RESEARCH PAPER

The Statistical Link between Obesity, Diabetes, and Cardiovascular Risk: A Quantitative Analysis

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ABSTRACT
Obesity is a multifactorial disorder characterized by excessive accumulation of body fat and is recognized as a significant risk factor for various chronic diseases. It is commonly assessed using the Body Mass Index (BMI), a standard measure that classifies individuals based on their weight relative to height. To statistically analyse key contributing factors associated with obesity and propose evidence-based strategies for its prevention and management. BMI of ≥30 was used as the diagnostic criterion for obesity, in accordance with the World Health Organization (WHO) guidelines. The study employed a statistical approach to analyse a dataset comprising anthropometric, dietary, and lifestyle variables influencing obesity. The analysis revealed that obesity is strongly associated with increased risks of developing diabetes, cardiovascular disease (CVD), and certain cancers. Factors such as poor dietary habits, physical inactivity, family history, and age were significant contributors. This study emphasizes the importance of identifying and statistically validating the multifactorial causes of obesity. Understanding these risk factors is essential for implementing effective public health strategies and individualized management plans to mitigate the global burden of obesity. These findings highlight the importance of early risk identification and support the development of data-driven public health interventions and personalized prevention strategies aimed at reducing the growing global burden of obesity and its associated diseases.

Keywords: Obesity, BMI, Statistical analysis, Diabetes, Cardiovascular disease, Risk factors, Public health
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INTRODUCTION

Prevention and management of obesity require a profound insight into the complex interactions involved in its causation. Obesity is a multifaceted and multifactorial disorder associated with excessive fat accumulation in the body[1]. Body Mass Index (BMI) is a common way to figure out how unhealthy being overweight is. To get BMI, you divide a person's weight in kilograms by the square of their height in meters (kg/m²). If your BMI is 25 kg/m² or higher, you are considered overweight. If it is 30 kg/m² or higher, you are considered obese. Although body mass index is a key determinant of obesity, abdominal obesity measured by waist circumference is also associated with risks. Overweight and obesity are established risks for a variety of diseases, including diabetes and other diseases[2]. Recent studies also indicate a positive association between higher BMI and more severe outcomes in COVID-19 patients. Additionally, elevated BMI can negatively impact quality of life by reducing the life expectancy. This study underscores the importance of incorporating measurements like height weight ratio, age weight ratio and type of food consumption details, in addition to BMI, for a more accurate assessment of mortality risk[3].Hence statistical approach to analyse the factors leading to obesity in of great significance to bring about an awareness on the importance of diet and lifestyle to prevent obesity and its related disorders. Obesity is a thus a risk factor requiring attention and its prevalence having tripled over recent decades and continuing to rise. At its core, obesity stems from a prolonged imbalance between calories intake and used calories, leading to the excessive accumulation of fat not only in adipose tissue but also in other cell types, causing lipotoxicity. This disrupts the function of multiple organs and systems, contributing to more than 200 related medical conditions, making obesity as the fifth leading cause of death globally. Urbanisation and modernisation have paved way for socio economic growth, which has paved way for improved and modified lifestyle[4]. Also, pandemics including the recent covid has increased sedentary lifestyle, where more are addicted to their mobiles, leading to more indoor life. Increased unemployment's have led to stress and unhealthy eating dieting habits in most parts of the world, which are also the contributing factors to obesity.

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Hence, obesity has now become a global problem and burden and has threatened people with an array of negative health impacts. Since obesity affects the entire human body, affecting all organs, it is considered as one among the serious non-communicable diseases (NCD)[5-6]. The hazards of obesity is ever on the increase and is projected to double and triple in coming years leading to great loss of life. Therefore, it is the need of the hour to review the factors leading to obesity and take measures to mitigate the threat, since obesity is now considered to be a global threat of the 21st-century, affecting all age groups Economic growth, industrialization, a more sedentary lifestyle, and shifts in dietary patterns especially after covid have all led to a rise in the rates of overweight and obesity, which have doubled or even quadrupled in the past 30 years[7]. Research indicates that individuals who are overweight or obese, particularly those with central obesity, face a higher risk of developing CVD[8]. This global surge in overweight and obesity rates, coupled with the heightened risk of CVD, has raised significant concerns in many countries. Additionally, the relationship between obesity and conditions such as dyslipidemia, hypertension, diabetes, insulin resistance, and systemic inflammation further compounds the risk of developing CVD[9]. The energy imbalance in obesity in males and females also needs attention, where the calories taken should be properly used, without excess accumulation (Figure 1a).

