

*Review Report*



## **Enhancing Reduced Risk of Obese Patient Exposure to COVID-19 Attack through Food and Nutritional Adjustment**

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**Abstract:** The COVID-19 pandemic is a major global challenge. There are several risk factors associated with mortality in patients with COVID-19, including age, gender, diabetes mellitus, cerebrovascular, cardiovascular, and pulmonary diseases. Among these factors, patients with cardiovascular disease, diabetes mellitus, and obesity have the highest mortality rates. This paper aims to review how adjusting food and nutrition can help reduce the risk of obese patients contracting COVID-19. Various literature sources were examined, including studies on the genetics of obesity and the consequences it can have, such as diabetes, heart and vascular diseases, cancer, trauma, and infection. Consequently, the role of nutrition in reducing the risk of obese patients being exposed to COVID-19 was described. It is recommended that obese patients strictly adhere to a diet that includes adequate and balanced food intake in order to reduce their risk of contracting COVID-19.

**Keywords:** COVID-19, Nutritional Adjustment, Obesity, Patients

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## 1. Introduction

The COVID-19 pandemic is a major challenge across the globe. The World Health Organization (WHO) declared the 2019–2020 coronavirus outbreak as a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, and a pandemic on March 11, 2020 (Cucinotta & Vanelli, 2020; WHO, 2020). According to the WHO (2020), local transmission of the disease has been recorded in most countries across all six WHO regions. The first case of coronavirus disease in Nigeria was confirmed on Friday, February 27, 2020, in Lagos State, through an Italian traveler who arrived in Lagos on February 25 and became symptomatic on February 26 (Nigeria Centre for Disease Control, NCDC, 2020). According to the NCDC (2021), as of May 12, 2021, Nigeria recorded 176,564 confirmed cases, discharged 152,369, and had 6,243 fatalities. Being the epicenter of the pandemic in Nigeria, Lagos state recorded 22,562 confirmed cases, discharged 21,119, and had 220 fatalities. The clinical spectrum of COVID-19 ranges from a symptomatic disease to severe acute respiratory infection requiring intensive care unit (ICU). There are multiple risk factors related to mortality in patients with COVID-19. These factors include age, gender, diabetes mellitus, cerebrovascular, cardiovascular, and pulmonary diseases (Du et al., 2020; Eseadi et al., 2019; Kang, 2020; Li et al., 2020). Among these factors, the highest mortality rate in COVID-19 patients was reported in patients with cardiovascular disease, diabetes mellitus, and obesity (Wu & McGoogan, 2020). Research on the impacts of COVID-19 encompasses various aspects, including the effects on education, health, and workplace outcomes of individuals (Ardi et al., 2022; Egara, et al., 2021; Eze et al., 2021; Ossai & Eseadi, 2022).

Obesity is defined as abnormal fat accumulation and is a common, costly condition. According to the WHO (2021), obesity is classified into three groups based on body mass index (BMI). The prevalence of obesity has tripled since 1975 and is an established risk factor for other diseases such as diabetes, hypertension, heart disease, and cancers (Zhi et al., 2016). Moreover, obesity is related to the downregulation of the inflammatory pathway, which leads to increased expression of inflammatory molecules, including interleukin-6 (Aziz et al., 2020). The association between obesity and mortality is very powerful (Stefan et al., 2020). There is a tendency for respiratory dysfunction in people with obesity. This dysfunction is often associated with increased airway resistance, impaired gas exchange, reduced lung volume, and respiratory muscle strength. People with obesity are at increased risk for hypoventilation-related pneumonia, pulmonary hypertension, and cardiac stress (Rojas-Osornio et al., 2019).

Furthermore, in obesity, molecules specific to adipose tissue may play a role in forming a favorable environment for immune-induced diseases (Moser et al., 2019). Previous studies have reported the association between obesity and viral infections. When considered in this context, obesity may increase the risk for COVID-19 infection and be associated with a worse prognosis. Calder et al. (2020) observed that weight status, in particular obesity, is one of the single biggest determinants of hospitalizations and critical illness, after age, for both men and women. While the connections between weight and COVID-19 are being realized, it is well known that being overweight or obese is linked to an increased risk of diet-related diseases such as pneumonia and a weak immune system. Additionally, the result of measures adopted to reduce the spread of the infection, such as limitations on physical activity, incidental exercise, and social isolation, has resulted in dietary changes and movement restrictions. Food system supply chains and market functioning have led to reliance on processed foods with a longer shelf life. Wu and McGoogan (2020) further emphasized that the COVID-19 pandemic compounds malnutrition in all its forms by

