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Addressing the challenges of overweight and obesity: strategies for promoting a healthier future

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ABSTRACT

The prevalence of overweight and obesity among over 1 billion people worldwide constitutes a major public health concern. There is an increased risk for the onset of noncommunicable diseases such as type 2 diabetes, cardiovascular diseases, and various types of cancer, while productivity and life quality are diminished. The social, environmental, and behavioral influences on obesity and overweight can be mitigated through targeted interventions, as these conditions are largely avoidable. This study explores the latest findings on the causes, consequences, and remedies for overweight and obesity, with a global perspective. Additionally, it outlines several effective measures and strategies that have been put into place or are being considered in various contexts, including financial constraints, marketing limits, primary healthcare options, and school-based initiatives. To change the obesity epidemic and promote healthy eating and active living for everyone, the research calls for immediate action and a useful strategy that promotes healthy eating and diet, increased physical exercise, and modifications to environmental elements.

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1. INTRODUCTION

In the world, with more than 1.9 billion overweight people and over 650 million adults diagnosed with obesity, obesity and overweight have epidemic proportions. In addition, more than 41 million children under five are affected by overweight or obesity. These circumstances also have significant health consequences, including an elevated risk of mental health issues such as depressive and anxiety disorders and chronic diseases such as heart disease and specific types of cancer. In addition, the financial strain caused by overweight and obesity is horrifying, with estimates for annual healthcare expenses and productivity losses in the billions of dollars [1].

Around the world, millions of individuals are struggling with major public health issues, including obesity and obesity. World Health Organization (WHO) explains overweight and obesity as the accumulation of an unhealthy amount of body fat which can pose health risks (e.g., dietary and diet habits, genetic and environmental factors). Body-mass index (BMI), determined by dividing a person's weight in kg by height in m^2, is the most widely used indicator of overweight and obesity. Overweight is defined as having a BMI greater than 25, while a BMI over 30 signifies obesity [2].

More than one billion individuals worldwide, including children, adolescents and adults, are affected by obesity. Recent analyses [3] revealed that worldwide, obesity rates among children and adolescents have

quadrupled, while obesity rates among adults have more than doubled from 1990 to 2022, estimated over 220 million individuals from over 190 nations. The World Obesity Federation (WoF) predicted a worldwide occurrence of 1 billion people as of 2030 [4], but this prediction had already been surpassed in 2022.

The major causes of overweight and obesity include poor diet, lack of exercise, genetics, and certain medications, leading to excess body fat. These conditions contribute to chronic illnesses, such as diabetes and hypertension, reducing quality of life and burdening healthcare systems. Moreover, obesity may have a significant impact on national security and military readiness [5].

Hypertension and high blood pressure are the most common underlying causes of obesity and overweight. Examine the diagnosis and treatment methods of hypertension in individuals and the alternative treatment, including medication and lifestyle modifications, as preventative measures of the disease [6]. Several mathematical models evaluated strategies for managing obesity and proposed actions to policymakers of public health to mitigate the reverse pattern of obesity [7].

Physical activity, diet, and pharmaceutical treatments are essential components of immunity generation against specific diseases [8]. These factors provide valuable insights into the human body's ability to combat infections [9]. The influence of physical exercise on the immune system of humans has been extensively studied. It has been shown that exercise can influence immunity at different levels. This research has also explored how exercise can contribute to the prevention of pandemics through the concept of herd immunity. In addition, studies have aimed to determine the optimal exercise requirement to maximize immune system function [10].

Addressing overweight and obesity requires a comprehensive strategy involving various stakeholders such as decision-makers, healthcare professionals, educators, and the community. This strategy aims to foster supportive environments that promote healthy habits, raise public awareness, and ensure equal access to prevention and treatment services. In this paper, the global obesity situation will be assessed and solutions focusing on diet and the environment will be proposed.

2. METHOD

This research was conducted using peer-reviewed journal articles that were published within the past five years. The emphasis was placed on finding articles that contained both global and United States specific data on trends in obesity. Openly available datasets and patient hospital data were utilized for data analysis purposes to model trends of obesity and health effects on a global scale. Additional economic data was utilized also for the impact of obesity on gross domestic product (GDP) using economic data. To ensure the quality and accuracy of sources used for information in the paper, all data were cross-checked with multiple reputable sources. The specific topics of interest for the research included causes of obesity, tracking, and analyzing the trends of the global obesity problem, diseases related to being overweight, and ways to overcome the obesity crisis.

3. RESULT AND DISCUSSION

3.1. What are overweight and obesity?

Excessive body weight is a defining feature of obesity and overweight. It is calculated by dividing the weight of the person (kg) by the square of his/her height (m). Obesity is commonly referred to as having a BMI of 30 or higher, whereas being overweight is generally characterized by BMI ranging from 25 to 29.9. These divisions are employed to evaluate the possibility of emerging associated health issues. The emergence of overweight and obesity is influenced by several variables. These include inherited traits, food preferences, inactivity, sedentary behavior, psychological characteristics, and environmental features. Weight growth and fat are often the result of a complicated interaction of these factors.

Obesity and overweight can lead to serious health consequences. It raises the risk of several chronic illnesses, such as stroke, heart disease, some forms of cancer, type 2 diabetes, and musculoskeletal problems. Additionally, it may result in social and psychological problems like prejudice, despair, and low self-esteem. Over the recent decades, there has been a consistent increase in the prevalence of overweight and obesity on a global scale. Numerous socioeconomic trends, including urbanization, globalization, and eating patterns, might be linked to this tendency. Along with sedentary lifestyles, the availability of low-cost, processed foods which contain high amounts of fat, sugar, and salt has increased overweight and obesity rates [5], [6].

3.1.1. Children and adolescent obesity

Industrialized and developing countries are experiencing a rise in childhood obesity rates, albeit at very different rates and in distinct trajectories. In addition to 155 million children of school age, nearly 22 million children under five are significantly overweight worldwide. According to this, one in ten kids globally is overweight. This worldwide average represents a broad range of prevalence levels. In the Eastern Mediterranean Region (EMR), it was projected that between 1992 and 2001, there were around 23.5 million school-age children who were overweight or obese; by 2010, that number had nearly quadrupled to 41.7 million. After Americans, EMR countries exhibit the second-highest rates of excess weight and obesity globally, surpassing that of European

nations [11], [12]. Table 1 shows the prevalence of overweight and obese people in EMR countries. This data further demonstrates the globally high rates of overweight and obese individuals.

