECTIVE

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The prevalence of overweight and obesity in most developed and developing countries has been increasing markedly over the past two decades. This increase includes all ages, genders, racial and ethnic groups, income, and educational levels. A variety of genetic, environmental, physiological, psychological and sociocultural factors influence the development of obesity. Iran like many other developing countries is now experiencing the global epidemic of obesity and its consequences. Recent epidemiological studies have revealed that the prevalence of obesity, overweight, and metabolic syndrome in Iran is equal to or higher than Europe and the United States and it is the primary cause of the rising prevalence of type 2 diabetes and the important comorbid states such as hypertension, cardiovascular, renal, and gastrointestinal diseases along with increasing the burden of cancers. This is also in line with the present etiologies of death in Iran with cardiovascular disease and cancer accounting for nearly 60% of causes of nontraumatic death. The prevalence of obesity in Iran has reached epidemic proportions and is specifically affecting women and younger age groups also. The increased consumption of calorie-dense regular and fast foods and sucrose-enriched drinks, together with an increasingly sedentary lifestyle, appear to be major factors contributing to this epidemic. The per capita consumption of carbonated beverages in Iran is 42 liters per year and 40% of Iranians consume more food than they need, and the average Iranian consumes 40% more carbohydrate and 30% more fat than needed. To deal with this epidemic, prevention should receive high priority and social measures such as taxing fast foods, subsidizing fresh food and vegetables, and spending more public money on projects to promote physical activity are necessary. There is also emerging evidence that treating obese subjects, particularly those with metabolic syndrome or type 2 diabetes, has short-term effects on the prevention of diabetes; improves glucose, lipid, and blood pressure parameters; and is likely to have beneficial effects on long-term health outcomes.

Keywords: BMI ● diabetes ● Iran ● metabolic syndrome ● NAFLD ● obesity

Introduction

Obesity has become one of the most important health problems throughout the world. It is no longer the sole problem of the developed countries, and its prevalence is increasing all over the globe including South-East Asia, Middle East, and Iran.1, 2 Strong evidence links obesity to increased morbidity and mortality.1 Psychosocial consequences are substantial as well,2 including decline in health-related quality of life.3, 4 The risks of overweight and obesity may soon cause as much disease and death as cigarette smoking. Obesity is a gateway disease that can lead to the metabolic syndrome (syndrome X) and type 2 diabetes with increasing risk of cardiovascular and cerebrovascular diseases, hypertension, obstructive sleep apnea syndrome, obesity-hypoventilation syndrome, gallbladder disease, and certain types of cancer. In this review, we discuss health risks associated with obesity and describe the status of the obesity in Iran with emphasis on the importance of preventive measures for obesity and its complications.
Definition
Obesity refers specifically to having an abnormally high proportion of body fat or adipose tissue in relation to lean muscle mass. The most common method used to assess obesity and overweight is the body mass index (BMI). BMI is a simple, rapid, and inexpensive method that can be applied generally to adults; it is not sex-specific and is significantly correlated with total body fat as well as morbidity and mortality. There are exceptions to this rule; some persons with an “obese” BMI may have a normal amount of body fat and a large muscle mass, while others with a “normal” BMI may have excess adiposity and reduced muscle mass. BMI is a mathematical calculation based on weight and height. An individual’s body weight in kilograms is divided by the square of height in meters. The World Health Organization (WHO), and the National Institutes of Health (NIH) proposed guidelines for classifying weight status by BMI. In this classification BMI of 25 – 29.9 kg/m² is considered as overweight, and 30 kg/m² or more is defined as obesity in adults (Table 1). A WHO expert panel suggested that there are a proportion of Asian people with a high risk of type-2 diabetes and cardiovascular disease at BMIs lower than the existing WHO cut-off point for overweight. The WHO has suggested lower cut-off points for consideration of therapeutic intervention in Asians: a BMI of 23 to 27.5 represents increased risk, and 27.5 or higher represents high risk. However, at present the absolute BMI cut-offs for overweight and obesity remain unchanged for Asians. In children and adolescents, BMI above the 85th percentile is used as an index of overweight and BMI above the 95th percentile is defined as obesity.

