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Review Article

Lifestyle Risk Factors and Management of Obesity: A Mini Review

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ABSTRACT

Obesity is one of the most serious public health problems of the 21st century. The most common method used to define obesity is the BMI (weight/height squared in meters). If a person's BMI is 30 or above is considered to be obese. In this review we focus on the different factors that cause obesity and on the different available treatment strategies. The mechanism behind weight gain is based on the energy intake of an individual. Positive energy balance leads to gain weight. With rapid economic growth, urbanization and westernization traditional diets high in fibres were replaced by diets high in sugar and fats which are high in energy and lead to a positive energy balance and therefore gain weight. Also, energy high food prices have declined leading to increased consumption of the latter. Fast foods which sell low quality/energy high foods for a convenient price are an example of this phenomenon. Daily choices also influence the prevalence of obesity. For instance, eating out often can expose individuals to larger portions eventually leading to the phenomenon of portion distortion. Physical activity affects the energy balance of an individual along with dietary choices. Increase in physical activity, as shown in different studies, promotes weight loss. Combining low-fat diet with either vigorous exercise or simple lifestyle activity has been proven to be the best modality for weight loss. There are three main management strategies that can be followed in order to lose weight: lifestyle changes, pharmacotherapy and surgery. The primary approach to treat obesity is weight loss through diet and exercise, supported also by behavioural therapy. The aim of the diet should be lowering the calorie intake. People should first of all inform themselves about the different macronutrients normal intake levels and consult an expert. If no adequate weight loss is achieved by lifestyle changes, medications like Orlistat may be taken. If medications and lifestyle changes aren't successful, surgery may be considered as an option to lose weight.

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Introduction

Obesity is a chronic and multifactorial medical condition based on both genetic and behavioral factors. It is not just a cosmetic concern. Obesity constitutes a medical problem wherein an abnormal and excessive fat accumulation promotes adipose tissue dysfunction that increases the risk ratio of negative effects on health [1, 2]. Energy balance equation constitutes a simple concept for weight management. More specifically, for successful weight loss, people must burn more calories than they consume (negative energy balance) [3]. In contrast, for people that want to gain weight, the consumption must be higher than the expenditure

(positive energy balance) [3]. And if people want to maintain weight, they must be in a steady energy balance (balanced weight) [3].

There are numerous methods to define and categorize obesity. Body mass index (BMI), used by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), is a crude population measure. BMI is defined as a person's weight in kilograms divided by their height squared in meters [4]. There is often a misconception between the terms obese and overweight. A person of BMI of 30 or more is generally considered obese while a person of BMI of 25 or more is considered overweight. More specific BMI classifies obesity into three grades. BMI of 30-34.9 is classified as class I, BMI of

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35-39.9 as class II and BMI equal to 40 or more is classified as class III [2]. BMI correlates to the degree of body weight but should not be the only indicator for presence of metabolic disease risk [4]. That is because it does not distinguish between lean, fat, bone tissue, gender, and ethnicity and thus is not a highly precise estimate of body fat [4].

Another technique, Bioelectric Impedance (BIA), uses an electrical signal through the body to measure the resistance of the body, using information from this resistance, body fat composition can be measured [5]. The current faces more resistance passing through body fat than it does through water [5]. This means even though the BMI of a muscular body and an overweight body might be the same, the BIA would be different. In addition to these, Dual Energy X-ray Absorptiometry (DEXA) technique uses X-ray beams that pass through different body tissues at different rates to measure body composition [5]. Finally, it is of importance to note that Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) are now the most accurate and precise methods for measuring tissue, organ, and whole-body fat mass as well as lean muscle mass and bone mass [5]. However, their use is limited because of the amount of ionizing radiation used as that can be dangerous and cause numerous side effects.

As mentioned above, obesity is a result of numerous factors. Patterns of consumption, urban development, and lifestyle habits influence the prevalence of obesity. Obesity was at one point considered a problem only in high income countries, but now it is dramatically on the rise in low- and middle-income countries too. More specific epidemiological studies show that in the last three decades, the worldwide prevalence of obesity has increased to 27.5% for adults and 47.1% for children. [6] In 2015, 603.7 million adults and 107.7 million children were obese in 195 countries. [7] Obesity is now considered to be one of the most serious public health problems of the 21st century and is listed as one of the leading preventable causes of death worldwide. Being evolved into a global epidemic obesity is a condition of major concern [6-8].