Despite extensive research, several critical gaps remain in understanding the integrated statistical relationship between obesity and its major comorbidities. Many existing studies examine obesity, diabetes, and cardiovascular risk factors independently or rely primarily on descriptive epidemiological approaches. Limited studies employ comprehensive quantitative modelling that simultaneously evaluates anthropometric, dietary, genetic, and lifestyle determinants to determine their combined influence on obesity-driven metabolic disorders. Furthermore, there remains insufficient statistical validation of how lifestyle and demographic variables interact to accelerate the transition from obesity to metabolic and cardiovascular complications[10].

The present study addresses these gaps by employing a quantitative statistical framework to analyse a dataset comprising anthropometric measurements, dietary patterns, and lifestyle variables associated with obesity. Using BMI ≥30 as the diagnostic criterion, the study evaluates correlations and risk associations between obesity and major metabolic outcomes. The analysis demonstrates that obesity is significantly associated with an elevated risk of developing metabolic disorders such as Type 2 Diabetes and cardiovascular complications including Coronary Artery Disease and Hypertension. Contributing factors identified through statistical modelling include poor dietary habits, physical inactivity, increasing age, and family history.

The novelty of this study lies in its integrative statistical approach, which simultaneously evaluates multiple lifestyle and biological determinants to establish quantitative links between obesity and cardiometabolic risks. By identifying statistically significant predictors and interaction patterns among risk factors, this research provides deeper insight into the multifactorial pathways through which obesity contributes to metabolic and cardiovascular disease progression.

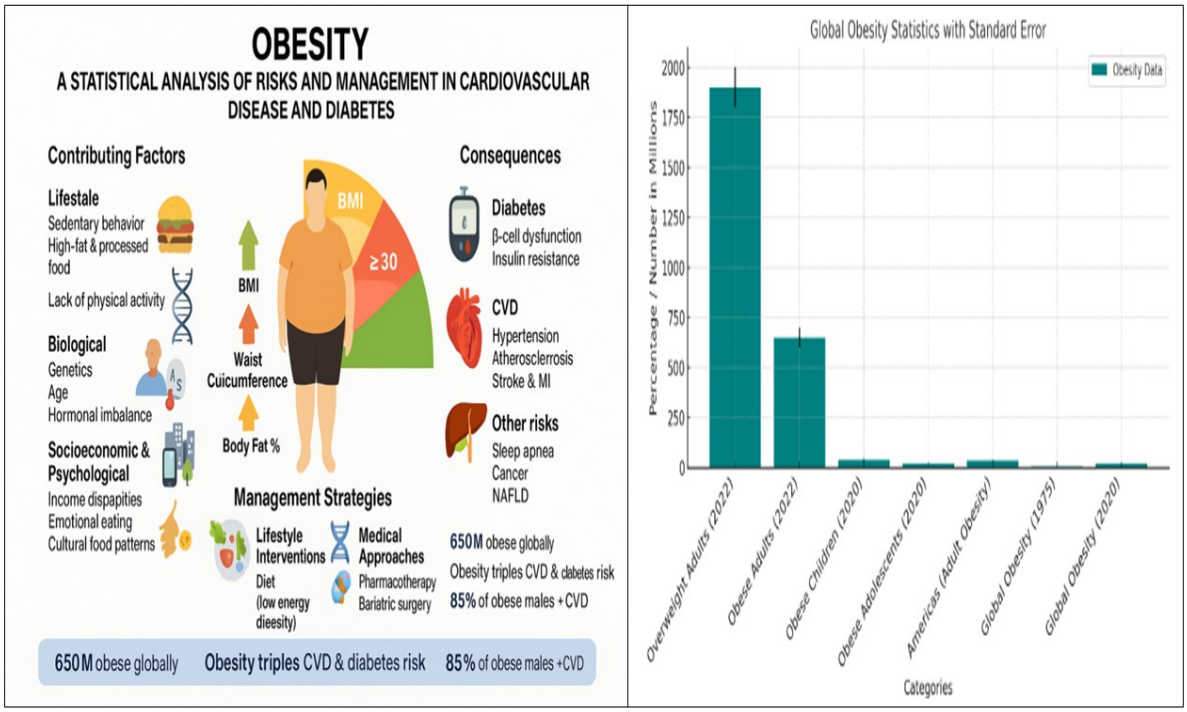

Figure.1. a) Overview on Obesity and b) Global Statistics

MATERIALS AND METHODS

In the last five decades, the prevalence of obesity has increased to pandemic proportions worldwide[11].