making healthy diets less affordable and accessible. Vegetables, fruits, and animal source foods, key elements of a healthy diet, have become increasingly difficult for the poor to access and afford, leading to a shift towards processed food products with a longer shelf life and reduced dietary diversity. Nutrition is not a treatment for COVID-19, but it is a modifiable contributor to the development of chronic disease, which is highly associated with COVID-19 severe illness and deaths. A well-balanced diet and healthy patterns of eating strengthen the immune system, improve immune metabolism, and reduce the risk of chronic disease and infectious diseases. However, a call for action is needed not only to ensure that an adequate quantity of food reaches the poor and vulnerable, but also to ensure that food systems offer quality, healthy, and nutritious food. Therefore, the prevention of diet-related diseases is crucial in preparedness for COVID-19 and future health threats. This study aims to explore the potential roles of food and nutritional adjustment in reducing the risk of obese patients being exposed to COVID-19.

## *1.1. Conceptual Review*

### *1.1.1. Obesity*

The concept of obesity is defined by WHO (2021) as the abnormal or excessive accumulation of fat that can harm a person's health. To classify obesity in adults, the commonly used measure is the body mass index (BMI), which is calculated by dividing a person's weight in kilograms by the square of their height in meters ( $\text{kg}/\text{m}^2$ ). A BMI equal to or greater than 30 indicates obesity in adults. BMI is a useful measure at the population level because it is the same for both sexes and all adult age groups. However, it should be noted that BMI may not accurately reflect the level of fatness in different individuals. When defining obesity in children, age must be taken into consideration. For children under 5 years of age, obesity is determined by weight-for-height measurements that are more than 3 standard deviations above the median of the WHO Child Growth Standards. Overweight and obesity are significant public health challenges, often referred to as the "epidemic of the 21st century" (WHO, 2023). In fact, in most countries, overweight and obesity cause more deaths than underweight. These conditions are major risk factors for various non-communicable diseases, including Type 2 Diabetes, Cardiovascular Disease (CVD), stroke, and several types of cancer. They account for more than 70 percent of all deaths in adults aged 30 to 70 years. The global prevalence of obesity has nearly tripled since 1975, with more than one in three adults being overweight in 2016. Additionally, there has been a worrying increase in childhood overweight and obesity, with an estimated 5.6 percent or 38.3 million children under 5 years of age being overweight in 2019, according to data from UNICEF-WHO-World Bank (2020).

### *1.1.2. Classification of Body Weight in Adults*

The current most widely used criteria for classifying obesity is the body mass index (BMI). BMI is calculated by dividing body weight in kilograms by height in meters squared. It ranges from underweight or wasting ( $<18.5 \text{ kg}/\text{m}^2$ ) to severe or morbid obesity ( $\geq 40 \text{ kg}/\text{m}^2$ ). In both clinical and research settings, waist circumference has become an increasingly important measure of overweight/obesity (Flegal et al., 2009). It is a measure of abdominal adiposity, which refers to fat around the organs. Abdominal adiposity is primarily visceral, metabolically active fat and is associated with metabolic dysregulation. This predisposes individuals to cardiovascular disease and related conditions. According to internationally used guidelines for metabolic syndrome, which is a cluster of dysmetabolic conditions that increase the risk of cardiovascular disease, a waist circumference that increases cardiovascular risk is defined as  $\geq 94 \text{ cm}$  in European men and  $\geq 80$

cm in European women. Different cut points are recommended for other races and ethnicities, such as  $\geq 90$  cm and  $\geq 80$  cm for men and women, respectively, in South Asians, Chinese, and Japanese (NCD Risk Factor Collaboration, 2017).

### 1.1.3. Classification of Body Weight in Children

In children, body weight classifications differ from those of adults because body composition varies greatly as a child develops. Additionally, these classifications vary between boys and girls due to differences in sexual development and maturation. The World Health Organization (WHO) Child Growth Standards are currently the most widely used classification system for weight and height status in children from birth to 5 years old. These standards are based on data collected from children in six regions across the globe who were born and raised in optimal conditions (Ogden et al., 2014). The WHO also published updated growth references that combined the 1977 National Center for Health Statistics (NCHS)/WHO growth reference with the 2006 WHO Child Growth Standards (Schwarz et al., 2008; Turck et al., 2013). This combination resulted in the most recent BMI-for-age references for individuals aged 5-19 years. As a result, the latest WHO guidelines aim to provide seamless standards and references from birth all the way into late adolescence/early adulthood.