Although overall obesity remains the most potent risk factor for increased morbidity and mortality, an additional risk factor involves the distribution of body fat. The presence of excess fat in the abdominal area—out of proportion to total body fat—is an independent predictor of risk factors and morbidity. Waist circumference and waist-to-hip ratio (WHR) are correlated with abdominal fat content. A WHR ≥ 0.95 in men and ≥ 0.85 in women is considered abdominal obesity. In another definition, waist circumference > 102 cm in men and > 88 cm in women is considered high risk. For most people, increased adiposity at the waistline, as opposed to the hips and thighs, increases the risk for health problems. Individuals with increased risk by waist circumference and/or WHR have been shown to be at increased risk for type 2 diabetes, dyslipidemia, hypertension, and atherosclerotic disease.

Epidemiology
With increasing urbanization, and lifestyle changes characterized by physical inactivity, obesity has become a major health issue throughout the world. Obesity is increasing in frequency in the United States. Initial results from the 1999 National Health and Nutrition Examination Survey (NHANES) estimate that 61% of US adults are either overweight or obese; adult obesity nearly doubled, increasing from 15% to 27%, during the 14-year reporting period of NHANES III. Obesity and overweight are no longer the sole problem of the developed countries. Their prevalence have increased in South-East Asia, Japan, and China. There are large between-country and within-country differences in levels of obesity and overweight, and obesity can coexist with malnutrition, especially in developing countries and countries undergoing economic and cultural transition. The prevalence of adult obesity is also high in Eastern Europe, the Eastern Mediterranean, central and South America (especially Argentina, Chili, Paraguay, and Mexico), and some parts of western Europe (Finland, Germany, Spain and the United Kingdom). In Tehran Lipid and Glucose Study (TLGS), 40% of the adult study population in Tehran, Iran, were overweight (BMI, 25 to 29.9 kg/m²) and 23.1% of them were obese (BMI ≥ 30 kg/m²) (Table 2). Also, in a recent survey of blood donors in Tehran, 47% of the studied adult Iranian population were overweight and 24% of them were obese. In Golestan cohort study of esophageal cancer, 28.5% and 17% of rural adults older than 40 years of age were reported to be overweight and obese, respectively. In the same

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<th>Table 1. Classification of obesity in adults.</th>
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<td><strong>Obesity class</strong></td>
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<td>Underweight</td>
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<td>Normal</td>
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<td>Overweight</td>
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<td>Extreme obesity</td>
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This classification is based on the American Gastroenterology Association (AGA) guidelines on obesity.
study, the percentages of urban adults more than 40 years of age who were overweight or obese were 38% and 36.7%, respectively. This study shows the impact of urbanization on increasing incidence of obesity and overweight in Iran (Table 3). Obesity is also rapidly increasing among children and adolescents. Over the past 25 years, the prevalence of overweight or obesity has doubled in American children ages 6 to 11 years and tripled in American adolescents ages 12 to 17 years. A 75% relative increase in obesity in adolescents is noted from 1970 to the present and currently 25% of American adolescents are identified as being obese. In a survey of 2 – 5 years old children in two provinces of Iran (Gilan and Sistan) 8% of children were obese, which was significantly higher than expected. In TLGS, 13.3% of girls aged 10 – 19 years and 12.6% of boys in the same age group were overweight, and 4.1% and 6.7% were obese, respectively, showing a relatively high prevalence, although it seems obesity is still less common among Iranian adolescents than their American counterparts.