According to data from the Global Burden of Disease study, 603.7 million people were found to be suffering from obesity. Projections have been made that by 2030, 38% of the global adult population will fall under the category of overweight, and 20% will be suffering from obesity[12]. The COVID-19 pandemic also impacted this issue significantly, as it created a more obesogenic environment, thereby affecting weight gain trends. The World Health Organization (WHO) has increasingly recognized it as a major issue for global health and economies. The World Health Organization defines it as having a BMI of 30 or greater[13-14]. It has been included in the list of priorities for public health in many countries and organizations, which will help in changing behaviors to reduce the prevalence of obesity in society. It is recognized that obesity is a major risk factor for CVD and is one of the main causes of death worldwide [15]. However, the association of overweight and obesity as defined by BMI categories of 25 to <30 for overweight and 30 or greater for obesity with the risk of CVD has not been consistent across studies [16]. Obesity has become an epidemic in adults as well as children. A study of almost 360,000 people in nine European countries has recently concluded that "both general and abdominal obesity have a predisposition for death." Various risks have been associated with obesity, and these include the risk factors for CHD: hypertension, dyslipidemia, atherosclerosis, and diabetes mellitus [17].

However, recent studies have suggested that not all definitions of obesity have predicted the risk of cardiovascular disease equally well. However, it has been noted that the risks for cardiovascular disease and CHD increase with the degree of obesity, regardless of the method used to define obesity[18]. Rapid increase in obesity rates and its associated disease burden, it is crucial to prioritize monitoring BMI and implementing evidence-based interventions to combat this growing public health challenge. The factors that influence obesity and its associated disorders can be categorised as, Genetics, metabolism, and hormonal regulation all play critical roles in determining an individual's susceptibility to obesity [19].

Unbalanced diet and life without physical activity are significant factors to weight gain. Emotional eating and lifestyle choices also influence behaviors related to food consumption and exercise. The built environment, including access to healthy foods and recreational spaces, significantly impacts physical activity levels and dietary choices [20]. Socioeconomic status affects access to resources, education, and opportunities for healthy living, creating disparities in obesity rates. Stress, mental health issues, and cultural attitudes toward body image and food can also influence eating behaviours and lifestyle choices (Figure 1b). The above figure depicts the global obesity statistics. As of 2022, over 2 billion adults were found to be overweight and 650 million were obese and the prevalence increased three times within a span of 27 years from 1975 to 2022.Similarly the percentage of obesity was found to increase from 4% to 18% from 1975 to 2020. The highest prevalence of obesity was identified in North America, where 35% of adults were obese.

RESULTS AND DISCUSSION

Factors in diagnosing Obesity

The diagnosis of overweight and obesity is vital for early management leading to prevention of the consequences of obesity related disorders. The awareness about the factors leading to obesity is crucial for mitigating the side effects. Body weight is the major contributor of obesity, and therefore various factors leading to increase in body mass index needs attention. The relationship between height and weight is hence given importance.