Nutrition Transition

As many countries experience rapid economic growth, urbanization and epidemiological changes, food preferences and availability tend to also change leading to nutritional transitions [9]. Diets high in sugar, fat and animal products replaced traditional diets that were based on complex carbohydrates and fiber [10]. These transitions in general promote a positive energy balance, since caloric intake is exceeding caloric output, thus resulting in weight gain and on long-term obesity. Simultaneously, homogenization and westernization increased the energy density of the global diet (acceleration in fast food, soft drinks and meat consumption). Additionally, the numerical elevation in large local supermarkets and fast food outlets, rapidly led to displacement of fresh food markets and promoted the consumption of high processed/energy-dense food [10]. Furthermore, a noted decline in cost of low-quality/energy high foods caused a reduction in dietary intake of grain and increased world average energy intake greatly [9].

Eating Choices and Behavior

Eating choices are made on the basis of taste, cost, convenience, and, to a lesser extent, healthfulness and variety [11]. Eating out; a common

time saving and convenient habit, has coincided with the increasing prevalence of obesity, especially if it is done on a frequent basis [12]. In general, food prepared away from home is higher in total energy, total fat, saturated fat, cholesterol and sodium, contains less fiber and calcium and is overall of poorer nutritional quality than at-home food. Additionally, those who eat out more, on average, have been found to have a higher BMI [9]. Increased frequency of eating prepared food in combination with the increasing portion sizes, are likely contributors to the rising prevalence of obesity.

Large portions tend to increase energy intake at a meal, with no increase in satiety. Increased quantity for the same amount of money for smaller portions has lured people, as it offers more value for money. However, exposure to larger food portion sizes contributes to 'portion distortion' among consumers. People who experience portion distortion consider larger portions as an appropriate amount to consume at a single occasion. In this essence, passive overconsumption is likely to occur [13]. Finally, habitual snacking is not clearly associated with obesity. The high energy density of common snack foods, however, combined with an increased snacking frequency may promote weight gain and obesity [9].

Fast Food

Fast food outlets have increased from about 30,000 in 1970 to more than 233,000 locations in the USA in 2004 and have been classified as the most rapidly expanding sectors of the US food distribution center [14]. Percentage of caloric intake from fast food has increased by fivefold over the past three decades. Also, the frequency of consuming fast food has increased; about 30% of children to more than 50% in college students use fast food daily [15]. Many aspects of fast food make it the prime suspect to the associated increases in overweight and obesity. Fast food is highly attractive for consumers due to convenience, low cost, abundant menu choices, flavor and taste. However, it contains large amounts of sugar, fats, carbohydrates, less minerals and vitamins (micronutrients), it is low in fiber, high in glycemic load and excessive in portion size [13]. Thus, increased fast food consumption is associated with exceeding of daily energy requirements resulting in obesity as a long-term effect.

Specific types of carbohydrates have been greatly associated with obesity [16]. Highly refined carbohydrates (e.g. polished white rice and refined wheat flour), refined starches (e.g. potato chips and potatoes), as well as products high in processed sugars (e.g. sweets and sugar-sweetened beverages (SSBs)) are considered great contributors to long-term weight gain [10]. Especially, SSBs have attracted much attention because they are associated with weight gain and obesity risk [17]. SSBs are beverages that contain added caloric sweeteners such as sucrose and high-fructose corn syrup [18]. They include soft drinks, carbonated soft drinks, fruit drinks, sports drinks, energy and vitamin water drinks, sweetened iced tea, cordial, squashes, and lemonade, and are collectively the largest contributors to added sugar intake in the US [19].