Table 1. The prevalence of overweight (BMI≥25–29.9) and obesity (BMI≥30) among adults at the national level in certain EMR countries [11]

Country	Date of survey	Sample size	Sex	Age (year)	Overweight (%)	Obese (%)
Bahrain	2007	863	M	20-65	34.8	32.3
		906	F		31.1	40.3
Iran	2004-2005	45,082	M	15-65	42.8	11.1
		44,322	F		57.0	25.2
Kuwait	2007	918	M	20-65	38.9	30
		1,362	F		28.9	
Lebanon	1995-96	501	M	20-70	43.4	14.3
		715	F		30.6	15.5
Libya	2000	334	M	15-50	19.2	5.8
		350	F		21.1	7.1
Morocco	1998-1999	9,120	M	18+	28.0	5.7
		8,200	F		33.0	18.3
Oman	2000	3,076	M	20-70	30.6	15.5
		3,367	F		27.2	22.3
Palestine	2002	1,534	F	15-49	-	10.9
Saudi Arabia	2005	1,658	M	25-65	43.0	31.5
		1,621	F		28.8	50.4
Tunisia	2005	2,379	M	35-70	51.7	37.0
		2,964	F		71.7	13.3

3.1.2. The current situation of child obesity around the world

Childhood getting attacked by obesity is one of the primary global public health issues. While it is increasing in Western and industrialized nations, the frequency is still low in particular developing countries. Obesity rates in South America and the eastern Mediterranean are around 30–40% higher than those in Southeast Asia (10–20%), Europe (20–30%), the Western Pacific (10–20%), and Africa (10–20%) [13]. On the other hand, doing physical exercise can lower children's and teenagers' (ages 13 to 18) risk of obesity (BMI). There is some evidence that diet-only therapies may be beneficial in these age groups, but there is also some evidence that diet-plus interventions may be helpful [14].

Studies show that childhood obesity is a significant issue worldwide, with 155 million school-age children being overweight or obese. Rates have increased dramatically in developing nations, particularly in urban areas and among higher socioeconomic backgrounds. Additionally, obesity may negatively affect quality of life, work prospects, income level, and educational success as children grow into adults. Around 200 million children globally are affected by obesity or being overweight.

3.2. Prevalence of obesity in adults

Since the early 1980s, the predominance of obesity has increased quickly, and as of 2015, over 2 billion individuals worldwide were affected. A significant risk factor for bad health, including heart disease, diabetes, several malignancies, shortened life expectancy, and death, is obesity. Global statistics from 1698 research indicate that between 1975 and 2014, the predominance of obesity grew in men from 3.2 to 10.8% and from 6.4 to 14.9% in women. In the United States (US), the predominance of severe obesity among adults was 9.2% in 2017–2018; women were more likely than males (6.9%) to have severe obesity (11.5%). Individuals aged 40 to 59 had the highest frequency of extreme obesity (11.5%), followed by individuals aged 60 and above (5.8%) [15].

3.3. Effect of obese and overweight in the United States

A BMI of greater than 25 kg/m^2 indicates that 38% of people are overweight or obese, per the WHO and obesity atlas 2023 study. It is predicted that 51% of people worldwide are going to be overweight or suffer from obesity by 2035, with the South Pacific Islands will be in the highest position in this epidemic. Even more startling is the prediction that by 2030, 78% of US adults will be overweight or suffer from obesity. According to estimates, the world will face a loss of almost four trillion USD by 2035 due to obesity.

This amounts to about 3% of the current GDP and is almost equivalent to the financial damage caused by the coronavirus-19 (COVID-19) pandemic 2020. According to current forecasts, in 2030, nearly 57% of people worldwide will be overweight or will suffer from obesity. Between 2020 and 2035, the incidence of obesity is predicted to increase from 10% to 20%, posing a danger to society and healthcare systems [16].

The global increase in obesity rates has raised concerns about the prevalence of obesity-related health conditions and their impact on public health systems worldwide. Obesity is associated with various chronic diseases, including type 2 diabetes, hypertension, cardiovascular disease, and certain types of cancer.

Addressing the obesity epidemic requires a comprehensive approach that combines individual-level interventions, community-based programs, policy changes, and health system strategies. Promoting healthy eating habits, encouraging regular physical activity, and creating environments supportive of healthy behaviors are essential components of obesity prevention efforts. Collaborative efforts involving governments, healthcare providers, community organizations, and individuals are needed to address the complex factors contributing to the obesity epidemic and improve population health outcomes [17].

3.4. Causes of obesity

Overeating and inactivity cause energy imbalance, leading to obesity. Excess nutrients are stored as triglycerides in adipose tissue, resulting in nutrient deficiency. Genetic obesity has three types: syndromic, polygenic, and monogenic. Monogenic obesity, caused by a single gene mutation, exhibits early-onset obesity, and insatiable appetite. Polygenic obesity arises from multiple gene variations. Syndromic obesity, often with malformation syndrome, features dysmorphic traits and organ abnormalities, indicating developmental issues [18], [19]. The WHO asserts that trans fats are linked to obesity, which causes more than 500,000 cardiovascular disease-related deaths prematurely each year globally. The WHO just started a push to eliminate fats from food habits by 2023 to solve the problem [20].

3.5. What kind of food should we eat to prevent obesity?

3.5.1. It's critical to regulate calorie density and fat consumption to lose weight

To improve adherence, the government guidelines include a list of fatty food intake shown in Table 2 that may be used to achieve daily energy requirements. This range enables people to modify their fat consumption according to their dietary choices and cultural beliefs. Weight loss is achievable with varying fat consumption levels. However, excessive fat intake can lead to calorie-dense diets and weight gain. Portion control is crucial to manage energy intake, especially with high-fat meals. Low-calorie diets typically range from 1,000 to 1,500 calories per day, with recommended deficits of 500–750 calories daily. Substituting high-fat foods with lower-fat options like boiled chicken and vegetables or low-fat yogurt can help moderate fat intake. Limiting solid fats, such as trans and saturated fats, and opting for oils rich in polyunsaturated and unsaturated fats is advisable. Including healthy fats in moderation can enhance food palatability and overall diet quality [21], [22].

