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Review Article

# Obesity Epidemiology: A Serious Public Health Concern in India

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## I N F O

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## A B S T R A C T

Over the past several years, India has seen the incidence of obesity double or quadruple due to economic expansion, industrialisation, motorised transportation, urbanisation, a more sedentary lifestyle, and a nutritional change to prepare dishes that are rich in calories. Many things contribute to becoming overweight or obese since bodyweight is influenced by various factors, including genetics, metabolism, behaviour, the environment, culture, and socioeconomics. When evaluating the risk of various diseases, the quantity, location, and distribution of fat and obesity in the human body are significant. Being overweight and having an improper fat distribution are linked to a variety of illnesses. Obesity occurs when a person's weight exceeds their body fat percentage. Therefore, obesity has already increased dramatically in India as a consequence of these factors, putting Indian residents at risk for health concerns. Our study aims to bring awareness to the problems, better understand the problems, and record the incidence of obesity and overweight in the Indian community. Obesity education and public awareness may go a long way toward preventing these issues.

**Keywords:** Public Health, India, Nutritional Status, Obesity, Overweight

## Introduction

Obesity is a physiological disease in which fat accumulates in the body. It's a chronic ailment that the WHO and numerous other national and international organisations have categorised as a disease.[1] The condition is increasingly being recognised as a significant contributor to the global disease burden, owing to the pandemic levels of obesity that have been seen in recent decades. In industrialised countries, cancer and cardiovascular disease are the two main causes of mortality. Unfortunately, 'cardiovascular

disease (CVD)' is a primary reason for death and disability. In heart disease survivors, the expense of 'blood pressure-lowering', 'antithrombotic', and 'diuretic' drugs is high. Stroke survivors are often plagued by mental health issues and physical problems such as weakness in their muscles and joints. Obesity's cost to society is borne almost entirely by diabetes.[2-5]

'Overweight' and 'obesity' have experienced a rise in global incidence in recent years. The WHO predicted that more than seven hundred million individuals and 2.3 billion people would be overweight by 2015. An estimated 2.5+ million Americans lose their lives each year as a result of obesity-related illnesses. Overconsumption of calories results in fat storage in the body. Obesity, caused by this fat storage in the body (Figure 1), is becoming one of the most frequent nutritional diseases in industrialised nations. As a result, one in every four persons will acquire diabetes. As a consequence of being overweight or obese, one in every three people will have 'heart disease', and one in every four people will acquire cancer.[6-9]

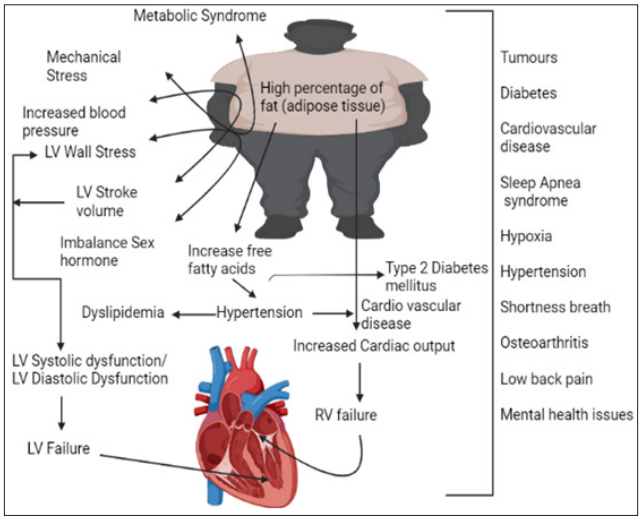


**Figure 1.Complications of Obesity as a Public Health Problem (BioRender was used to make this image)**

When someone's weight exceeds what is deemed normal or suitable for their height and weight, they are said to be overweight. When it comes to maintaining body mass (BMI), obesity is defined by a high amount of fat in the form of 'adipose tissue'.[10-12] Obesity is defined as having "too much fatness" or having obesity that causes illness.[13] Even while it is impossible to identify the specific causes of the epidemic, a sedentary lifestyle, a lack of physical activity and an abundance of energy-dense meals are among the primary factors.[14-18] As a result, obesity has risen to become the most serious worldwide issue confronting our nation.

