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A Review on Obesity and Associated Disease

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Abstract:

Obesity is a significant public health issue that extends beyond industrialized nations, emerging as a critical concern in developing countries such as Bangladesh. Excessive caloric consumption resulting from heightened intake of refined sweets, sugary drinks, vegetable oils, processed and fast foods, coupled with insufficient physical exercise, a scarcity of recreational areas, and a sedentary lifestyle, contributes to the onset of obesity. Excess adiposity, sometimes referred to as obesity, and surplus body weight are linked to a heightened risk of several illnesses, including type 2 diabetes, dyslipidemias, cardiovascular disease, hypertension, and cancer. This review article elucidates the pathophysiology and illness associations related to obesity.

Keywords: Obesity, Disease Association, Public Health Problem

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 [1,2]. Body mass index (BMI), a measurement which compares weight and height, defines people as overweight (pre-obese) if their BMI is between 25 kg/m² and 30 kg/m², and obese when it is greater than 30 kg/m². [3] BMI is calculated by dividing the subject's mass by the square of his or her height, typically expressed either in metric or US "customary"- unit [4].

Metric: BMI = kilograms / meters²

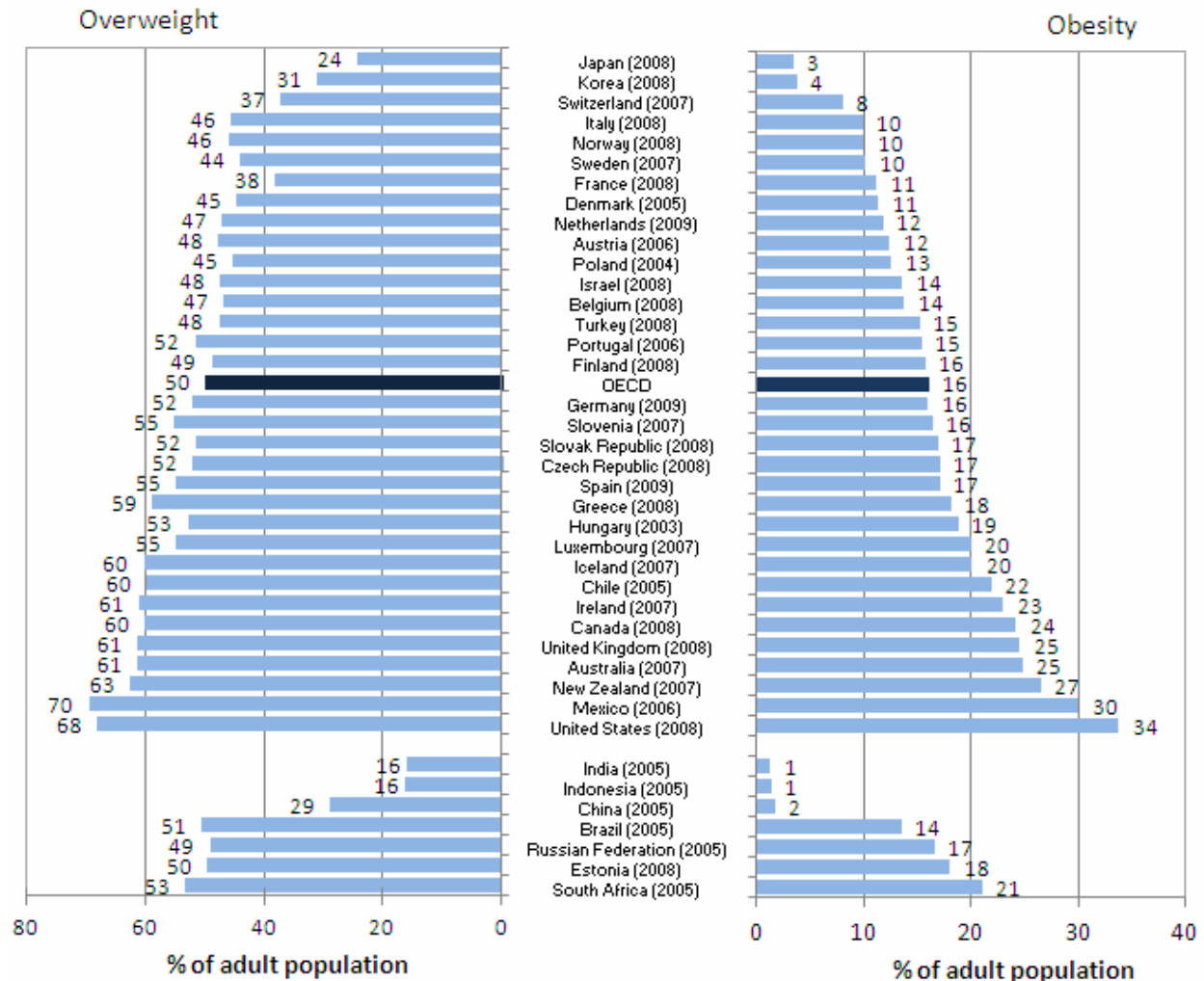
US customary and imperial: BMI = lb / in² where lb is the subject's weight in pounds and in is the subject's height in inches.