Table 2. An overview of the nutritional objectives and workable eating plans for losing weight

Element	Nutritional goal	Recommendation
Fat	20 to 35% of total calorie intake	Fat has high energy density. Select suitable portions of healthy fats to improve diet quality. - Replace high-fat foods with lower-fat alternatives - Incorporate monounsaturated and polyunsaturated fats
Protein	10 to 35% of total calorie intake	Incorporate protein to create satisfying dishes and fulfill nutrient requirements. - Incorporate lean meats, skinless poultry, fish, eggs, legumes, tofu, and low-fat dairy products
Carbohydrate	45 to 65% of total calorie intake	Instead of refined grains, switch to whole grains. Examples comprise wheat, brown rice, oats, barley, and corn.
Fiber	20 to 35 grams per day	Include fiber to help increase satiety - Add legumes, fruits, vegetables, and whole grains
Added sugar	Limit to <10% of total calorie intake	Limit foods and beverages containing added sugars. - Main sources of added sugars are snacks, sweets and beverages - Non-nutritive sweeteners can be a substitute
Beverages		Select low-calorie beverages. - Water is the best choice - Limit intake of alcoholic beverages
Dietary strategy		Recommendations
Monitor portions		Select suitable portions to meet daily energy requirements. - Serve large portions of low-energy-dense foods - Serve smaller, less frequent portions of medium energy-dense foods - High-energy-dense foods should be prohibited from consumption.
Increase the proportion of lower-energy-dense foods		Lower-energy-dense foods provide satisfying portions to help increase satiety. - Half of the plate should be filled with fruits and vegetables - Start the meal with a first course, broth-based soup or salad

3.5.2. Manage added sugar intake and consider non-nutritive sweeteners to prevent obesity

The relationship between workplace stress and unhealthy eating behaviors is a topic of interest in recent research. High levels of stress in the workplace have been associated with increased consumption of high-fat and high-sugar foods, leading to unhealthy eating habits and potential weight gain. Stress-related eating patterns, such as emotional eating or eating in response to stress, can impact individuals' dietary choices

and overall health outcomes. Implementing workplace wellness programs that focus on stress reduction and healthy eating habits can contribute to fostering a healthier work environment and supporting employees' overall well-being [23].

3.5.3. To create satisfying meals, it is important to include both protein and fiber

A balanced diet with essential nutrients is crucial for good health and disease prevention. Research suggests that increasing protein intake can reduce hunger and calorie intake. Similarly, dietary fiber promotes fullness and aids weight management. Protein and fiber-rich foods are linked to lower calorie consumption, weight loss, and disease prevention. Including recommended protein sources and fiber-rich foods like fruits and vegetables can support weight management and overall health. Further research is needed to determine ideal protein amounts and understand their role in weight management. Table 2 provides nutritional guidelines on foods that give the required amounts of protein, as well as fiber-rich foods, to include for a healthy lifestyle [24].

3.5.4. Links between eating patterns and health

The 10–20% of youth worldwide suffer from mental health issues, with physiological and behavioral changes during adolescence increasing the risk. Studies show that skipping breakfast can lead to higher levels of stress, sadness, and mental discomfort in teenagers. Additionally, unhealthy eating habits, such as consuming fast food and sugary drinks, are associated with increased psychological symptoms in teens. These behaviors may contribute to inflammation and ultimately raise the likelihood of depression and anxiety. Fast food and roadside stands are often less nutritious than home-cooked meals, leading to detrimental health effects [25]–[27].

3.6. Obesity-related diseases and conditions

Adult obesity poses intricate medical risks and is a concerning public health issue. Mazon *et al*. [28] explored connections between obesity, neurodegenerative diseases like Alzheimer's and Parkinson's, and metabolic changes. They found that nutrition-related metabolic dysfunctions may worsen existing conditions and initiate neurodegenerative illnesses. Provenzano *et al.* suggest that adult obesity and diabetes heighten the risk of Alzheimer's disease [29]. The increased risks align with Alzheimer's pathogenesis, which begins years before clinical symptoms appear.

Figure 1 has shown that there are strong links between obesity and a variety of other health issues, particularly cardiovascular disorders. Patients who are overweight or obese are more likely to experience cardiovascular problems compared to those with normal BMI. Addressing obesity is crucial in preventive efforts for cardiovascular disease, and disseminating effective techniques to treat underlying problems is essential on a public level. Obesity is also closely linked to diabetes, with high BMIs and excess weight accounting for a significant portion of type 2 diabetes cases. In addition to health implications, obesity can lead to social problems such as increased medical costs and workplace issues related to employees taking medical leave and insurance rates. Preventing and treating obesity is critical in addressing these interconnected health problems [30].

3.6.1. Down syndrome

Numerous variables, including a genetic predisposition, reduced physical exercises, hypothyroidism, elevated blood cholesterol, and an unusual diet, may increase the greater risk of obesity in people with hypotonia, down syndrome, a lowered metabolic rate, a heightened vulnerability to systemic inflammation, depression, and a lack of social and financial support are other potential contributing factors. Reduced cognitive function may influence dietary choices and physical activity levels, which may be one of the causes contributing to obesity. In 2020, Nordstrøm *et al.* examined the dietary health of DS individuals with mild and moderate intellectual impairment and found no significant association [31]. Fructuoso *et al.* found that elevated levels of inflammatory biomarkers galectin-3 and HSP72 are linked to obesity [32]. This suggested that elevated adipose tissue levels resulting in mild inflammation are contributing elements for the creation of obesity in individuals with down syndrome [32], [33].

3.6.2. Most obese countries around the world

Interestingly, compared to earlier in the century, BMI growth has slowed in high- and some middle-income nations since 2000. It's important to note that the increase in obesity prevalence rates has slowed down, particularly in high income nations like the US (from 30% in 2009 to 32% in 2019), the United Kingdom (from 19% in 2009 to 19.7% in 2019), and France (from 13% in 2009 to 14.5% in 2019). This is notably true throughout the last ten years. However, as obesity trends have accelerated in several places, particularly emerging ones with sizable populations, the incidence of obesity worldwide is still rising. For instance, China, one of the nations with the most significant populations worldwide, had a 90% rise in incidence.