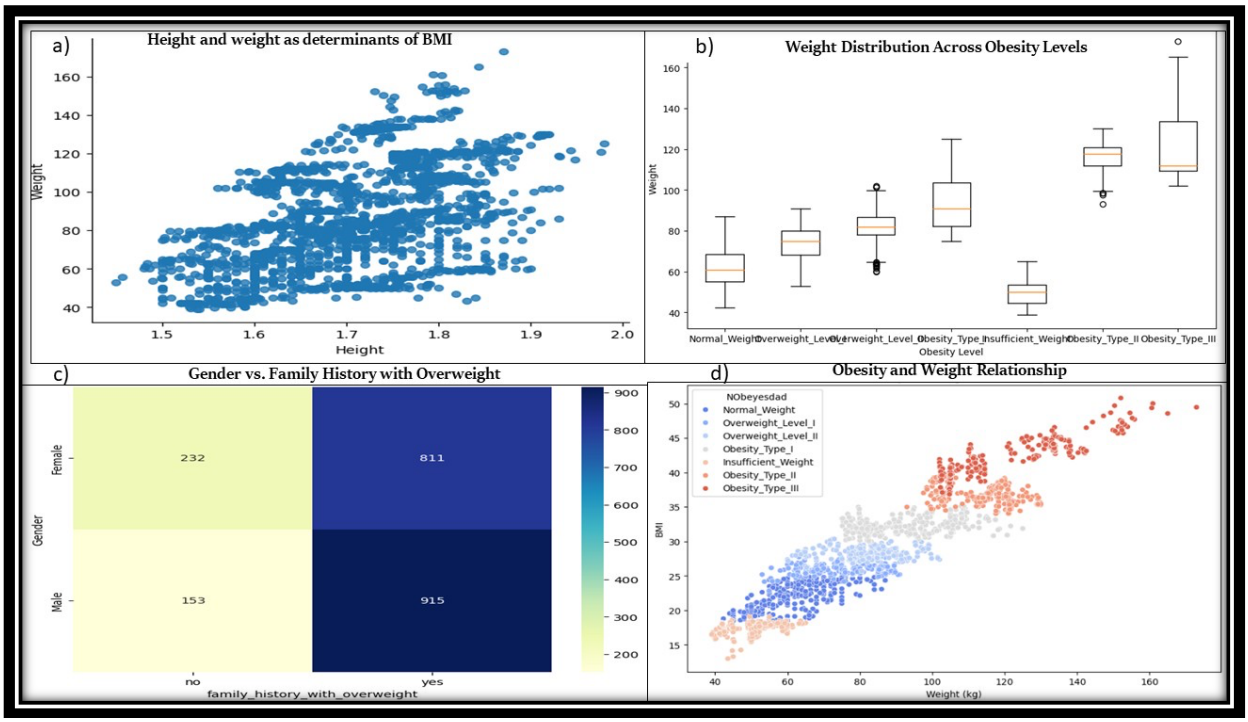

Figure2.a) Height and weight as determinants of BMI b) Obesity levels based on weight

c). Gender and family history with overweight d) Weight and obesity relationship

The above figure 2a and figure 2b shows the relationship between height and weight in calculating Body mass index (BMI). Height of the maximum obese individuals ranges from 1.6 to 1.9m. Likewise, in the case of many types of obese individuals, it was found that type II and type III obesity are found in individuals weighing more than 120kg. Individuals with a family history of obesity, who had a high BMI, are also at risk of getting affected by obesity, as shown in figure 2c and figure 2d. 80% females and 90% males with a family history are found to be obese. According to research, 35-40% of the weight predisposition is inherited from parents to their children. Family history of being overweight is a very important risk factor for obesity and hyperlipidaemia. With age, many manifestations can also develop in this high-risk group. Thus, every reason exists for the health personnel to seize every opportunity to include direct family members in health education.

In addition to the above, weight and 'BMI' have a high positive correlation, close to 1, as expected, since BMI is calculated using weight and height. Diet plays a pivotal role in determining the weight and consequently, the BMI. Data obtained based on three different foods as vegetarian food, non-vegetarian food and fatty fast food suggest that increase in fatty fast foods along with non-vegetarian food accompanied by a decreased fibre rich vegetarian food increased the risk of developing obesity (Figure 3a and Figure 3b).

The figure indicates that 90 per cent of the overweight and obese samples were non-vegetarians and only 10 per cent were vegetarians.

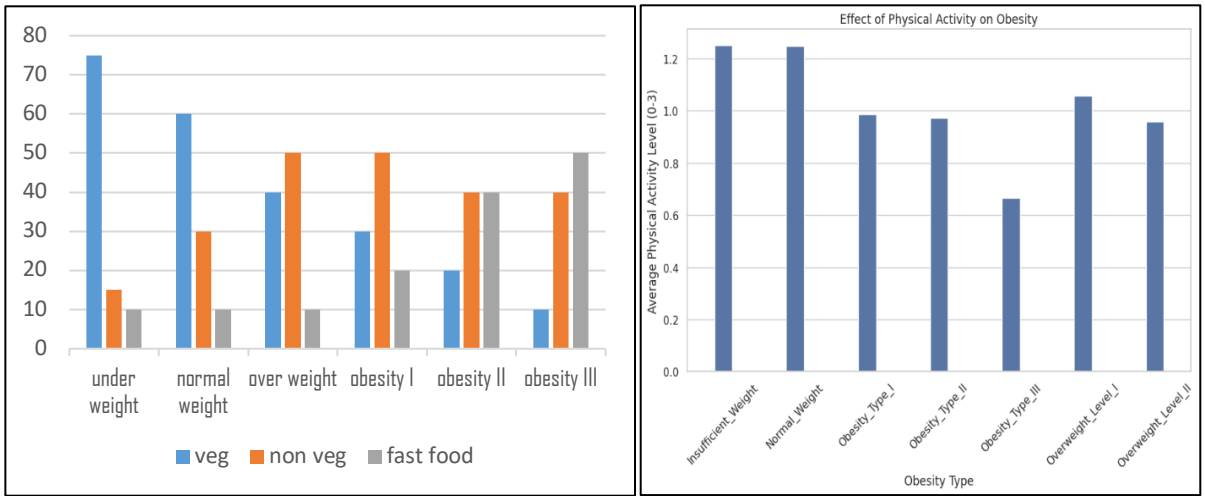

Figure.3 a) Obesity determined by diet b) Physical activity and obesity severity

A clear trend is visible where individuals in lower obesity classes (e.g., Insufficient Weight, Normal Weight) tend to have higher average physical activity levels. As the obesity level progresses (e.g., Obesity Type I, Obesity Type II, etc.), there's a noticeable decrease in the average physical activity level.