In the past three to four decades, consumption of added sugar in the form of SSBs has increased dramatically across the whole globe [20]. Those type of drinks provide many calories and virtually no other nutrients. The mean intake provided by a can of sugar-sweetened soda or fruit punch is about 150 calories, most of which are from added sugar [21]. When drinking sugary beverages people do not satiate fully and feel the urge

to consume more food to satisfy themselves, an action which can gradually promote weight gain [21]. Additional metabolic effects from the fructose fraction of these beverages may also promote accumulation of visceral adiposity, since it is metabolized faster to fat (triglycerides) [22].

Physical Activity

Obesity may not be caused solely by lack, or absence, of exercise, but physical activity generally is one of the most instrumental discretionary components of daily energy expenditure due to the ways it can affect the energy balance [23]. As a result, physical activity has the capability to have a monumental part of the solution for the obesity epidemic that has been drastically increasing.

It is common knowledge that weight gain occurs when energy expended is less than dietary consumption over a period of time. Several studies have argued that there is a strong correlation between the decline of physical activity, in occupational and leisure settings, and the increase of obesity rates in the past 50 years [24]. Data from the National Health and Nutrition Examination Survey revealed a 3-fold greater risk of gaining weight in men and a 4-fold greater risk in women linked with lack of physical activity [25]. Levels of housework-related energy expenditure for women has dropped more than 350 kcal in the US over the last 50 years, due to labor-saving devices such as robot vacuums. It was concluded by Archer *et al.* (2013) that this could be a potent contributor to the increase of morbid obesity of women over the last 5 decades, as housework has been displaced with sedentary activities such as sitting, watching television and lying down to read [26].

In another study recently performed by Church *et al.* (2011), daily energy expenditure in regard to work related physical activity in the US has decreased by 120 kcal during the last 5 decades for men and women, which could be correlated to the increase of obesity in the US during the same time period [24]. Moreover, substantial utilization of domestic mechanization in Brazil and China has reduced physical activity at work as it involves less movement, which has only contributed to the rising obesity epidemic [27]. A 12-month study performed by Shook *et al.* (2015) examined the possibility of an existing relation between physical activity and appetite, with an increase of the latter leading to weight gain [28]. The authors concluded that physical activity and appetite are inversely proportional, implying individuals who performed higher physical activities had a lower appetite than individuals who performed lesser physical activities [28]. This implies that physical activity can help prevent weight gain by reducing a person's appetite, and not just by increasing the body's expenditure.

All previous studies point towards a link between lack of physical activity and the obesity epidemic leading to increase of physical activity using different exercises as an appropriate solution for weight loss or prevention of weight gain. American College of Sports Medicine recommend that exercise programs should be at 150-250 min/per week to prevent weight gain and 225-420 min/per week to promote clinically significant weight loss [29]. A meta-analysis performed by Richardson *et al.* observed that over an average period of 4 months while maintaining caloric intake without any restrictions, obese patients lost on average 1.2 kg by walking 10,000 steps per day or 1,000 steps above

their baseline [30]. Furthermore, a randomized control trial by Donnelly *et al.* on effects of aerobic exercise without caloric restriction, showed that 16 months of different aerobic exercises at 2000 kcal per week induced a 5.2 kg weight loss in men [31].

These results were not translated in women, but such intensity of aerobic exercises prevented further weight gain in women [31]. On the other hand, a meta-analysis by Miller *et al.* showed that combining exercise with diet restriction produced a three-to-five-fold greater change in body weight compared to exercise alone [32]. Finally, a study by Andersen *et al.* evaluated the effect of low-fat diet with either vigorous aerobic exercise or simple lifestyle activity, and both groups lost approximately 8 kg of weight following 16 weeks of intervention [33]. Weight maintenance was then monitored for 1 year after the intervention, and at 12 months those with most physical activity lost an additional 2 kg while those with minimal physical activity regained 5 kg [33]. These studies show that exercise alone might only cause a moderate decrease in weight loss but is necessary for preventing weight gain (Table 1).

Table 1: Summary of modalities used by different studies to promote weight loss using increase of physical activity.