Region-specific obesity prevalence: the American and European continents suffer the most due to obesity. In the USA, the obesity rate was 6.8% in 1980 which rose to 22.4% in 2019. The United States and Mexico had the largest rate of obesity, 23.2% and 18.4%, respectively, while Colombia had the lowest rate

(9.8%). Comparably, the obesity rate in Europe was 8.4% in 1980 which jumped to 20% in 2019, with the largest percentages of obese persons being found in Turkey (17.5%) and Russia (15.9%). In France, the least frequent condition was obesity, with a prevalence incidence of 10.3% [34].

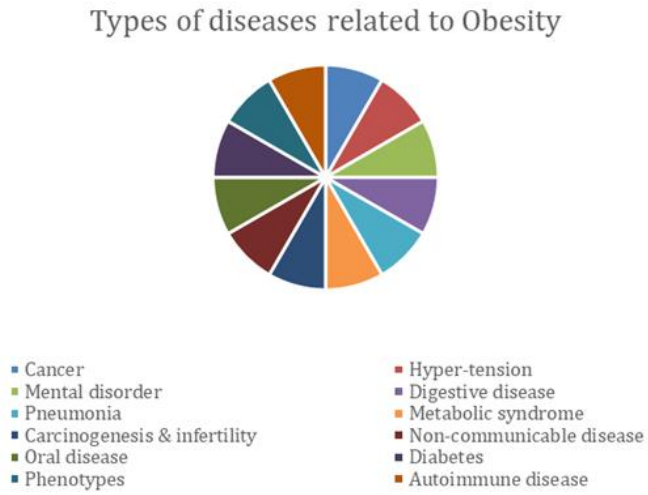

Figure 1. Types of diseases related to obesity

3.7. Impact of obesity on mental health

The two most common or most occurred health issues, anxiety and obesity, frequently co-occur. A huge investigation within the World Mental Health surveys found that being overweight is related to modest impacts (OR in the range of 1.2–1.5) in increased anxiety and depression around 13 different countries, with a high amount among females with more extreme obesity. In a comprehensive meta-analysis encompassing 25 trials, the odds ratio for anxiety was 1.10 for overweight individuals and 1.30 for obese individuals. The meta-analysis revealed comparable aggregated effects for both men and women. A somewhat earlier meta-analysis of 16 trials (2 prospective, the other 14 cross-sectional) revealed comparable effect sizes, with an irregular ratio of 1.4 for the relationship between obesity and anxiety. Mood issues are associated with obesity as well. Community research, including more than 36,000 Canadians, found a 1.46 odds ratio between lifetime severe depression and contemporaneous obesity in female participants but not in male participants [35], [36].

3.7.1. Obesity, depression, and associated mood disorders

Development of coronary artery risk in young adults creates depression which causes obesity. Needham *et al.* discovered that those with depression gained weight at a considerably higher rate than those without the illness [37]. Furthermore, there was a favorable correlation found between the onset of depressive symptoms and an increase in waist circumference. Adolescent depression may be caused by obesity [34].

According to the National Longitudinal Study of Adolescent Health (ADD Health), among individuals who were of average weight at baseline, sad mood at baseline strongly predicted obesity one year later. Another long-term cohort research by Richardson *et al.* regarding the connection between teenage depression and adult obesity revealed that depression in late adolescence is linked to obesity in the future, but only among girls [38]. Of the group, 7% experienced significant depression in early teenage years that is (ages 11, 13, and 15) and 27% in late teenage years (18 and 21 years old). The 12% of research participants were obese at age 26. A bidirectional association was discovered: sadness raised the chance of obesity by 58%, while obesity increased the risk of depression by 55% [39].

3.7.2. Variations by race and ethnicity in mental health and obesity

Obesity's impact on mental well-being varies among older individuals, influenced by race and ethnicity. Studies indicate that white older adults face a higher risk of mental illness due to obesity compared to other groups. For example, Xiang and An [40] research revealed a strong connection between overweight and future depressive symptoms among white individuals but not among African Americans or Hispanics. Assari discovered that higher BMI correlated with poorer self-rated mental health in white and hispanic older adults, whereas black and Asian middle-aged individuals reported improved mental health outcomes [41].

3.8. Epidemiology of obesity and cardiovascular disease

In Table 3, you can see the classification of weight; the BMI of that weight and the disease risk people (men and women) have due to that weight and waist circumference. We can see in the classification row that the weight is increasing from low to high. There is a range of body mass parallel to that and the disease risk is high, low, moderate, very high or very low accordingly to that weight is mentioned in the Table 3.

Table 3. Recommendations from the WHO about the relationship between illness risk, waist circumference, and BMI cut-off points for overweight or obesity [42]

Classification	Body mass index (kg/m2)	Disease risk (relative to average weight and waist circumference)	
Caucasian population		Men<102 cm	Men>102 cm
		Women<88 cm	Women>88 cm
Underweight	<18.5	Very high	
Healthy weight	18.5–24.9		High
Overweight	25.0–29.9	Increased	High
Obesity class I	30.0–34.9	High	Very high
Obesity class II (morbid obesity)	35.0–39.9	Very high	Very high
Obesity class III (severe obesity)	≥40.0	Extremely high	Very high
Obesity class III (severe obesity)	≥40.0	Extremely high	
South Asian, Chinese, and		Men <90 cm	Men <90 cm
Japanese populations		Women <80 cm	Women >80 cm
Underweight	<18.5	Low	Average
Healthy weight	18.5–22.9	Average	Increased
Overweight (at risk)	23.0–24.9	Increased	Moderate
Obesity class I	25.0–29.9	Moderate	Severe
Obesity class II	≥30.0	Severe	Very severe

- Cumulative incidence cases in Latin America

In Table 4, we can see 2,000-calorie healthy American eating pattern that includes daily or weekly portions of food categories, subgroups, and components. Over there you can see what food and what portion of healthy American eats daily or weekly for a balanced diet. In Figure 2, we can see how adult obesity is increasing constantly before and after the year 2000, in Alabama and Mississippi we can see that the percent is increasing from 12% for Alabama and 15% for Mississippi.