Obesity and its Effects

Dietary intake, height, weight, BMI, family history, and physical activity are thus identified as determinants of obesity. It has been found that obesity is not just a cosmetic problem. It is a medical condition and has the potential to cause many other diseases and health problems. It has the potential to cause heart problems, diabetes, high blood pressure, high cholesterol, liver problems, sleep problems, and cancer. All these problems can be associated with increased morbidity and mortality rates because of cardiovascular diseases, especially when there is the accumulation of adipose tissues in the abdominal area. It has been found in international epidemiological studies that abdominal obesity is an independent risk factor for CVD. Obesity has the potential to cause hypertension, dyslipidaemia, diabetes or insulin resistance, and increased fibrinogen and C-reactive protein levels, all of which are the causes of CVD (Figure 4).

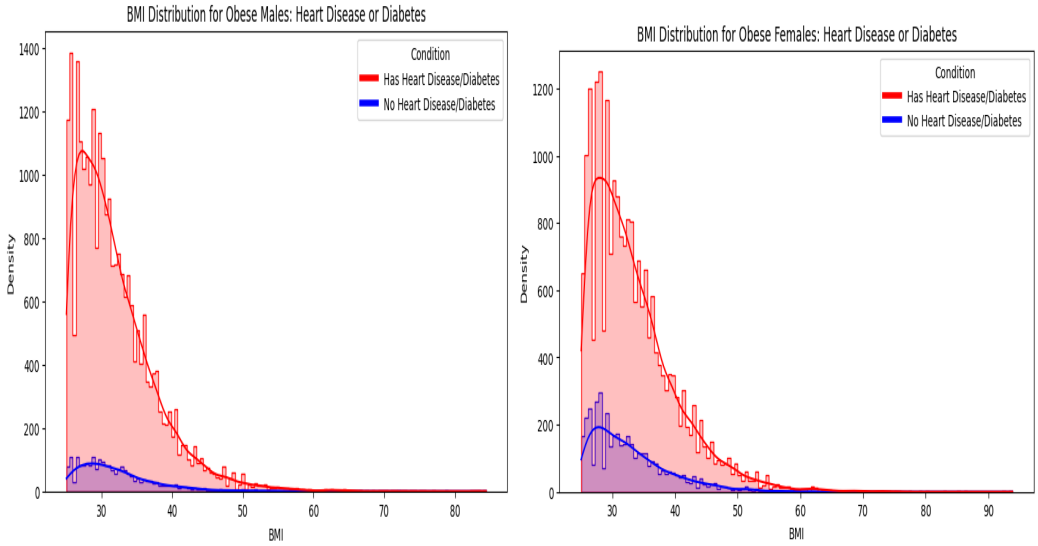

Figure.4. Prevalence of obesity leading to CVD and diabetes

The BMI is mostly the determinant of obesity, which is a leading cause of heart problems and diabetes. In both males and females, majority population with high BMI (obese) are often associated with heart diseases and diabetes, whereas a small percentage of obese are unaffected.

Obesity and Diabetes

Type 2 diabetes arises from insulin resistance in diverse bodily tissues and diminished insulin secretion from pancreatic β-cells. The increasing global prevalence of obesity has significantly contributed to the rising incidence of type 2 diabetes cases in recent years, as both conditions are intricately connected through mechanisms related to insulin regulation and pancreatic β-cell functionality. So, having too much body weight is a big risk factor for getting type 2 diabetes [21]. The risk increases with the increase in the body mass index. Therefore, the increase in the prevalence of obesity at the global level has resulted in the increase in the incidence of type 2 diabetes. The pathophysiology is much more complex and involves disturbances at the cellular and organ levels, including the β cells in the pancreas and the adipose tissue and insulin resistance in multiple organs in the body, to explain the relationship between obesity and type 2 diabetes. Fortunately, the pathophysiologic changes are reversible by good weight loss (Figure 5a).

