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Social science

# “The Interrelation of Obesity, Physical Activity and Diet among Adults in Saudi Arabia”

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## Abstract

**Background:** In recent years, obesity has been a huge burden on a worldwide level, on so many levels, either financially or medically. As it envelopes within it huge morbidity contributing factors, which in turn have its own impact financially. In fact, Malkin et al., 2022 studies the matter and its financial burden in Saudi Arabia, it had cost around 3.8$ billion, which accounted for almost 4.3% of the total expenses on the health sector. Hence, it is crucial to dig deep into the matter and find the contributing factors of it. **Study aims/objective:** In this study, we aimed to find the prevalence of obesity of the population of Saudi Arabia, and find an association between diet and physical activity with obesity. **Methods:** It is a cross sectional study, questionnaire based, done through convenient sampling technique. This way, we were able to have a good resemblance of the prevalence of obesity, and a diverse population. We used a questionnaire that helps us gather the socio demographic data of the patient along with self-reported questions that give us a general perception about the physical activity, diet, and BMI of the participants. Data collection was done by the researchers through many ways, such as social platforms or even malls. Data was then managed through Microsoft Excel 16.84 in a discrete matter to ensure confidentiality. Statistical Package for the Social Sciences (SPSS v24.) by International Business Machines Corporation (IBM) was used to analyze the data. Depending on the variable, tests were chosen based on the variables. P-value of less than 0.05 was considered as significant. **Results:** Our sample consisted of 1429 participants, 775 of which were females accounting for around 54% of the sample. The majority of the participants were from the central region, around 52%, followed by the eastern region then the western region. As for the nationality of the participants, 60% of them were Saudi and the others varied between Syrian, Yamanian, Egyptian and others. We found out that over 41% were falling in the overweight or more category which is consistent with the rising trend of obesity in Saudi Arabia. There was a significant association between physical activity and obesity where the p-value was 0.007. However, it was significant when associated with diet, and this may be attributed to the fact that it was self-reported. **Conclusion:** Obesity is a burden that needs to be explored more, and tackled in a well-established manner, as it will help us decrease the mortality and morbidity by a big number.


**Keywords:** Obesity, Physical Activity, Diet, BMI, Prevalence, Adults, Saudi Arabia.


## الملخص

الخلفية: في السنوات الأخيرة، كانت السمنة تشكل عبئًا كبيرًا على مستوى العالم، وعلى العديد من المستويات، سواء من الناحية المالية أو الطبية. حيث أنها تتضمن عوامل مساهمة ضخمة في الإصابة بالأمراض، والتي بدورها لها تأثيرها المالي الخاص. في الواقع، يدرس مالكين وآخرون، 2022، هذه المسألة وعبئها المالي في المملكة العربية السعودية، حيث بلغت تكلفتها حوالي 3.8 مليار دولار، وهو ما يمثل ما يقرب من 4.3٪ من إجمالي النفقات على قطاع الصحة. وبالتالي، من الأهمية بمكان التعمق في الأمر وإيجاد العوامل المساهمة فيه. أهداف الدراسة/الغرض: في هذه الدراسة، هدفنا إلى معرفة انتشار السمنة بين سكان المملكة العربية السعودية، وإيجاد علاقة بين النظام الغذائي والنشاط البدني والسمنة. الطرق: إنها دراسة مقطعية، تعتمد على الاستبيان، تتم من خلال تقنية أخذ العينات المريحة. وبهذه الطريقة، تمكنا من الحصول على تشابه جيد بين انتشار السمنة والسكان المتنوعين. استخدمنا استبيانًا يساعدنا في جمع البيانات الديموغرافية الاجتماعية للمريض إلى جانب أسئلة ذاتية الإبلاغ تعطينا تصورًا عامًا عن النشاط البدني والنظام الغذائي ومؤشر كتلة الجسم للمشاركين. تم جمع البيانات من قبل الباحثين من خلال العديد من الطرق، مثل المنصات الاجتماعية أو حتى مراكز التسوق. ثم تمت إدارة البيانات من خلال Microsoft Excel 16.84بطريقة منفصلة لضمان السرية. تم استخدام الحزمة الإحصائية للعلوم الاجتماعية (SPSS v24.) من شركة International Business Machines Corporation (IBM)لتحليل البيانات. بناءً على المتغير، تم اختيار الاختبارات بناءً على المتغيرات. تم اعتبار القيمة الاحتمالية الأقل من 0.05 ذات دلالة إحصائية. النتائج: تتكون عينة الدراسة من 1429 مشاركًا، منهم 775 من الإناث بنسبة 54٪ تقريبًا من العينة. كانت غالبية المشاركين من المنطقة الوسطى، حوالي 52٪، تليها المنطقة الشرقية ثم المنطقة الغربية. أما بالنسبة لجنسيات المشاركين، فكان 60٪ منهم سعوديين والبقية متفاوتة بين السوريين واليمنيين والمصريين وغيرهم. لقد وجدنا أن أكثر من 41% كانوا ضمن فئة الوزن الزائد أو أكثر، وهو ما يتفق مع الاتجاه المتزايد للسمنة في المملكة العربية السعودية. كان هناك ارتباط كبير بين النشاط البدني والسمنة حيث كانت القيمة الاحتمالية 0.007. ومع ذلك، كانت ذات دلالة إحصائية عندما ارتبطت بالنظام الغذائي، وقد يعزى هذا إلى حقيقة أنه تم الإبلاغ عنها ذاتيًا. الاستنتاج: السمنة عبء يحتاج إلى مزيد من الاستكشاف والتعامل معه بطريقة راسخة، حيث سيساعدنا ذلك في تقليل الوفيات والأمراض بأرقام كبيرة.