### Health risks associated with obesity

Obesity is an important risk factor for many serious chronic diseases. It is an independent risk factor for increased mortality. Overall mortality begins to increase with BMI levels greater than 25 (relative risk = 1.1) and increases most dramatically as BMI levels surpass 30 (relative risk = 1.5). For example, a BMI of 35 increases mortality by a factor of 2.5. Obesity has important endocrine and metabolic consequences. The increasing incidence of type-2 diabetes during last two decades has mirrored, and is presumed to be a direct result of the obesity epidemic. Obesity is an independent risk factor for hypertriglyceridemia, and low HDL-cholesterol level. Overweight and obesity are the root causes of the metabolic syndrome. This syndrome is characterized by the constellation of abdominal obesity, hypertension, type 2 diabetes, and dyslipidemia. Abdominal obesity is associated with resistance to the effects of insulin on peripheral glucose utilization; the associated hyperinsulinemia may then lead to hypertension and an adverse metabolic consequences. Hypertriglyceridemia, low HDL-cholesterol, and fasting hyperglycemia are the metabolic consequences of this syndrome; all of them promote the development of atherosclerosis. The strong association of metabolic syndrome with coronary heart disease and cardiovascular mortality has been confirmed in several prospective trials. Furthermore, obesity is associated with an increased risk of heart failure. Obesity can also affect liver and gastrointestinal tract. Most large epidemiological studies have found that gastroesophageal reflux disease (GERD) symptoms are more common in obese persons. In Iran, GERD is presently the most common gastrointestinal disease and its incidence has mirrored, and is probably related to obesity epidemic. Obesity is an important risk factor for gallbladder disease, particularly in women. The risk of symptomatic gallstones increases linearly with BMI. Compared with lean women (BMI < 24 kg/m²), obese women (BMI ≥ 30 kg/m²) had a twofold excess risk and extremely obese women (BMI > 45 kg/m²) had a sevenfold excess risk of symptomatic gallstones. Also, obese patients who develop gallstone pancreatitis or alcoholic pancreatitis experience a worse outcome than lean patients. Obesity and metabolic syndrome are also associated with a constellation of liver abnormalities, manifested by hepatomegaly, increased liver biochemistry values, and alterations in liver histology (macrovesicular steatosis, steatohepatitis, fibrosis, and cirrhosis). Also, serum ALT increases linearly with increasing BMI. Nonalcoholic fatty liver disease (NAFLD), the so called hepatic manifestation of metabolic syndrome, is increasing worldwide in adults and children in parallel with the global epidemic of obesity. Obesity can also affect other organs. It is
associated with pulmonary function abnormalities, obesity-hypoventilation syndrome, and obstructive sleep apnea.\(^{36}\) Obesity is also associated with hyperuricemia, gout,\(^{37}\) and osteoarthritis.\(^{38}\) Epidemiological studies have associated obesity with a range of cancer types, although the mechanisms by which obesity induces or promotes tumorigenesis vary by cancer site. These include insulin resistance and resultant chronic hyperinsulinemia, increased bioavailability of steroid hormones, and localized inflammation. Overweight and obesity are associated with an increased risk of several malignancies including esophageal, gallbladder, pancreatic, breast, renal, uterine, cervical, and prostate cancers.\(^{39 - 41}\) In a large prospective trial of 900,000 US population, increased body weight was associated with increased death rates for all cancers combined and for cancers at multiple specific sites.\(^{42}\)

**Obesity and its consequences in Iran**

According to official national data, each Iranian citizen consumes about 42 liters of carbonated beverages per year. These drinks contain considerable amounts of sucrose (28 g/300 mL) in addition to the pressurized gas. This may contribute to the increased prevalence of GERD.\(^{29}\) The same report indicates that about 40% of Iranians consume more food than they need and the average Iranian consumes 40% more carbohydrate and 30% more fat than needed. Added to these is the increased interest of the community in a more westernized diet containing junk and fast food (sandwiches, pizza, potato chips, and snacks) that are fatty, spicy, and salty themselves and are usually served with fatty and spicy sauces. Sedentary lifestyle due to lack of adequate exercise and decreased walking, and stressful life conditions should be added to this constellation. All these factors contributed to the emergence of obesity epidemic in Iran.