Table 4. 2,000-calorie healthy American eating pattern that includes daily or weekly portions of food categories, subgroups, and components

Food group	Amount in the 2,000-calorie-level pattern
Vegetables	2½ c-eq/day
Dark green	1½ c-eq/wk
Red and orange	5½ c-eq/wk
Legumes (beans and peas)	1½ c-eq/wk
Starchy	5 c-eq/wk
Other	4 c-eq/wk
Fruits	2 c-eq/day
Grains	6 oz-eq/day
Whole grains	≥ 3 oz-eq/day
Refined grains	≤ 3 oz-eq/day
Dairy	3 c-eq/day
Protein foods	5½ oz-eq/day
Seafood	8 oz-eq/wk
Meats, poultry, eggs	26 oz-eq/wk
Nuts, seeds, soy products	5 oz-eq/wk
Oils	27 g/day
Limit on calories for other uses (% of calories)	270 kcal/day (14%)

The analysis in Table 5 is on 10 countries [43] with highest and lowest prevalence rates in obesity in women by 2030 it is seen that in the highest side prevalence rate is greater than in the lowest side. The obesity is greater in the highest side than in the lowest side. Now let's see Table 6, which is on 10 countries with highest and lowest prevalence rates in obesity in men by 2030 it is seen that in the highest side prevalence rate is greater than in the lowest side. The obesity is greater in the highest side than in the lowest side.

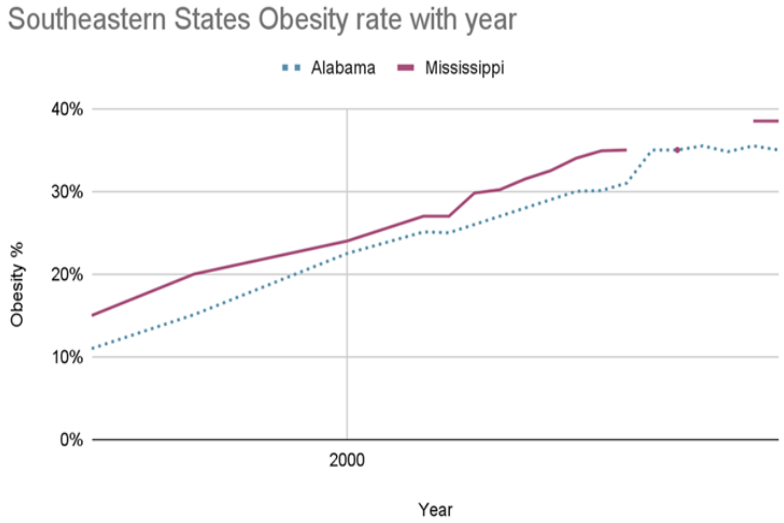

Figure 2. Adult obesity constantly increases within a year in Alabama and Mississippi in the United States [7]

Table 5. The American nations with the greatest and lowest predicted rates of obesity in women by 2030

10 highest countries		10 lowest countries	
Country	Prevalence 2030 (%)	Country	Prevalence 2030 (%)
Bermuda	48	Guatemala	31
United States	47	Saint Lucia	32
Puerto Rico	47	Venezuela	32
Dominican Republic	46	Colombia	33
Bahamas	46	Antigua and Barbuda	34
Dominica	45	Bolivia	34
Jamaica	43	Brazil	34
Suriname	42	Ecuador	35
Costa Rica	42	Paraguay	35
Saint Vincent and the Grenadines	42	Peru	36

Table 6. The American nations with the greatest and lowest predicted rates of male obesity by 2030 [43]

10 highest countries		10 lowest countries	
Country	Prevalence 2030 (%)	Country	Prevalence 2030 (%)
United States of America	47	Trinidad and Tobago	16
Canada	39	Antigua and Barbuda	16
Bermuda	37	Saint Lucia	16
Puerto Rico	36	Guyana	18
Argentina	35	Grenada	19
Uruguay	33	Bolivia	21
Chile	33	Ecuador	21
Bahamas	33	Peru	21
Mexico	32	Barbados	21
Dominican Republic	32	Guatemala	22

3.9. How can we overcome the crisis?

Obesity is a global health issue affecting millions of people worldwide, with increasing numbers projected for the future. The WHO warns of the detrimental effects of obesity on the health of adults and children, urging countries to take action to prevent and treat this severe health problem. Recommendations include promoting healthy nutrition for pregnant women, continued breastfeeding for infants and toddlers, improving the food environment by limiting unhealthy food promotion and making healthy options more accessible, creating safe spaces for physical activity, and educating on healthy eating habits from childhood. The WHO is actively involved in monitoring and addressing the global obesity challenge, providing guidance, and support to nations in implementing preventive measures. An expedited action plan to combat obesity is being developed for heavily affected countries, with the proposal discussed at the 76th World Health Assembly in May 20 [44].

- Ways to overcome the obesity crisis

Obesity has become a global health crisis that affects individuals of all ages, races, gender, and socioeconomic backgrounds. It is a complex issue that requires various strategies to overcome. Here are some methods that can be utilized to tackle the obesity crisis:

- Education

Integrating nutrition education into the curriculum from a young age could be a successful solution to promoting healthy behavior. For instance, schools often incorporate nutrition education into their curricula for teaching the students the significance of following a healthy routine and the importance of consuming fruits, vegetables, and whole grains. Such teachings also emphasize the negative impacts of eating fast food, sweets, sugary drinks, and processed snacks. Through enhancing students' comprehension of nutrition, these programs fostered healthier food selections and cultivated enduring habits of nutritious eating.

- Create a contemporary obesity movement

Raising public awareness of the origins, effects, and prevention of obesity is one of the main objectives of the current obesity movement. People are made aware of the dangers of obesity, such as heart disease, diabetes, and cancer, through education efforts, media campaigns, and community outreach programs. People can better understand the importance of maintaining a healthy lifestyle and making educated nutrition and physical activity decisions.

- Promoting healthy eating

Encouraging the consumption of balanced diets rich in fiber and implementing policies to make healthy foods more accessible and affordable are essential strategies in combating the global obesity issue. Raising awareness of the importance of nutrition through public health campaigns, educational initiatives, and media messages can help promote good eating habits and dispel myths about healthy eating. By promoting healthy eating habits, communities, and governments can strive to prevent obesity and its related health consequences, ultimately improving the overall well-being of individuals [45].