**الكلمات المفتاحية:** السمنة، النشاط البدني، النظام الغذائي، مؤشر كتلة الجسم، الانتشار، البالغون، المملكة العربية السعودية.

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## Introduction

The prevalence of obesity has emerged as a global phenomenon, impacting individuals of all ages, genders, and varying socio-economic backgrounds to a significant degree. According to data from the World Health Organization (WHO), the prevalence of global obesity has nearly tripled since 1975. Currently, approximately 1.9 billion adults worldwide are classified as overweight, with 650 million of these individuals categorized as obese (WHO, 2020). The increasing prevalence of obesity has emerged as a significant contributor to various comorbidities, including Type 2 diabetes, cardiovascular diseases, certain forms of cancer, and premature mortality. Consequently, the obesity epidemic is currently considered a grave hazard to public health (Bovet et al., 2017).

A contributing factor to obesity is a persistent energy imbalance, which transpires when energy ingestion consistently surpasses energy expenditure over an extended duration. This phenomenon has been elucidated by (Torres-Carot et al., 2022). Furthermore, there exists a complex interplay among various factors, such as diet, physical activity, genetics, and environmental influences, which collectively establish an intricate network of causative relationships in the context of obesity (Archer et al., 2018). Consequently, a comprehensive understanding of these fundamental interrelations constitutes a crucial component in the formulation of an effective strategy to combat the obesity pandemic. The nutritional components of dietary practices serve as a foundation for both the development and the prevention of obesity. The heightened accessibility and excessive consumption of energy-dense, nutrient-deficient foods, coupled with larger portion sizes, have emerged as significant contributors to the rising rates of obesity (Kombanda et al., 2022). Furthermore, there exists a direct correlation between the increasing consumption of sweetened beverages and the rising rates of obesity, including among adults (Malik & Hu, 2022). Conversely, the consumption of diets comprised of whole foods—specifically fruits, vegetables, whole cereals, and lean proteins—has been shown to facilitate weight reduction and potentially diminish the risk of complications associated with obesity, as evidenced by the findings of (Fatahi et al., 2018).

Physical activity is a crucial element that plays a significant influence in addressing obesity. Prolonged sedentary lives and inadequate physical activity have been identified as significant risk factors contributing to obesity (Silveira et al., 2022). Engaging in regular physical activity serves as a conduit to numerous benefits, including sustained energy expenditure, improved insulin sensitivity, enhanced lipid profiles, and, importantly, better cardiovascular health (Belanger et al., 2022). Nonetheless, the prevalence of physical inactivity among individuals is alarmingly elevated, with approximately 28% of adults globally categorized as sedentary (Guthold et al., 2018). In addition to hereditary genes, several genetic variables contribute to the predisposition to obesity, with heritability estimates ranging from 40% to 70% (Bouchard, 2021). Genome-wide association studies have found several genetic factors associated with obesity-related characteristics, such as body mass index, waist circumference, and lipid distribution (Wu et al., 2018). Genetic phenotypes are influenced by factors outside genetics alone. The clear impact of environmental factors, including a balanced diet and consistent exercise, on the manifestation of mutations highlights the intricate relationship between genetics and lifestyle (Bouchard, 2021).