### 1.1.4. Nutrition

According to MedlinePlus (2023), nutrition is a concept that is associated with the proper intake of healthy and balanced diet for optimal health outcomes. It encompasses all processes through which living things access nutrients, metabolize them, and use them to support life's processes. The School of Health (2017) state that nutrition is the study of food and how our bodies use it for growth, reproduction, and maintenance of health. It also involves the process of providing the necessary nutrients for health, growth, development, and survival. Nutrition is a comprehensive science that interprets the interaction of nutrients and other substances in food in relation to the maintenance, growth, reproduction, health, and disease of an organism. This includes the intake of food, absorption, the building of complex cell structures, catabolism, and excretion. Human beings require food to grow, reproduce, and maintain good health. Food helps our bodies stay warm, build or repair tissue, and maintain a heartbeat. Eating the right foods can help us avoid certain diseases or recover faster when illness occurs. These and other important functions of food are fueled by chemical substances in our food called nutrients.

Nutrition is universally important and critical for children because it is a major building block for their future health outcomes. Adequate nutrition is crucial to ensure the health, growth, and development of a child and to help them reach their full potential (PAHO, 2011; WHO, 2010). Good infant and young child feeding practices are important to facilitate adequate nutrition, especially from conception to about twenty-four months after birth (World Food Programme, 2020). Without proper feeding practices and quality food, a child's future learning ability, productivity, immune response, and reproductive outcomes can be negatively affected (PAHO, 2011; WHO, 2010). Nutritional deficits during early childhood can lead to long-term impairments in intellectual performance, reproductive outcomes, and health during adolescence and adulthood (Esther, 2017). Cholesterol is produced by the body itself and can also be found in dairy, meat, eggs, and poultry. High-density lipoproteins (HDL), also known as "good cholesterol," gather excess cholesterol in the arteries and send it to the liver. Low-density lipoproteins, or "bad cholesterol," build up plaque in the arteries and can lead to coronary heart disease. Artichokes, lima beans, soybeans, pears, wheat, oat bran, and peas are all high sources of dietary fiber, a nutrient that lowers LDL. Bad cholesterol can be found in margarine, red meat, and sugary and creamy snacks. To reduce your child's risk, limit

their consumption of snacks and use vegetable oil instead of margarine when cooking. Choose lean meats, such as extra lean ground beef, to reduce saturated fat intake, and remove the egg yolk from eggs when cooking (Hovdenak et al., 2019; Kristjansdottir et al., 2009).

Kristjansdottir et al. (2006) suggest that a child should have a well-balanced diet to prevent infections and diseases. A balanced diet provides all the necessary nutrients in correct proportions for healthy growth. A balanced diet contains all the required nutrients, such as energy, proteins, fats, vitamins, and minerals, for proper maintenance of health and optimal growth. Foods like dairy and beans are high in protein and low in fat, while bread is rich in carbohydrates but low in proteins. It is important for a child's diet to be both high in quality and sufficient in quantity. If a child's diet lacks nutrients and energy, it can negatively affect their weight gain and body growth. The child's diet should provide adequate quantities of proteins, carbohydrates, fats, vitamins, minerals, and other nutrients.

### *1.2. Purpose of the Study*

The general purpose of this research is to explore the potential roles of food and nutritional adjustment in reducing the risk of obese patients being exposed to COVID-19. Specific purpose is to examine existing literature on:

- (a) Genetics of obesity.
- (b) Consequences of obesity.
- (c) Roles of food and nutritional adjustment in reducing the risk of obese patients being exposed to COVID-19.

### *1.3. Review Questions*

The following questions guided the study:

- (a) What is the genetics of obesity?
- (b) What are the consequences of obesity?
- (c) What are the roles of food and nutritional adjustment in reducing the risk of obese patients being exposed to COVID-19?

## **2. Materials and Methods**

A narrative literature review was undertaken to collect pertinent information regarding the influence of obesity on susceptibility and severity of COVID-19. Both authors conducted a critical analysis on studies retrieved to shed light on the impact of food and nutritional adjustment in reducing the risk of obese patients being exposed to COVID-19. Google Scholar was the main database used for the literature search.

## **3. Results and Discussion**

### *3.1. Genetics of Obesity*

To date, more than 60 common genetic variations have been linked to an increased susceptibility to obesity. However, it is believed that the 32 most common genetic variants only account for less than 1.5% of the overall variation in BMI between individuals (Ogden et al., 2014). These researchers also found that when these 32 genetic variations are combined into a genetic risk score for obesity, individuals with the highest genetic risk (those carrying over 38 risk alleles) have an average BMI that is only 2.7 kg/m<sup>2</sup> higher than those with a low genetic risk. This means that there