The consequences of undernutrition and overnutrition for adolescents in West Bengal, India[19-23] and across India[24-27] have been well documented. The most common reason for someone to be undernourished is because they aren't eating enough. Individuals who suffer from this condition tend to lose bodyweight and have a set of symptoms, like sluggishness and osteoarthritis, among others (dry skin, low blood pressure etc.). In addition, studies have shown that prolonged hunger is linked to the development of nutritional oedema, as well as to burning feelings in the hands and feet.

## System of Weight Classification for Adults

The weight-to-height ratio of the body is now the most commonly used criteria for obesity classification, and it varies from underweight or wastefulness (18.0+ kg/m$^2$) to severe, even morbid, overweight (40.0 kg/m$^2$). Measures of abdominal adiposity like waist circumference have become more important and discriminating in clinical and research settings as an overweight/ obesity predictor.[28] Adiposity in the abdominal region results from fat accumulation surrounding the organs, especially visceral fat. In addition, metabolic dysregulation, which is connected to an increased likelihood of cardiovascular disease and other ailments, is another effect of this fat.[29] European men must have a waist circumference less than 94 cm, and European women must have a waist circumference less than 80 cm if they want to reduce their cardiovascular risk. However, other races and ethnicities should use a different cutoff point.[29]

## BMI and Obesity Metrics Calculation

In the struggle against obesity, a standard public health measure of overweight and obesity should be established as soon as possible. The 'BMI' is a measure used by the 'National Institutes of Health' (NIH) to categorise people as overweight or obese. In order to calculate Body Mass Index, just two elements are required, height and weight, and their exact measurements are taken. Body Mass Index is obtained by dividing one's weight in kilogrammes by one's height in metres squared.[30]

## Possible Risks associated with Obesity

Calculating a result's 'attributable fraction' (the proportion of the outcome that can be attributed to obesity) is critical for determining whether or not obesity is contributing to an increased risk of disease, death, or disability.

$$AF_p = \frac{p(RR-1)}{p(RR-1)+1},$$

The attributable fraction (AF), the proportion of men in each BMI range (p), and the related relative risk (RR) are all indicated by RR. Since the percentage of obese people in each attributable fraction calculation will be the same, relative risks may be compared to examine the varied effects of obesity on mortality and morbidity. This review was based on data gathered from a follow-up survey of health professionals.[5,31-34] The nurses' health study in the United States was used to emphasise the relative risks

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of ''stroke'', ''mortality'', ''coronary heart disease'', and ''type 2 diabetes mellitus'' associated with different BMI categories.[35-37]

## Microbiomes and Viruses as Environmental Pathogens

Despite the fact that numerous viruses have been identified as having the potential to have a causative role in obesity, higher Ad-36 viral loads have been seen. Studies undertaken in a range of human populations have shown that it is most likely the cause of obesity in both adults and children, with associations to other metabolic characteristics.[38,39]

New insights regarding obesity and illnesses have come up as a result of recent discoveries in understanding how billions of bacteria in the human microbiome affect obesity, energy metabolism, and carbohydrate and fat digestion, for example, according to a research conducted on mice, greater adiposity is a feature that may be passed on by microbiome transplantation.[40,41]

## Diabetes

Type 2 diabetes is closely linked to diabetes and obesity, which should come as no surprise. A three-fold increased risk of type 2 diabetes is associated with being overweight, whereas a seven-fold increased risk is associated with being obese. Weight gain during early to mid-adulthood and obesity during childhood and adolescence are substantial risk factors for acquiring type 2 diabetes later in life (Table 1). When combined with other metabolic disorders (such as dyslipidemia, insulin resistance, hypertension, and poor glycaemic control), obesity doubles one's chance of getting diabetes.[42,43]

## Cancer

It was discovered that obesity was a significant factor in around 6% of all cancers identified in 2007. Overweight people are more likely to develop gallbladder, oesophagus, colon, liver and pancreatic cancers; postmenopausal breast and ovarian cancer, endometriosis, and prostate and renal disease.[44,45]