- Any BMI ≥ 35 or 40 is severe obesity

- A BMI of ≥ 35 or 40–44.9 or 49.9 is morbid obesity
- A BMI of ≥ 45 or 50 is super obesity

The following graph illustrates the prevalence of overweight and obesity among the global population. Data from several nations indicate that the prevalence of overweight individuals ranges from 16% in India to 70% in Mexico, while the prevalence of obesity varies from 3% in Japan to 34% in the USA, highlighting a concerning scenario. Due to the lack of data for Bangladesh, an accurate estimation of the prevalence of overweight and obesity is unattainable. It is anticipated that this prevalence would be elevated rather than diminished, attributable to rising urbanization, changes in dietary preferences towards processed and high-calorie foods, insufficient physical exercise, and a sedentary lifestyle. [5]

BMI	Classification
< 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



Pathogenesis of Obesity

The pathophysiology of obesity is complex and encompasses humoral and neuronal systems that regulate appetite and satiety. These stimuli react to genetic, dietary, environmental, and psychological cues, activating regions in the hypothalamus. The neurohumoral system regulating energy

balance has three components. The peripheral or afferent systems that generate signals from diverse locations. These include leptin and adiponectin generated by adipocytes, ghrelin from the stomach, peptide YY from the ileum and colon, and insulin from the pancreas. Leptin, derived from the Greek word "Leptos" meaning thin,

is a 16 kDa hormone generated by adipocytes and is the result of the *ob* gene. The leptin receptor (OB-R), a product of the *ob* gene, is classified as a type I cytokine receptor, which encompasses gp130, granulocyte colony-stimulating factor, and interleukin-6 and -2 receptors. Leptin-deficient genetically modified mice are unable to detect fat reserves, resulting in excessive consumption and weight gain. Adiponectin stimulates fatty acid oxidation, resulting in a reduction in fat mass. Besides leptin and adiponectin, adipose tissue persistently synthesizes cytokines such as TNF, IL-1, IL-6, IL-18, chemokines, and steroid hormones, resulting in a chronic subclinical inflammatory condition characterized by elevated levels of CRP. Ghrelin is synthesized in the stomach and the arcuate nucleus of the hypothalamus, and it is the only identified gut hormone that enhances food consumption (orexigenic action). The arcuate nucleus in the hypothalamus processes and integrates inputs to produce various outputs via two subgroups. The primary order of neurons include POMC (Pro-opiomelanocortin) and CART (Cocaine- and amphetamine-regulated transcript) neurons, whereas the secondary order includes Neuropeptide Y and AgRP (Agouti-related peptide). The effector system transmits signals produced by the second-order neurons of the hypothalamus to regulate food intake and expenditure. POMC and CART enhance energy expenditure and facilitate weight reduction by generating alpha melanocyte stimulating hormone (MSH) and activating melanocortin receptors 3 and 4 (MC3/4) in second-order neurons. NYP/AgRP neurons facilitate food consumption and weight augmentation via the activation of Y1/5 receptors in secondary neurons. [6]