is only a 15-pound (7-kilogram) weight difference between two individuals who are both 5'3" (160 cm) tall, but one has a high genetic risk for obesity and the other has a low genetic risk. While genetics certainly play a role in obesity, the relatively small difference in BMI and the significant increase in obesity rates over the past 50 years in both developed and developing countries suggest that there are other risk factors at play. This has led to a growing body of research on gene-environment interactions, which explores how genetic risk factors interact with behavioral and environmental factors such as diet and exercise. The concept of gene-environment interactions has gained popularity, as seen in the "thrifty gene" hypothesis. In population research, these interactions are being observed, such as the FTO variant (rs9939609), which is the strongest genetic risk factor for obesity. This variant increases the odds of obesity by an estimated 23% per allele, but this risk can be modified by factors like physical activity in both adults and children (von Ruesten et al., 2011). However, these interactions have only been studied in a limited number of genetic risk factors out of millions, and with only a few environmental factors. This raises important questions about how to understand and apply this complexity in public health and personalized medicine.

### 3.2. *Consequences of Obesity*

Obesity is associated with an increased risk of almost every chronic condition, including diabetes, dyslipidemia, and poor mental health. It also significantly increases the risk of stroke, cardiovascular disease, certain cancers, and osteoarthritis.

**3.2.1. Diabetes:** Excess weight and diabetes are closely linked. The American Diabetes Association recommends testing for type 2 diabetes and assessing the risk of future diabetes in people over 45 years old who are overweight or obese (ElSayed et al., 2023). Overweight individuals have three times the risk of developing type 2 diabetes compared to those with normal weight, while obesity increases the risk by seven times. Excess weight in childhood, young adulthood, and weight gain throughout early to mid-adulthood are strong risk factors for diabetes. While not all overweight or obese individuals have diabetes, more than 80% of those with diabetes are overweight or obese (Daousi et al., 2006). Obesity itself raises the risk of diabetes even without other metabolic dysregulation factors. Metabolically healthy obese individuals have half the risk of their unhealthy counterparts but still have four times the risk compared to those who are normal weight and metabolically healthy.

**3.2.2. Heart and Vascular Diseases:** Ischemic heart disease and stroke are the leading causes of death globally. Excess body weight is a well-known risk factor for heart disease and ischemic stroke, including dyslipidemia and hypertension. Recent studies consistently show that overweight individuals are at an increased risk of heart disease and stroke, even beyond the implications of hypertension, dyslipidemia, and dysglycemia (Bendor et al., 2020; Powell-Wiley et al., 2021).

**3.2.3. Cancer:** A significant proportion of all cancers diagnosed are often attributed to obesity (Islami et al., 2019). In addition to being a major risk factor for diabetes, which itself is a risk factor for most cancers, obesity is associated with an increased risk of esophageal, colon, pancreatic, postmenopausal breast, endometrial, and renal cancers (Pati et al., 2023; Scully et al., 2021).

**3.2.4. Trauma and Infection:** A study conducted in Pennsylvania trauma centers from 2000 to 2009 found that obese patients had higher in-hospital mortality rates and increased risks of major surgical complications compared to non-obese patients. Severely obese patients had a 30% higher risk of mortality from trauma and double the risk of major complications. Severely obese females also had more than double the risk of developing wound complications and four times the risk of developing decubitus ulcers (Glance et al., 2014). A meta-analysis of obesity in trauma care concluded that

obesity was associated with a 45% increased odds of mortality, longer stays in the intensive care unit, higher rates of complications, and tended to be associated with longer durations of mechanical ventilation and hospital stays compared to non-obese patients, despite equivalent injury severity (Liu et al., 2013).

### **3.3. Roles of Food and Nutrition in Reduced Risk of Obese Patient Exposure to COVID 19 Attack**

Adeloye et al. (2021) emphasized the high prevalence of overweight and obesity in Nigeria. They also reported that approximately 12 million people in Nigeria were estimated to be obese in 2020, with a higher occurrence in urban areas, especially among women. This may be attributed to sedentary lifestyles and the proliferation of processed food outlets. Factors such as rising income, urbanization, unhealthy lifestyles, and the consumption of highly processed diets are contributing to an obesity epidemic in the country. Obesity occurs when there is an energy imbalance between calories consumed and calories expended, resulting in an excess of body weight. This energy imbalance is influenced by significant social and economic changes beyond the control of any individual. Moreover, a well-balanced diet and healthy eating patterns can strengthen the immune system, improve immune metabolism, and reduce the risk of chronic and infectious diseases associated with COVID-19. It is recommended to include fruits and vegetables as snacks, consume green leafy, red, and yellow vegetables and fruits daily, and calcium-rich foods, seafood, eggs, and legumes into the diet. Processed meats should be limited, excessive fat, sugar, and salt should be avoided, and high-fat intake from sources like fatty cheeses, butter, flavored margarines, spreads, sandwich bread, and various buns should be minimized. Sugar-rich and salty snacks that are high in fat should also be avoided. Additionally, taking care of heart health involves avoiding fried foods, fatty foods like cold and cured meats, and mayonnaise. Maintaining a healthy weight, engaging in regular exercise, and avoiding extreme weight-loss diets are also important.