As stated above, about 40% of Tehran’s population are overweight, and 23% of them are obese.\(^{16}\) The age-standardized prevalence of the metabolic syndrome in a study on adult population in Tehran was 33.7%,\(^{43}\) and based on population-weighted estimates, approximately 8 million Iranian adults have this syndrome. This figure includes 2 to 3 million individuals with type 2 diabetes and at least 4 million adults with hypertension.\(^{15, 43}\)

The prevalence of metabolic syndrome in Iran was even higher than that reported (21.8%) from the United States.\(^{44}\) The prevalence rate will increase steadily among men and women in the older age groups. Prevalence among older segments of the population is already approaching 50%.\(^{43}\) This is most likely due to rapid “nutrition transition” during the 1990s, with concomitant physical inactivity, and increases in energy and fat intake. Increasing prevalence of obesity and metabolic syndrome might therefore be expected. Thus, it is not surprising that death from cardiovascular diseases is presently the most common cause of mortality in Iran and constitutes 45% of etiologies for all types of death in this country.\(^{45}\) Also, presently nonalcoholic steatohepatitis (NASH) is the most common cause of elevated serum ALT level in Iran.\(^{46}\) Additionally, according to a recently finished autopsy-based study, 34% of individuals who died randomly from accident or trauma and underwent autopsy for forensic reasons in Tehran had evidence of fatty liver and 2.1% were found to have steatohepatitis.\(^{47}\) Thus, in future we may encounter a higher incidence of end-stage liver diseases due to NASH and we should be prepared for that. It also emphasizes the huge economic burden of metabolic syndrome and its consequences in health status of the developing societies which, in addition to morbidity and mortality from cardiovascular diseases, will also result in chronic and finally end-stage liver disease. Several studies have shown that BMI is an independent risk factor for the presence of self-reported heartburn and regurgitation in a community-based population.\(^{28, 29}\) Gastro-esophageal reflux disease presently is the most common gastrointestinal disease in Iran and it may be at least partly due to epidemic of obesity. Whether this indicates primary or secondary impairment of gastrointestinal function in obese individuals will require further study. Considering such a wide range of diseases related to obesity, the financial burden associated with obesity in Iran is considerable, both in terms of direct and indirect costs.