Authors	Modality	Outcomes
Richards on <i>et al.</i> [30]	10000 steps per day	0 to 1 kg of weight loss
Donnelly <i>et al.</i> [31]	Aerobic Exercise	2 to 5.2 kg weight loss
Miller <i>et al.</i> [32]	Aerobic Exercise & Caloric Restrictions	Three-to-five-fold greater change in body weight compared to exercise alone
Andersen <i>et al.</i> [33]	Low-fat diet with either vigorous aerobic exercise or simple lifestyle activity	8 kg loss in both groups The group with minimal exercise regained 5 kg while the group that performed vigorous aerobic exercises lost 2 kg

Management and Treatment Strategies

Obesity can lead to difficulties in day-to-day living, risk to psychological and social well-being (due to a negative self-image, discrimination) and to major health risks [34]. Indeed, obesity increases the likelihood of several cardiovascular diseases such as myocardial infarction and angina. It is also associated with an increased risk for diabetes type 2, gallbladder stones and osteoarthritis. Therefore, it's essential to control and treat it [34].

Management of obesity can include lifestyle changes (nutrition, physical activity, and behavior therapy), medications or surgery. The primary approach in treating obesity is weight loss through diet and exercise [35]. Various dietary strategies can effectively reduce weight, (i.e., low-, very low-, and moderate-fat diets, high-protein diets, low-carbohydrate diets, and low glycemic index diets) [36]. Macronutrients consumption has been the foundation for many weight reducing diets. Fat, carbohydrates, and proteins have all been highlighted at different times as the key to weight loss [36].

Table 2: Summary of nutritional goals and practical dietary strategies for weight loss [36, 39].

Element	Nutritional Goal	Recommendation
Fat	20 to 35% of total calorie intake	Fat is high in energy density. Choose appropriate portions of healthy fats to improve diet quality and meet nutritional needs. <ul style="list-style-type: none"> • Substitute lower-fat foods for those higher in fat • Include monounsaturated and polyunsaturated fats
Protein	10 to 35 % of total calorie intake	Include protein to create satisfying meals and meet nutrient needs. <ul style="list-style-type: none"> • Include lean meats, poultry without skin, fish, eggs, legumes, tofu, and low-fat dairy products
Carbohydrate	45 to 65% of total calorie intake	Switch to whole grains instead of refined grains. <ul style="list-style-type: none"> • Examples include wheat, brown rice, oats, barley, corn
Fiber	20 to 35 grams per day	Include fiber to help increase satiety <ul style="list-style-type: none"> • Add legumes, fruits, vegetables, and whole grains
Added Sugar	Limit to less than 10% of total calorie intake	Limit foods and beverages containing added sugars. <ul style="list-style-type: none"> • Main sources of added sugars are snacks, sweets and beverages • Nonnutritive sweeteners can be a substitute
Beverages		Select low-calorie beverages. <ul style="list-style-type: none"> • Water is the best choice • Limit intake of alcoholic beverages
Dietary Strategy		Recommendation
Monitor portions		Choose appropriately sized portions to help meet daily energy requirements. <ul style="list-style-type: none"> • Serve large portions of very low- and low-energy-dense foods • Serve smaller, less frequent portions of medium energy-dense foods • Limit portions of high-energy-dense foods
Increase the proportion of lower-energy-dense foods		Lower-energy-dense foods provide satisfying portions to help increase satiety. <ul style="list-style-type: none"> • Fill half the plate with fruits and vegetables • Start the meal with a first course broth-based soup or salad • Substitute fruits and vegetables for higher-energy-dense ingredients

Diets coupled with behaviour therapy and ongoing support tend to produce longer lasting effects [37]. The common pattern between these diets is the low energy intake. Reducing a diet's energy density allows individuals to consume satisfying amounts of food for fewer calories. Strategies that lower energy density are flexible and can be personalized according to the patient [36]. Weight loss of 5-10% of initial weight, achieved through intensive lifestyle intervention, reduces cardiovascular disease (CVD) risk factors, prevents or delays the development of type 2 diabetes, and improves other health consequences of obesity [35]. Although improvements in some CVD risk factors can be seen with sustained weight loss as small as 3%, weight loss $\geq 5\%$ is generally considered to be clinically meaningful [38]. Table 2 shows a summary of nutritional goals and practical dietary strategies for weight loss. If the patient does not achieve adequate weight loss by lifestyle intervention for 3-6 months, pharmacotherapy can be considered along with it [40].