## Heart and Vascular Diseases

Overweight and obesity are linked to their usual antecedents, hypertension and dyslipidemia in general, in addition to being well-known risk factors for ischemic stroke and heart disease. Recent research has repeatedly revealed that benign obesity seems to be a fiction contrary to popular belief. The presence of excess weight increases the chance of 'heart disease' and stroke and the consequences of hypertension, dyslipidemia, and hypoglycaemia. A recent study has focused on the link between childhood obesity and adult disease because of the high frequency of juvenile obesity. It has been seen that obesity during childhood or adolescence is connected with a two-fold or greater risk of ''adult hypertension'', stroke, and CHD (coronary heart disease).[46,47]

**Table 1.Risk Factors, Comorbidities, and Consequences of Obesity**

| | Individual | Socioeconomic | Environmental |
|---|---|---|---|
| Risk factors (non-exhaustive) | Genetics | Lack of education | Junk foods (i.e., geographical locations with little or no quick access to healthful foods, for example, fresh produce and groceries) are a growing problem in America. |
| | Low levels of physical activity | Poverty | Obesogens are substances that cause weight gain (e.g., endocrine-disrupting chemicals) |
| | Calorie-dense foods that are deficient in nutritional value (e.g., sugar-sweetened beverages) | | Resources for physical activity are scarce, and towns are not walkable. |
| | Excessive energy intake in comparison to energy requirements | | Viruses |
| | Sleeping too little or too much | | Microbiota |
| | Sedentariness | | Obese social bonds are a problem |

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| | | | |
|---|---|---|---|
| | Exposures during pregnancy and perinatal period | | |
| | Drugs that are specific (e.g., steroids) | | |
| | Conditions affecting one's psychological well-being (e.g., stress, depression) | | |
| | Certain disorders (for example, Cushing's disease) are characterised by excessive production of cortisol. | | |
| Comorbidities and Sequelae (non-exhaustive) | Hypertension | Type 2 diabetes | Dyslipidemia |
| | Heart and vascular illnesses are two of the most common types of cardiovascular disease. | Osteoarthritis | Infertility |
| | Cancers of a specific kind (e.g., colon, oesophageal, postmenopausal breast) | Liver illnesses are a group of disorders that affect the liver (e.g., non-alcoholic steatohepatitis, non-alcoholic fatty liver disease) | Conditions and illnesses of the respiratory system (e.g., asthma, sleep apnea) |
| | Gallstones | Treatment and survival after a traumatic event | Infection |
| | Disabilities due to physical limitations | Conditions affecting one's psychological well-being (e.g., psychosocial function, depression) | Absenteeism/ loss of productivity |
| | Years of life wasted due to premature death | Increased medical expenses | Absenteeism and decreased productivity |

## Obesity's Genetic Contribution

While genetics are likely to have a role, this very little variance in BMI, together with the large rise in obesity in both developed and developing nations over the last half-century, indicates additional obesity risk factors. An estimated 1.5% of the variance in BMI may be attributed to the 32 most prevalent genetic variations. The people with the highest genetic risk (those with an average BMI of 3.0 kg/m2) had more than 38 risk allele bearers (those with an average BMI of 2.7 kg/m$^2$). An individual who is 5'3" (160 cm) tall has a 7 kg (11 lb) difference in weight between those with high and low hereditary risk.[48] The obesity pandemic cannot be explained by changes in the human population's genetic composition. It is possible that genes impact obesity development if individuals react differently to settings that encourage inactivity and ''high-calorie eating''. Furthermore, genes instruct the organism on how to adapt to changes in the surrounding environment. Consequently, genetic variations that promote hunger and food intake may have a role in the occurrence of obesity. Occasionally, a single gene mutation may be identified as the cause of hereditary obesity in a family (''monogenic obesity''). The exact nature of the genetic and environmental interactions that lead to obesity, on the other hand, is still a mystery (multifactorial obesity). Identifying persons with a high risk of obesity-related diseases, including diabetes, heart disease, and certain malignancies, is common among healthcare professionals. The influence of shared genetics and environment may be seen in the health histories of close relatives. Families can't alter their DNA, but they can help their children develop

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good behaviours, such as a nutritious diet and regular exercise. These changes might positively impact the health of current and future generations.[49,50]