**Treatment of obesity**

Obesity is a chronic, relapsing, serious, and prevalent disorder. Changing lifestyle, dietary therapy, and increasing physical activity are the cornerstones of therapy at the first step. Dietary therapy along with regular and adequate exercise have been shown to reverse the pathophysiology of
the metabolic syndrome, improve biomarkers of risk, and treat comorbidities. It is more efficacious to recruit individuals with friends or family and given behavioral treatment with social support strategies. Frequent telephone calls that included medical advice significantly improved weight loss stability. NIH recommends that persons who are overweight (BMI of 25.0 to 29.9 kg/m²) and have two or more risk factors should decrease their energy intake by approximately 500 kcal per day. This energy deficit, which is also recommended for persons with class I obesity (BMI of 30 to 34.9 kg/m²), will result in approximately a 1-pound (0.45 kg) weight loss per week and about a 10% reduction of initial weight at 6 months. Persons with class II (BMI of 35.0 to 39.9 kg/m²) or III (BMI ≥ 40 kg/m²) obesity should aim for a more aggressive energy deficit of 500 to 1,000 kcal per day, which will produce approximately a 1- to 2-pound weight loss per week and approximately a 10% weight loss at 6 months.² Diet that focus on reducing fat intake alone produce less initial weight loss than those that restrict both fat and total energy intake.⁴ Recently, there has been a renewed interest in the use of low-carbohydrate diets for losing weight. For example, in one study, severely obese subjects with a high prevalence of diabetes or the metabolic syndrome lost more weight during six months on a carbohydrate-restricted diet than on a calorie-restricted and fat-restricted diet. Subsequently, however, weight loses were the same in the two diets by 1 year.⁴⁹ Adding a regular exercise program to short-term (≤ 6 months) diet intervention does not increase initial weight loss significantly,⁵⁰ unless it is prolonged and vigorous activity (e.g. 88 minutes per day of brisk walking or cycling).⁵¹ Thus, although increasing physical activity is usually not effective for initial weight loss, physical activity is very important for long-term weight management.⁴ Aerobic exercise has additional health benefits that are independent of weight loss itself. Increased physical activity and aerobic fitness are associated with a decreased risk of developing diabetes,⁵² and dying from cardiovascular disease.⁵³ Persons with BMI ≥ 27 and two additional risk factors, or persons with BMI ≥ 30 whose dietary therapy was unsuccessful can be advised for pharmacotherapy. The greatest problem in treatment obesity is the high rate of relapse, so the most important challenge of pharmacotherapy is to maintain long-term weight loss, because, patients who respond to drug therapy usually regain weight when therapy is stopped.⁵⁴ Thus, effective pharmacotherapy for obesity is likely to require long-term, if not lifelong, treatment. Drugs with noradrenergic and serotoninergic effects (e.g. Sibutramine), or drugs that inhibit pancreatic lipases (e.g. Orlistat) are approved by FDA for long-term therapy of obesity. More discussion about pharmacotherapy of obesity is not in the scope of this paper. Readers are referred to more comprehensive reviews in this regard.⁵⁵ Finally, patients with BMI ≥ 35 kg/m² and two additional risk factors or patients with BMI ≥ 40 kg/m² in whom other attempts at weight loss have failed should be considered for surgery. Although, there are various bariatric operations, two dominate surgical practice in the western world. One is vertical banded gastroplasty and another is gastric bypass surgery.⁵⁶ In Iran, the minimally invasive surgery for obesity is still not popular among the surgeons, and Iranian surgeons should become more familiar with these two types of operative procedures. A modified intestinal bypass surgery which maintains an adequate length of small bowel to prevent short bowel syndrome has been shown to prevent the progression of NASH and subsequent liver fibrosis in Iran,⁵⁷, ⁵⁸ while resulting in adequate weight loss and acceptable quality of life for the patients. Pharmacotherapy of NASH, the hepatic manifestation of metabolic syndrome, is another important issue at the agenda for prevention of end-stage liver disease in obesity. When diet and exercise fail to control the liver inflammation and fibrosis associated with NASH, drug therapy is the next step. Experience in pharmacotherapy of NASH is still limited. Agents like troglitazone, ursodeoxycholic acid, and betaine have been evaluated with limited success. We have used Probucal⁵⁹, ⁶⁰ an antioxidant lipid-lowering agent, both in an open labeled and a placebo-controlled randomized trail with good and acceptable results. Treatment of NASH with metformine is also promising.⁶¹ Further study and follow-up is necessary to find the best agent for treatment of NASH. In summary, the best strategy to prevent obesity and metabolic syndrome is health promotional activity advocating healthy lifestyle, with special emphasis on a balance healthier diet, more consumption of dairy products,⁶² adequate physical activity and regular aerobic exercise,⁶³ maintenance of ideal body weight, and weight reduction in overweight people.
Conclusion

Obesity is now the number-one nutritional issue worldwide and in Iran. Present epidemiologic data also provide insight into the major consequences of obesity. Since, the incidence of conditions such as cardiovascular disease, hypertension, diabetes, and cancer are increasing across the globe, the associated financial burden is staggering as well. Clearly, preventive efforts as the mainstay of medical practice must be enhanced. We must support comprehensive national programs (similar to those targeting tobacco uses) along with community and school-based nutritional education efforts. It can be concluded that developing countries are in the midway of two different health issues. While infectious diseases remain an important health problem, obesity and metabolic syndrome, and their consequences are emerging as one of the main health issues in the agenda. Thus, widespread community adoption of common-sense approaches to prevention of insulin resistance and obesity with all their known health consequences is now a high priority, just as cigarette smoking has been a priority in many countries for the last two decades. 64 Governmental health policies and national budgets should be directed to these two different problems.

References

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