- Obesity affecting pregnancy

Pregnancy-related obesity is a health issue that is now linked to higher rates of morbidity in both mothers and newborns. Morbid obesity (BMI>35) and obesity (BMI 30-34.9) can cause several issues and complications for mothers, preeclampsia (3-6.3%), including hypertension (10.2-12.3%), and gestational diabetes (6.3-9.5%). Hazards that might affect the fetus include macrosomia (15.4–17.2%), premature delivery (4-5.5%), and reduced fetal development (1-0.8%). Maternal obesity has also been linked to a greater incidence of abortion (1.70-3.11%) and neural tube abnormalities (NTD) in fetuses. The delivery process is impacted by obesity as well. Obese mothers are more likely to undergo vaginal surgery (8.5–11.1%), induce labor, and have labor last longer. Preeclampsia, fetal distress, and other problems resulting from maternal obesity are the main reasons for the rise in cesarean section births [46].

Age-standardized prevalence of obesity increased, according to 2016 worldwide research by the non-communicable diseases risk factor collaboration, from 3.2% in men in 1975 to 10.8% in 2014 and from 6.4 to 14.9% in women. The frequency of pre-pregnancy obesity in the United States of America (U.S.A.) increased by 0.5%-point year, from 17.6% in 2003 to 20.5% in 2009. In the US, non-Hispanic Black and Mexican American women have more chances than other groups to be obese, with 31.9% of women of reproductive age being obese and 55% being overweight or obese. The frequency of maternal obesity in the European region is expected to increase from 7 to 25% by 2020 [14]. In the UK, the presence of first-trimester pregnancy obesity has increased dramatically in the past 19 years, more than doubling from 7.6 to 15.6% (1989 and 2007) [47].

- Mothers' opinions about excellent and healthy cuisine

When asked what they thought was "good" food, moms highlighted fruits, vegetables, and items typically prepared at home. Most moms believed food cooked in the house was safer than food prepared outside. Rich dishes such as beef were praised by several moms as delectable or valuable. A few mothers discussed the importance of having a varied diet and how to get a balanced one. Some moms of children attending medium- and low-tuition schools believed that fast food items like shawarmas (vegetables and meat wrapped in flatbread) and burgers were healthy for their kids, but if cooked at home, they started making these meals at home. Overall, they think if fast food is cooked at home, it can be healthy for their children [35].

- Make gradual weight loss adjustments

Shortage of energy is a crucial part of diets for weight reduction and its maintenance. Dietary management focuses on the idea of "eat less, move more" under the "calories-in, calories-out" model. Nonetheless, body weight affects both the dynamic processes of energy intake and expenditure, which also affect one another. Thus, efforts to establish an energy deficit through dietary measures are hindered by physiological alterations making it difficult to lose weight [21].

One of the critical reasons why gradual weight loss adjustments are recommended is because they are more realistic and achievable for individuals. Changing one's diet or exercise routine overnight can be

overpowering and challenging to sustain in the long run. On the other hand, making minor adjustments allows for a smoother changeover and increases the likelihood of them becoming lifelong habits. A good diet allows consuming a maximum of 1,000–1,500 calories daily. Several organizations recommend 500–750 calories daily to lose weight. Typically, low-calorie diets limit fats or carbs, but if a calorie deficit alone happens, there is no evidence that one is more crucial for weight reduction than the other [22], [48].

Additionally, gradual weight loss adjustments are easier to maintain because they don't require extreme measures or deprivation. Diets that involve reducing an entire type of food or severely restricting calories are often unsustainable, as they can leave individuals unsatisfied and deprived. This can lead to binge eating or reverting to old habits once the diet is over. By making gradual changes, individuals can still enjoy a balanced diet and have more flexibility in their food choices, making it easier to maintain their weight loss journey [49]. Table 7 shows the recommendations for women, before, during and after pregnancy for avoiding the onset of becoming overweight. It recommends certain diet and exercise for the different times of pregnancy: pre-pregnancy, pregnancy and postpartum.

Table 7. Guidelines for managing obesity during pregnancy, after birth, and pre-pregnancy from the International Federation of Gynecology and Obstetrics (FIGO) committee [50]

Phase	Guidelines
Pre-pregnancy	1. Women should maintain their weight according to their BMI. Think about the disparities in ethnicity.
	2. Obesity has adverse effects on fertility; it has a negative effect while giving childbirth. It has many health consequences, including an increased risk of noncommunicable illnesses for both the obese woman and her unborn child. All women with a BMI of ≥30 should be informed of these facts.
	3. It is essential to motivate all obese women to adopt a healthy lifestyle with moderate physical activity and nutrition to reduce weight. Bariatric surgery is one of the several weight-management procedures that may be considered to be suitable and accessible.
	4. Folic acid supplementation of at least 0.4 mg and maybe up to 5 mg daily is recommended for all obese pregnant women.
Pregnancy	1. At the initial prenatal appointment, all women should have their height, weight, and BMI assessed. Think about the disparities in ethnicity. Advise on the proper weight increase during pregnancy.
	2. Pregnant women should be advised to follow a proper diet and a healthy lifestyle, that involves regular physical exercise, weight management, and vitamin supplements.
	3. Obese women should know the hazards obesity and excessive gestational weight gain have to their unborn babies as well as to their long-term health. This includes the risk of noncommunicable illnesses.
	4. Medical institutions should clearly define multidisciplinary paths for the clinical management of obese pregnant women.
Postpartum	1. All obese women before pregnancy should have assistance starting and continuing their breastfeeding.
	2. Appropriate postnatal follow-up should be provided to all obese women who have pregnancy problems, taking into account local resources, care routes, and the unique health needs of each mother and her children.
	3. It is essential to support all obese women in their efforts to reduce weight after giving birth, with a focus on a nutritious diet, nursing when it is feasible, and frequent, moderate exercise. Given the elevated risk of noncommunicable illnesses for both them and their offspring, they should be informed of the significance of ongoing monitoring.
	4. When choosing the best type of postnatal contraception, maternal obesity should be taken into account.