Table 3 shows a list of the drugs approved by the U.S. Food and Drug Administration (FDA) that produce weight loss.

Long-term use drugs such as Orlistat are safe to be used for a longer period. Orlistat reduces absorption of fat by 30 % by inhibiting the gastrointestinal lipase [39]. A 4-year placebo-controlled trial with Orlistat in 3304 overweight patients showed that 21% of patients with prediabetes achieved mean weight loss more than 11% below baseline in the group treated with orlistat compared to 6% below baseline in the placebo-treated group during the first year of use. For drugs approved for long-term use, if 3% mean weight loss is not achieved during three months of medication use, there is a need to reconsider the treatment modality [40].

Table 3: Drugs approved by the U.S. Food and Drug Administration that induce weight loss [41].

Generic name, year of approval	Trade name(s)	Dose	DEA schedule
Pancreatic lipase inhibitor approved by the FDA for long-term use (≥ 12 months)			
Orlistat, 1999	Xenical	120 mg 3 times daily before meals	Not scheduled
Orlistat, 2007	Alli (over the counter)	60 mg 3 times daily before meals	Not scheduled
Serotonin-2C receptor agonist approved by the FDA for long-term use (12 months)			
Lorcaserin, 2012	Belviq	10 mg twice daily	IV
Combination of phentermine-topiramate approved by the FDA for long-term use (12 months)			
Phentermine-topiramate, 2012	Qsymia	3.75/23 mg 7.5/46 mg 15/92 mg	IV
Noradrenergic drugs approved for short-term use (usually <12 weeks)			
Diethylpropion, 1959	Tenuate	25 mg 3 times a day	IV
	Tenuate Dospan	75 mg every morning	
Phentermine, 1959	Adipex and many others	15–30 mg/day	IV
Benzphetamine, 1960	Didrex	25–50 mg 3 times daily	III
Phendimetrazine, 1959	Bontril	17.5–70 mg 3 times daily	III
	Prelu-2	105 mg daily	

FDA: The Food and Drug Administration; DEA: data envelopment analysis; OTC: over the counter.

When all pharmacological attempts to lose weight have been unsuccessful, surgery should be considered. The least invasive type of surgery for weight loss is laparoscopic adjustable gastric banding [42]. In this procedure, the surgeon places an adjustable band around the upper part of the stomach, thereby creating a very small stomach pouch. As a result, the person will feel full after eating much less food [42]. Other common weight-loss surgeries work by reducing the amount of food the body can absorb such as gastric bypass surgery. During this procedure, the surgeon makes a small pouch at the top of the stomach and connects it to the small intestine. When a person eats, the food that he/she swallows goes into the new pouch and then into the small intestine, “bypassing” the stomach and the upper part of the small intestine, where absorption usually takes place [43].

Conclusion

Obesity is a chronic medical condition with a multifactorial etiology that involves both genetic factors and lifestyle factors. It is a serious and highly prevalent disease associated with increased morbidity and mortality. Indeed, obesity is responsible for several of the leading causes of preventable death, including cardiovascular diseases and type 2 diabetes. There, treating and controlling obesity should be major imperatives. The treatment should follow a physical examination (BMI and waist circumference measurement) and it should be individualized, meaning that it should be based on the eating and behavioral patterns of the patient and it must be taken into account whether the patient has obesity related complications. All patients should begin by adopting a healthier lifestyle through diet and exercise and should be followed by an expert. It is essential to focus on realistic goals; weight maintenance and prevention of weight regain. Pharmacotherapy and bariatric surgery can be taken into account whether the patient could not lose weight through diet and exercise. Physicians have a responsibility to recognize obesity as a gateway to disease and help patients with appropriate prevention and treatment schemes for obesity and its comorbidities.

Conflicts of Interest

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All authors contributed equally to the literature search, the analysis of data and the writing of the article.

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