## Obesity and Physical Training

Losing weight and being less obese may increase total energy expenditure and decrease adipose tissue mass. The ACSM guidelines include both aerobic and anaerobic exercises. Aerobic exercise uses up a significant amount of muscular oxygen (running, cycling, rowing, etc.). The amount of oxygen consumed during aerobic activity, on the other hand, meets the muscles' energy requirements without the need for additional energy.[51]

Insufficient oxygen is needed to fulfil the energy demands put on muscles during a weightlifting activity, making it an anaerobic activity. In order to generate more lactic acid and electricity, the muscles are required to break down other sources of energy.[52]

Exercise includes ''physical activity (PA)'', even if it does not have to be part of an organised training programme or series of sessions. METS (Metric Equivalent Tons) are measures of energy consumption used to compare the amount of effort and energy consumed during metabolic equivalent activities to that expended when sitting passively. Regular exercise throughout the day and incorporating it into other facets of one's lifestyle are both emphasised in this piece.

Problem-solving, spare time physical activity, and transportation are all part of leading an active lifestyle. A person's respiratory, muscular and cardiovascular fitness are essential considerations. Several recent studies have shown the benefits of physical exercise for persons of all ages on all of these fronts.[53,54]

Experts in West Bengal performed various studies on the impact of regular exercise on physiological health markers such as $VO_2$ Max, blood pressure, heart rate, and menstruation, and the association between menstruation and obesity.[55-60]

The teenage years are a period of fast growth and maturation. Teenage years are marked by increased dietary needs, which might vary substantially depending on your residence.[61] Unfortunately, data on teenagers' physical and nutritional state is rare, especially among indigenous peoples. Consequently, a database with data from various sections of the nation needs to be built. Teens in West Bengal have been studied to see how their physical and nutritional development compares to teenagers in other states.

## Discussion and Conclusion

It's difficult to fathom obesity. Thorough knowledge of how the epidemic's risk variables interact and feasible therapies for the epidemic's multi-levelled and complicated underlying causes are urgently needed. There has also been a significant decrease in physical labour and transportation automation due to the rapid economic expansion in many regions of the globe over the previous century. Diabetes has grown from being an uncommon illness of the rich to becoming one of the most prevalent diseases, with a rising number of the poor suffering as a result of an increasingly sedentary lifestyle and widespread availability of calorie-dense foods, among other factors. Despite the fact that type 2 diabetes and cardiovascular disease are intimately connected, this rapid demographic change has significant ramifications. As a result, the time has come for us to focus on the problem at hand and take the necessary steps to fix it.

There are important clinical and epidemiological ramifications of obesity and other metabolic diseases that may be linked to disparities in body adiposity between men and women. There are persistent health issues connected with growing body mass index (BMI), and how BMI grading is interpreted in terms of risk differences depending on the community.

According to the study, this may be ascribed to these individuals being increasingly dependent on market economies. Consequently, their roles and responsibilities are changing from those associated with a subsistence economy toward those connected with wage labour and manufactured commodities. To summarise, India is now confronted with two separate nutrition concerns, with the potential for growing obesity-related public health burden in the future, while undernutrition remains a concern among children and adults.

Obesity was shown to be more common among poorer individuals in most research studies done throughout India. It was also shown to be more frequent among females than males in the state of New York. Following the outcomes of the research, it was discovered that the problem of overweight and obesity is more frequent in metropolitan regions. As a result, it is expected that an intensive preventative strategy would minimise the burden of many chronic comorbidities on India's healthcare system, such as diabetes, cardiovascular disease, hypertension (high blood pressure), infertility etc.

Overweight and obesity have become more common among adults and children in India in recent years. Most other emerging countries, including the United States and the United Kingdom, have seen similar trends. These forecasts may not account for regional and subnational differences due to the considerable diversity in cultures, cuisine, and economic development across all the states of India. Given that the Indian constitution devolves the responsibilities of administration of the state-level implementation of health and nutrition policies, as it does in the United States, studying how these estimates may shift at the state level

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may be beneficial for the sake of future health policy planning. This might be accomplished by either establishing a distinct urban health programme or including a particular clause in the proposed legislation in National Urban Health Program that emphasises a healthy diet and frequent physical activity.

**Conflict of Interest:** None

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