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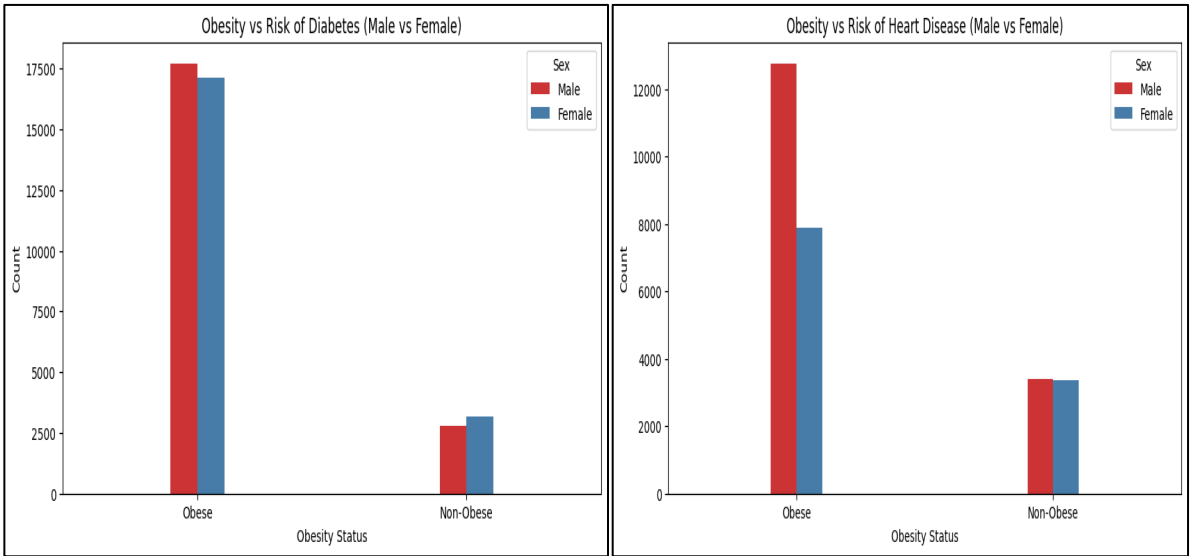

Figure 5. a) Obesity vs risk of diabetes in males and females b) Obesity vs risk of CVD

For every 20,000 obese people, 17,500 obese males and 16,750 females suffer from diabetes. Only 20% of the non-obese males and females suffer from diabetes, indicating that obesity increases the threat of diabetes. An excessive accumulation of body fat can lead to several metabolic disorders, including insulin resistance, atherogenic dyslipidaemia marked by elevated plasma triglycerides and diminished HDL-cholesterol levels, non-alcoholic fatty liver disease (NAFLD), β-cell dysfunction, prediabetes, and type 2 diabetes. As BMI, a common way to measure body fat, goes up, so does the risk of getting type 2 diabetes [22]

Being overweight, especially if it means having more fat around the stomach, in the abdomen, and in the liver and muscles, greatly increases the risk of getting prediabetes and type 2 diabetes. This is primarily attributable to its function in facilitating insulin resistance and hindering β-cell performance. Consequently, the worldwide escalation of obesity has been accompanied by a corresponding rise in type 2 diabetes cases. Learning more about how too much body fat affects the processes that lead to type 2 diabetes could help in creating effective ways to stop and treat the disease. [23]

Obesity and CVD

Obesity is one of the main causes of rising cardiovascular disease (CVD) mortality and morbidity. Throughout the duration of the study, the above-interlinked facts regarding BMI increase and escalating CVD rates have been discussed. CVD mortality and morbidity have been shown to increase with being overweight, especially with central deposition of adipose tissues [24]. It has also been shown that being overweight in the stomach is a risk factor for CVD around the world. Cardiovascular disease (CVD), which could be in the form of myocardial infarction (MI), stroke, or heart failure (HF), has been identified as one of the major contributing factors for mortality and disability among people living with overweight and obesity, thus highlighting the importance of early diagnosis of cardiovascular (CV) risk in reducing mortality and improving quality of life among obese and overweight people[25]. The World Heart Federation and the World Obesity Federation have come together to create educational resources for healthcare professionals with the aim of controlling this health menace (Figure 5b).

Statistics reveal that more than 85% of obese males are prone to CVD as opposed to only 55% of obese females. Non-obese male and female people are at a lower risk of CVD, indicating that obesity is an additional threat to CVD.

Dietary Interventions in the Management of Obesity

Grasping the biological mechanisms that govern weight regulation and food intake is crucial for effectively managing obesity and designing successful weight loss strategies. Alteration of the type of food eaten has been an essential way of addressing obesity for a long time [20]. Among the most important things to do to lose weight and avoid obesity is to eat fewer calories. Health experts like dietitians usually advise that the best way to treat obesity is to eat an energy-restricted diet. This is supported by various scientific groups [26]. Several evidence-based approaches are available for treating overweight and obesity, taking into account individual weight history, BMI category, and co-morbidities. These approaches include: This approach emphasizes changes in dietary habits and physical activity levels. It focuses on long-term behaviour modifications to promote sustainable weight loss and health improvements. These are structured meal plans that typically involve meal replacements or specific calorie-controlled foods designed to promote weight loss. Formula diets are often used under professional supervision. Pharmacotherapy may be prescribed for individuals who struggle with weight loss despite lifestyle changes [27]. Weight-loss medications can help reduce appetite or inhibit fat absorption. People who are very overweight or who can't lose enough weight with other treatments may want to think about bariatric surgery. This surgery can lead to significant and long-lasting weight loss, as well as better health for people who are overweight [28]. The main objectives of weight management include achieving a healthy weight, reducing obesity-related comorbidities,

and promoting overall well-being, as illustrated in the accompanying figures.