- Increasing physical activity

Promoting an active lifestyle is vital in combating obesity. Governments, schools, and workplaces should encourage regular physical activity by providing facilities, promoting active transportation, and creating initiatives like fitness challenges or exercise programs. Increasing physical activity may be used in several ways to combat the obesity issue: i) promoting active transportation; ii) incorporating physical activity into daily routines; and iii) promoting sports and leisure activities

- Exercise and weight reduction

A focused investigation of the impact of exercise on weight loss has been sporadic. Men who participated in a 12-month controlled random experiment lost an average of 1.8 kg in weight and 1.4 kg in females who engaged in moderate-to-intense physical exercise for half an hour daily, six days a week. Sedentary controls, on the other hand, gained 0.7 kg for women and 0.1 kg for men throughout that time. The data currently available addressing the effect of solitary physical exercise on weight loss in overweight or obese adults was examined in a recent thorough review and meta-analysis. The results showed that aerobic exercise of 120–240 minutes each week at intensities of 40–85% of maximum heart rate, or −1.6 kg (95% confidence interval, −1.64 to −1.56 kg) for six-month programs and −1.7 kg (95% CI, −2.29 to −1.11 kg) for 12-month programs, were associated with weighted mean differences in weight. Although aerobic exercise by itself is not a viable weight-loss approach, the scientists determined that it may be beneficial when combined with diets [51].

3.10. Relation between gross domestic product per capita vs male and woman obesity prevalence rate

GDP had an unexpectedly greater link with obesity of men than that of women, according to the Fisher r-to-z analysis (z=3.21, p<0.001). GDP showed a robust and noteworthy association with the frequency of obesity in both males (logarithmic, r=0.721, p<0.001, Figure 3) and females (logarithmic, r=0.471, p<0.001, Figure 3). More than double the variance in female obesity prevalence (22.20%) was explained by GDP, accounting for 51.98% of the variation in male obesity prevalence [52].

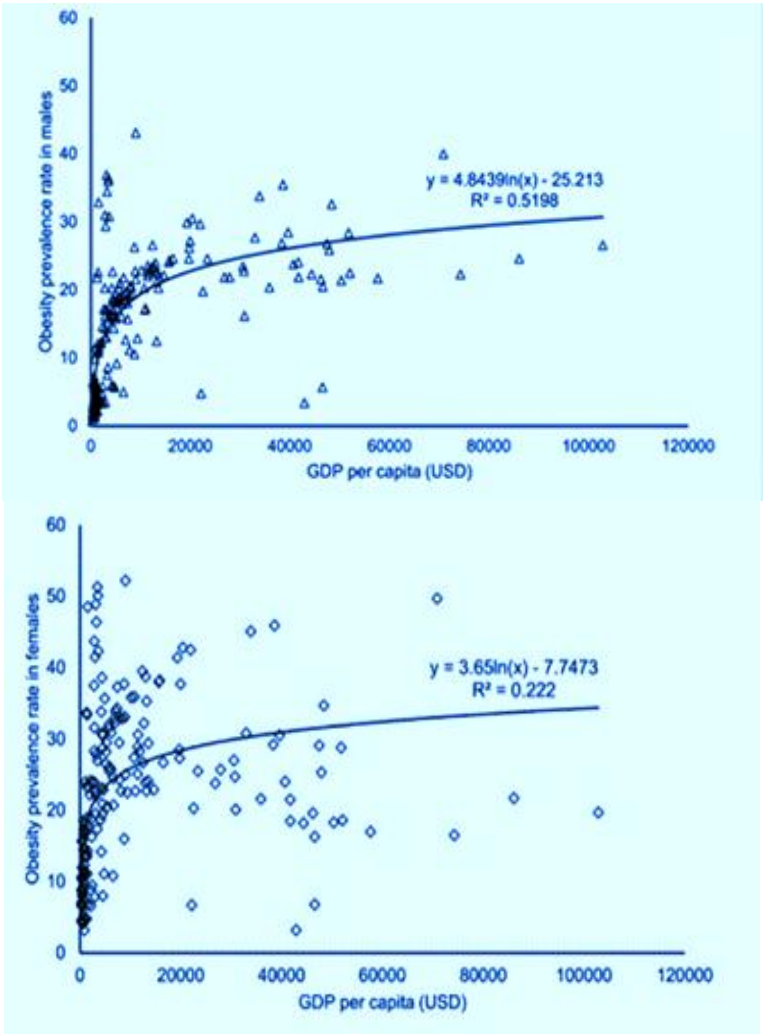

Figure 3. Relation between GDP per capita and male and woman obesity prevalence rate

- BMI and WC statistics by gender and location

The waist-circumference (WC) and BMI statistics are summarized by gender and location in Figure 4. Obesity in general (18.2%) and abdominal obesity (41.9%) were prevalent. Three-quarters of the individuals were overweight, while nine percent were underweight. Women have a greater prevalence of both general and abdominal obesity than in men (12.2 and 29%, respectively), at 25.2% and 56.1%, respectively. Similarly, compared to rural people (13.8 and 35.1%, respectively), urban residents had higher rates of both categories of obesity (21.7 and 46.6%, respectively) (p<0.01 and p<0.001, respectively). Comparing participants by geographic location, the presence of general and abdominal obesity was greater in Dhaka (30.8%) and Khulna (63.6%) whereas Rangpur and Chittagong had the lowest rates of both general and abdominal obesity (9 and 18.3%, respectively) [53].

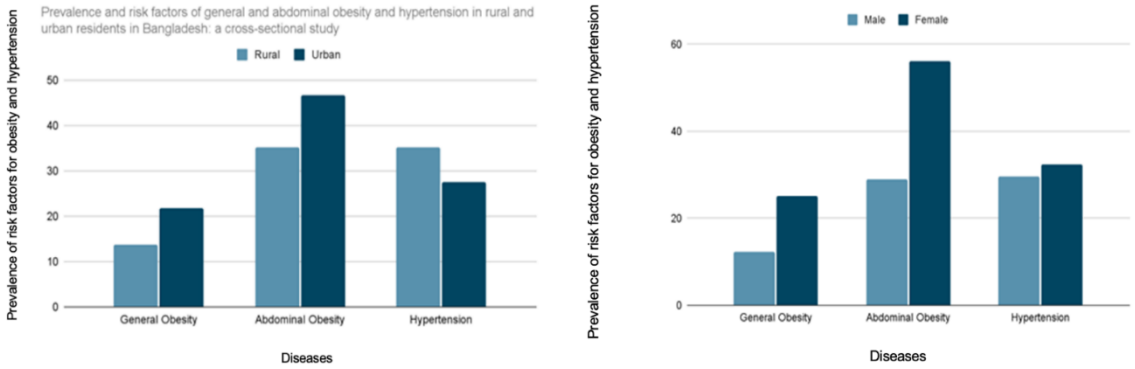

Figure 4. The presence of abdominal and general obesity as well as hypertension (percent of population) in Bangladeshi rural and urban populations [53]

4. METHOD FOR FINDING OBESITY IN GENES

Depending on the kind of obesity and the genotyping technology available, several strategies are employed to find obesity-associated genes. Early monogenic obesity gene discovery research employed a case-focused approach, wherein patients with extreme obesity and their afflicted and unaffected family members were screened using Sanger sequencing for putative gene-disrupting causative mutations. On the other hand, genetic variation linked to prevalent types of obesity has been found in extensive population research, either via the use of continuous variables like BMI or a case-control strategy. Initially, the search for genes responsible for obesity was based on hypotheses i.e. it was restricted to a group of potential genes that data indicated may be involved in controlling body mass. But in the last 20 years, advances in genetic technologies have made it feasible to explore the role of genetic variants in regulating body mass using a hypothesis-generating approach [54].