Review of literatures and discussion

Obesity elevates the risk of several ailments, notably cardiovascular disease, type 2 diabetes, sleep apnea, certain cancers, and osteoarthritis. Obesity is mainly attributed to a combination of excessive caloric intake, insufficient physical exercise, and genetic predisposition, while certain instances are predominantly due to genetic factors, endocrine problems, pharmacological agents, or mental conditions. Evidence supporting the notion that some obese individuals consume less food but gain weight owing to a sluggish metabolism is scarce; on average, obese individuals exhibit a higher energy expenditure than their slender counterparts due to the energy necessary for sustaining an elevated body mass.

Association of Obesity and Diseases

There is increased association of obesity and diseases. These include Diabetes, Hypertension, Osteoarthritis, Pancreatitis, Cholelithiasis and dyslipidemia which are discussed below [7].

Type1 Diabetes- There is overall evidence for an association between childhood obesity, higher BMI, increased risk of subsequent type1 diabetes.

Type2 diabetes- insulin resistance and hyper insulinaemia. Weight loss associated with improvement. Excess insulin retain Na, expansion of blood volume, production of excess norepinephrine, smooth muscle proliferation hallmark of Hypertension [9,10,11].

Osteoarthritis- marked obesity predisposes to degenerative joint disease. Cumulative effect of wear and tear on joint due to obesity, greater the burden of fat greater the trauma to joints with time [12].

Gall stone- 6 times more common in obese than non-obese. Increased total cholesterol, increased biliary excretion and

cholesterol in bile, cholesterol rich gall stones [13].

Nonalcoholic steatohepatitis- adolescents and adult who are obese and have type2 diabetes. Fatty change accompanied by inflammation lead to fibrosis.

Dyslipidemia- increased risk of CAD due to hyper TG, Low HDL Syndrome X- distinctive metabolic syndrome-abdominal obesity, insulin resistance, hyper TG, low HDL, HTN, increased risk of CAD.

Thrombosis- increases the risk of ischaemic stroke. Abdominal obesity is associated with increased risk of thrombosis [14].

Cancer- increased BMI and mortality in cancer esophagus, colon, rectum, liver and NHL [15,16].

Hypoventilation syndrome- respiratory anomalies, increased sleep both at night and day. Apnic pauses during sleep, polycythaemia and eventually RHF [17].

Obesity & Systemic Disease Association

GIT- increased gall stone, pancreatitis, Gastrointestinal reflux disease, Nonalcoholic fatty liver disease, abdominal hernia [18,19].

Endocrine & Metabolic system- Increased type 2 diabetes, insulin resistance, IGT, dyslipidemia.

Cardiovascular system- increased thromboembolism, Hypertension, Coronary artery disease, Chronic heart failure, Pulmonary hypertension, Asthma [20, 21].

Female Genital tract/gynaecological-

Menstrual abnormality, infertility, carcinoma [22,23].

Eye- Cataract

Musculoskeletal system- Osteoarthritis, Gout, Lowbackpain

Postoperative- Atelactasis, Pneumonia, Deepvein thrombosis, Pulmonary embolism

Genitourinary- Stress urinary incontinence [24].

Neurological- idiopathic inherited

Conclusions

The examined literature indicates that obesity is a significant public health issue in both emerging and affluent nations. It elevates morbidity and mortality across several disease associations in both children and adults, regardless of sex. Nonetheless, rigorous dietary regulation about an individual's height, weight, age, physical activity, reduced consumption of processed and high-calorie foods, and augmented intake of vegetables, antioxidants, and polyunsaturated fats will diminish the prevalence of obesity. A social movement encompassing all societal strata, including representatives of the populace, governmental and private health organizations, mass media, educators, and religious leaders, might significantly contribute to mitigating this issue.

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