Lifestyle Intervention

Most standard treatment recommendations include lifestyle changes that create a negative energy balance as the main way to deal with being overweight or obese. Although there exist numerous lifestyle approaches, nutrition, physical activity, and behavioural strategies represent the core components. Most people who want to lose weight are told to make a daily energy deficit of about 500 kcal by eating fewer calories, exercising more, and changing their behaviour. Keeping this deficit for a year can help you lose weight slowly and steadily.

As weight is lost, changes in the balance of energy require a reduction in the amount of energy taken in and a rise in the amount of energy expended over the weight management cycle. "Energy balance is a dynamic state: reducing weight settles at a lower balance; however, many individuals with overweight and obesity levels often fail to adhere to lifestyle interventions." Three aspects of these interventions were identified as having a strong relationship with higher levels of adherence by participants in a systematic review and meta-analysis: monitoring, support, and making dietary behaviors clear as the main goal for this intervention [12]. A meal replacement is a high-protein food item intended for replacement of at least one major meal per day. Products approved for sale as weight management aids must meet certain regulatory standards for vitamin, mineral, and trace element content and for energy content per serving. Products can be available in a variety of forms, including shakes, soups, or bars. The use of meal replacements in association with dietary and behavioral modification strategies is also very popular for weight loss among those who wish to reduce their weight [30]. Very low calorie diets (VLCD) are available for those who wish to use meal replacements to reduce their weight by providing fewer than 800 calories per day. Low calorie diets (LCD) provide greater than 800 calories per day, between 1200 to 1600 calories per day. There are different dietary options available for weight loss, and these may be effective for weight loss. The secret for weight loss and management of weight for various diets is reducing the density of food, which has been clinically proven to be effective in weight loss and management. Tools and strategies are available to ensure weight loss and weight management by reducing the density of foods in diets. The recent increase in obesity is primarily due to eating habits and food choices that promote calorie consumption [31].

Current recommendations for weight management emphasize the need to develop healthy dietary habits, such as the consumption of nutrient-rich diets, reduction of the serving size of calorie-rich foods, and reduction of the overall calorie density of the diet. Different diets that result in an energy deficit compared to expenditure have been found to produce similar amounts of weight loss. One of the main concepts in most diet plans is the lowering of the energy density, which enables individuals to consume enough food portions while lowering the energy intake. This concept is flexible enough to accommodate diverse diet plans, depending on the individual's energy needs, preferences, eating habits, food availability, and cultural practices[32]. Effective weight loss plans include lowering the energy intake by focusing on the macronutrient composition and food patterns in the diet. One of the most important principles that is followed in all the diet programs is the reduction of the energy density of the diet. There are various strategies that an individual may follow to design a balanced diet program. Similarly, a doctor may also help an individual design a healthy dietary habit [17-33].

Role of modified Dietary and Physical activity

Dietary change, or medical nutrition therapy, and exercise are major lifestyle interventions for weight management and glycaemic control. No single diet or exercise program is recommended for everyone; however, professional recommendations suggest a variety of dietary plans and physical activities that may contribute to reduced energy intake, weight loss, and improved glycaemia. These interventions can be somewhat flexible and individualized [34]. Ideal weight loss diets, and more broadly optimal diets for most people tend to be those with low energy density and high dietary fibre. These are typically diets that include good-quality proteins, fruits and vegetables, nuts and avocados as sources of healthy fats, and restricted intake of refined carbohydrates. Vegetarian and ketogenic diets both, therefore, are mostly consistent with these principles. The ketogenic diet has been shown to boost metabolic signalling by lowering blood glucose and insulin levels, increasing sensitivities to insulin, lowering body weight, and even showing promise in the prevention of cancer, not only in animal models but also in humans [35]. The Dietary Guidelines emphasize the need for low energy density with the MyPlate model. The model encourages a balanced diet and consumption of fruits and vegetables by filling half the plate. One of the strengths of this approach is its flexibility it provides clear guidance on healthy food proportions that can be applied to anyone, regardless of their specific calorie needs. Reducing the energy density of the main meal of the day will likely lead therefore to a significant reduction in calorie intake at a meal. This is because meals often constitute the largest proportion of calorie contribution. Low energy-dense meals can help to enhance satiety without increasing compensatory consumption. This can be achieved by reducing the amount of added fats. Water-dense foods such as fruits and vegetables can be used to replace high energy-dense foods [37]. For individuals who dislike vegetables, incorporating them discreetly into meals can help improve diet quality and support calorie control. Protein and fiber are also known to increase feelings of fullness and enhance satiety. Since many people worry about experiencing hunger when changing their eating habits, higher protein intake is often recommended to help manage appetite. Protein is regarded as the most satiating macronutrient, and