Understanding overweight and obesity revolves around the energy imbalance between consuming energy-dense foods and expending energy through physical activity (Elagizi et al., 2020; Oppert et al., 2021). As individuals consume fewer vegetables, consume more sugar-sweetened and nutrient-poor foods, derive 40% of their calories from sweetened beverages, and reduce physical activity, the prevalence of overweight and obesity will not significantly decrease and may continue to rise (Ervin & Ogden, 2012). The U.S. Department of Agriculture and U.S. Department of Health and Human Services (2020). provides guidelines to Americans regarding recommended daily food consumption and serving sizes that constitute a "healthy nutrition." The terms nutrition and diet quality are often used interchangeably when referring to healthy eating. A healthy diet or quality diet is defined as consuming foods recommended in the "My Plate" guidelines, which are low in saturated fats, trans fats, cholesterol, sodium, and added sugars, while staying within daily caloric requirements (Centers for Disease Control and Prevention, 2023). Interventions such as snack tasting (Branscum et al., 2013; Freedman & Nickell, 2010; Walker et al., 2008) and utilizing vegetables from the garden for snacks (Somerville et al., 2012) have been successful in increasing fruit and vegetable intake. However, the sustainability of these gains has not always been observed in follow-up studies (Branscum et al., 2013; Freedman & Nickell, 2010).

Obesity has been recognized as a risk factor for COVID-19, increasing the likelihood of severe symptoms and complications in individuals who are obese (Alberca et al., 2021; Perez et al, 2021). Inadequate dietary intake and nutritional deficiencies worsen the weakness of the immune system, making obese patients more susceptible to viral infections. However, adjusting dietary patterns and providing nutritional supplements have the potential to improve immune function and reduce the

susceptibility to viral infections among obese individuals. The implication is that it is crucial to address obesity and its related dietary factors in relation to COVID-19 by implementing dietary and nutritional changes to reduce the risk of obese patients being exposed to the virus and experiencing severe symptoms. Encouraging a well-balanced diet, rich in essential nutrients, can strengthen immune function and enhance the body's resistance to viral infections. Further research and public health programs should prioritize promoting healthy dietary practices to mitigate the impact of obesity on the susceptibility and severity of COVID-19.

#### **4. Conclusion**

Obesity is a significant contributor to preventable diseases and deaths worldwide. It presents a tremendous challenge not only to public health officials and healthcare providers but also to each individual, as no one is immune. Obese individuals are particularly susceptible to COVID-19 due to reduced physical activity, reliance on automated transportation, sedentary lifestyles, and easy access to high-calorie foods. Economic growth in many parts of the world has transformed obesity from a rare disease of the wealthy to one of the most common diseases, affecting even the poor. The causes of obesity are multifaceted and complex, with numerous risk factors that interact with each other. Therefore, it is crucial to gain a deeper understanding of these interactions and develop comprehensive solutions to this epidemic. Many experts advocate for a systems-level and systems epidemiology approach, which considers biological, behavioral, and environmental factors and their intricate feedback loops. In this context, food and nutritional intake play a crucial role in reducing the risk of obesity and susceptibility to COVID-19. It is essential to strictly adhere to a balanced and adequate diet to mitigate the risk of COVID-19 among obese patients. In Nigeria, it is important for parents to take proper care of their children to minimize the exposure of obese patients to COVID-19. Response plans to COVID-19 should include social protection programs, public awareness campaigns, and nutritional education. Financial assistance should be provided to low-income families to improve their nutritional intake. Consuming fruits and fresh vegetables on a daily basis is highly recommended. Additionally, food should be prepared and served at appropriate temperatures. Obese patients should also ensure they drink plenty of water.

#### **Acknowledgements**

The authors would like to appreciate the reviewers and editor for their suggestions.

#### **Conflict of Interest**

The authors declare no conflict of interest.

#### **Authors' Contributions**

The study's conceptualization, methodology, writing, data collection, analysis and revision were solely performed by PAO and MRA.

#### **Data Availability Statement**

The dataset used for this study is available on request. For further inquiries can consult the authors.

## Funding Information

This study was not funded by any organization.

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**Publisher: Department of Home Economics and Hospitality Management Education, University of Nigeria, Nsukka 41001, Nigeria**

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