4.1. Additional monogenic types of obesity

Genetic mutations have been identified as a cause of obesity, with advancements in whole exome and genome testing revealing single gene abnormalities linked to the condition. Mutations in the kinase suppressor of Ras 2 (KSR2) gene have been found to result in severe insulin resistance, low heart rate, decreased metabolic rate, and infantile hyperphagia. Interestingly, individuals with KSR2 mutations may benefit from treatment with metformin to improve weight loss and insulin sensitivity. Similarly, mutations in genes such as the tubby dipartite transcription factor (TUB) and carboxypeptidase E (CPE) have been associated with rod-cone dystrophy, impaired visual acuity, night blindness, severe obesity, type 2 diabetes, and other health conditions. Additionally, mutations in the retinoic acid induced 1 (RAI1) gene have been shown to disrupt the leptin-melanocortin signaling pathway, leading to various symptoms including obesity, hypoventilation, hypothalamic dysfunction, developmental impairment, and autonomic dysfunction. These findings highlight the complex interplay between genetics and obesity, providing insights into potential treatment strategies for affected individuals [54].

4.2. Obesity according to a country's income

Given the non-linear link between income and obesity, it is possible that as nations and individuals get wealthier over time, their rates of obesity may ultimately cease rising and may even start to fall. But if we examine how obesity has changed over time, we find the startling fact that obesity rates have never dropped in any nation. Regarding income categories, upper-middle-income nations (20.88%) and high-income countries (22.72%) had the greatest rates of adult obesity prevalence. Although the prevalence of adult obesity was significantly lower (13.45%) in lower-middle-income nations, there was significant variance within this group of nations (standard deviation of 8.74). With 6.04% of adults suffering from obesity, low-income nations had a comparatively lower rate of obesity. Additionally, the disparity in the frequency of obesity between men and women changed consistently among nation groupings. Adult male and female obesity prevalence were similar in high-income nations (21.2% vs. 24.5%). In comparison, it was lower in lower-middle (8.99% vs. 17.87%) and low-income (2.35% vs. 9.65%) countries for male obesity than for female obesity [54].

The misconception that overweight and obesity are mainly issues in high-income nations is debunked by the fact that over 70% of respondents were from low- or middle-income nations. All areas saw increases in overweight and obesity between 1980 and 2016, and when per capita income rises within nations, people with low incomes are disproportionately affected. Rural regions in low- and middle-income nations have experienced an increase in overall measures of overweight/obesity with metropolitan areas, except South Asia and much of Sub-Saharan Africa, where overweight/obesity remains largely an urban issue. More than 70% of nations—the great majority of which are still low- and lower-middle-income nations—now deal with a double

burden: a high frequency of undernutrition and overweight/obesity, with the lowest low-income nations progressively experiencing high levels of double burden [55], [56].

4.3. Obesity based on gross domestic product

The increase in Chinese GDP correlates with rising BMI among children and adolescents, similar to trends in other emerging countries. However, even in nations with fluctuating GDP growth, overweight, and obesity rates are on the rise. Interestingly, the prevalence of overweight individuals in wealthier countries remains consistent despite economic growth. Human development index (HDI) plays a role in population BMI increase, with higher HDI countries generally encouraging healthier habits. In China, economic growth has led to dietary shifts towards meat and oils, along with increased sugary beverage consumption and sedentary lifestyles among youth, contributing to higher calorie intake and obesity rates. To address this, national policies promoting healthier lifestyles are crucial to improve overall HDI [57], [58].

4.4. Obesity hurts human capital creation and educational achievements.

The OECD examined the relationship between self-assessed performance at school and a high BMI in children aged 11 to 15 across 32 nations. Overweight children perform worse in school than children of a healthy weight, as evidenced, for instance, by worse grades, a larger likelihood of absenteeism, and longer duration of absence. Furthermore, children who are overweight are less likely to complete higher school and have poorer educational achievement.

Additionally, there is a correlation between obesity and a higher chance of prolonged absences from school. Adolescents with obesity, aged 12-19 in the US, had a three-percentage point higher likelihood of missing school than adolescents with a healthy weight (69% of obese children missed school days in the previous year, compared to 66% of children with a healthy weight). Adolescents who are obese in the United States miss school far more frequently than those who have a healthy weight. Adolescents with obesity, aged 12 to 14, in the United States, reported missing nearly one extra day of school per year, as opposed to five days for adolescents with a healthy weight. For teenagers, this adds up to two more days (ages 15 to 19) [59]–[61].

5. CONCLUSION

Addressing overweight and obesity is crucial for public health and demands prompt action. The high rates of obesity and overweight worldwide, along with the associated health risks, necessitate collective efforts from individuals, communities, and governments. The data indicates a global increase in obesity rates, highlighting the urgency for immediate action to halt this trend. To overcome this crisis, policy changes and efforts should prioritize prevention, intervention, and treatment strategies that encourage healthy eating habits and create a supportive environment for those with weight problems. To effectively reach a vast number of people, social media and advertising efforts must focus on promoting education about the negative effects of unhealthy eating and a sedentary lifestyle. These initiatives must include educational and informative campaigns to foster acceptance and counteract the social prejudice towards individuals who are overweight. The challenge of addressing the prevalent issue of overweight and obesity is significant, yet indispensable for safeguarding mental well-being. Now is the time for action to promote a healthier and happier society. In order to end the obesity epidemic and promote healthy eating and active living for everyone, a comprehensive strategy must be formulated that promotes healthy eating and diet, increased physical exercise, and modifications to environmental factors.

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