several studies suggest that increasing protein consumption can promote greater fullness and reduce overall daily calorie intake [38]. Intermittent fasting has gained significant popularity for obesity management, attracting attention from both the scientific community and the media. This approach typically involves partial or complete energy intake restriction for specific periods, such as time-restricted fasting or alternate-day fasting, while permitting unrestricted eating during other times. Research on animals has indicated that intermittent fasting could be beneficial in treating various health problems, including cancer, diabetes, and heart disease[39]. In humans, intermittent fasting for 12-24 hours reduces blood glucose levels by 20%, reduces liver glycogen stores by 20%, and causes the body to go into a ketogenic state where fat is burned for energy [40]. In recent years, there has been growing interest in personalized nutrition, particularly in the commercial sector through direct-to-consumer genetic testing services.

A key factor driving personalized dietary recommendations is the observed variability in metabolic responses among individuals following standardized meal challenges. This suggests that tailored diets could effectively help manage elevated postprandial blood glucose levels and their associated metabolic consequences[41]. Gene-based dietary recommendations are tailored to an individual's genetic profile. The understanding that body weight is, in part, influenced by genetics supported by the identification of numerous genetic loci associated with various anthropometric parameters reinforces the notion that the differing degrees of success in weight loss among individuals may have a genetic basis [42]. Among the genetic factors that contribute to obesity, the fat mass and obesity-associated (FTO) gene has one of the strongest associations with body weight. Though the actual role of this gene is still unknown, it is speculated that it can affect body weight by inhibiting the development of brown adipose tissue [43]. Numerous studies have demonstrated correlations between gut microbiota, individual nutrition, and the incidence of diseases such as obesity. These correlations suggest that personalized nutrition tailored to the microbiome could be a valuable approach for weight loss. Emerging evidence indicates that changes in an individual's microbiome during dietary interventions are unique to each person, and this variability, along with individual physiology, can be attributed to a distinct microbiome signature[44]. Combining microbiome data with other personalized factors holds promise for enhancing our understanding of the complex interactions.

FUTURE PROSPECTS

The growing burden of obesity demands urgent attention from researchers, policymakers, and healthcare providers. Future strategies should focus on holistic prevention approaches that address diet, physical activity, and lifestyle behaviour. Strengthening community-based awareness programs and promoting healthy environments in schools and workplaces are essential. Nutritional education and access to balanced food choices must be improved. Medical interventions, including new medications and surgical options, should be refined for those with severe obesity. Continued research into the biological and environmental causes of obesity will support the development of effective, targeted interventions, ultimately reduce associated health risks and improving population well-being.

CONCLUSION

Obesity is indeed a multifaceted condition influenced by various interrelated factors and addressing obesity effectively requires a comprehensive and multidisciplinary approach that incorporates these various factors. This might include community initiatives to improve access to healthy foods, public health campaigns promoting physical activity, and psychological support for individuals struggling with emotional eating. Statistics on the contributing factors lead to better understanding, which in turn may help in addressing the multifaceted nature of obesity, thus leading to the development of targeted interventions that not only tackle the condition itself but also promote overall health and well-being.

LIST OF ABBREVIATIONS

BMI	=	Body Mass Index
WHO	=	World Health Organization
CVD	=	Cardiovascular Disease
CHD	=	Coronary Heart Disease
HDL	=	High-Density Lipoprotein
LDL	=	Low-Density Lipoprotein
NAFLD	=	Non-Alcoholic Fatty Liver Disease
MI	=	Myocardial Infarction
HF	=	Heart Failure
VLCD	=	Very Low-Calorie Diet
LCD	=	Low-Calorie Diet
kcal	=	Kilocalories
DNA	=	Deoxyribonucleic Acid
FTO	=	Fat mass and obesity-associated gene
NCD	=	Non-Communicable Disease
CDC	=	Centers for Disease Control and Prevention

IDF	=	International Diabetes Federation
NHANES	=	National Health and Nutrition Examination Survey
USDA	=	United States Department of Agriculture
MyPlate	=	USDA Dietary Guidance Tool

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Declaration of Conflict of interest

The authors declare no conflict of interest, financial or otherwise.

Ethics approval and consent to participate

Not applicable as no experiment was conducted on any animal or human

Author's contributions

The authors confirm their contribution to the paper: study conception and design: **MMN, DU,SS, JR, JK**; data collection:

NSG, SBN, BD, MM and DU; analysis and interpretation of results: **HS** draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

Availability of data and materials

Not applicable

Declarations

Authors declare that all works are original and this manuscript has not been published in any other journal

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