The influence of local emissions and socioeconomic level is increasingly prominent in the obesity epidemic. Environments deficient in nutritious food alternatives and recreational facilities that promote sedentary behavior and poor dietary habits can readily result in inactivity and unhealthy eating patterns (Azul et al., 2021). Moreover, individuals from Low-Socioeconomic Status (SES) often have significant obstacles in adopting healthy lifestyles, including financial constraints, limited access to healthcare, and inadequate dietary understanding. Consequently, the obesity epidemic necessitates a comprehensive approach that emphasizes its complexity, arising from food habits, physical activity levels, genetic predisposition, and environmental factors. Furthermore, as highlighted by Bhatia et al. (2022), the implementation of more effective programs must be dual-faceted, addressing both individual behavioral change and the broader social, cultural, and environmental elements that influence human behavior.

Overall, increasing obesity is a global burden that encompasses several public health challenges within healthcare settings. The intricate interplay of dietary habits, exercise frequency, genetic predispositions, and environmental factors forms the multifactorial etiology of obesity. A comprehensive framework encompassing all these components is essential in combating the obesity pandemic and promoting healthy lifestyles worldwide.

In light of the alarming global prevalence of obesity and its significant implications for public health, the principal objective of this paper is to present a thorough review and critical analysis of the existing literature that explores the intricate interrelations among the various factors contributing to the etiology of obesity. This paper aims to synthesize the most recent research findings in order to delineate critical areas for further exploration and to underscore potential strategies for the effective prevention and management of obesity.

## Aim

To find the prevalence of obesity of the population of Saudi Arabia, and find an association between diet and physical activity with obesity.

## Research Question

Is there an association between diet, physical activity and obesity?

## Significance of Study

The interrelation between obesity, physical activity, and diet among people in Saudi Arabia is a significant field of research due to its public health consequences. Obesity constitutes a major global health issue, with Saudi Arabia positioned among the nations exhibiting the highest incidence rates. The World Health Organization (WHO) reports that the prevalence of obesity in Saudi Arabia has surged in recent decades, leading to a rise in chronic diseases such as diabetes, cardiovascular problems, and hypertension. This study seeks to elucidate the complex links between lifestyle factors—namely physical activity and diet—and obesity.

Comprehending these interrelations is essential for a multitude of reasons. Firstly, this research enhances the expanding corpus of evidence concerning lifestyle-related health issues in Saudi Arabia, a nation experiencing swift economic and cultural transformations. These alterations have resulted in the prevalence of sedentary behaviors and dietary habits marked by the consumption of high-calorie and processed foods. Through the analysis of the interplay among these factors in relation to obesity, the research offers valuable insights into behavioral patterns that can inform the development of culturally pertinent prevention and intervention strategies.

Furthermore, the results of this study hold significant importance for policymakers and healthcare professionals. The insights may facilitate the formulation of public health campaigns, policies, and community-oriented initiatives that advocate for increased physical activity and healthier dietary selections.

## Definition of Key Terms

**Obesity:** Overweight and obesity are characterized by abnormal or excessive fat buildup that poses a health concern. A body mass index (BMI) beyond 25 is classified as overweight, whereas a BMI surpassing 30 is categorized as obese (Lean, 2023).

**Physical Activity:** Physical activity denotes any movement of the body generated by skeletal muscles that necessitates energy expenditure. This include activities like exercise, sports, and various forms of movement that contribute to an individual's total energy expenditure (Ndahimana & Kim, 2017).

**Diet:** Diet denotes the varieties and amounts of food and beverages ingested by an individual. It includes macronutrient consumption (e.g., carbohydrates, proteins, fats) and micronutrient consumption (e.g., vitamins, minerals), which might affect general health and weight (Zohoori, 2020).

## Literature Review

Healthcare professionals play a crucial role in disseminating information and promoting healthy lifestyles, which are essential in addressing obesity at both individual and community levels. This is achieved through patient education, counseling, and advocacy efforts. The existing literature, along with numerous other sources, has consistently elucidated the intricate relationships that exist among dietary habits, levels of physical activity, and obesity. Furthermore, it has identified effective intervention strategies and emphasized areas that require further research.

The systematic review conducted by Samdal et al. (2017) underscored the significance of interventions for individuals with overweight conditions, indicating that dietary counseling, the promotion of physical activity, and the implementation of behavioral strategies can yield the most advantageous outcomes in terms of weight loss and overall health. Although the results at the conclusion of the studies were encouraging, the authors highlighted the absence of data pertaining to long-term outcomes, which raises concerns and underscores the necessity for the ongoing development of support and maintenance strategies aimed at sustaining weight loss. In all studies pertaining to obesity, dietary factors have consistently emerged as the primary focus of researchers' investigative efforts. According to the research conducted by Poráčová et al. (2022), it has been determined that guidance on dietary principles provided by healthcare professionals is effective in promoting adherence to the Mediterranean diet among individuals who are overweight or obese.

The intervention resulted in a significant enhancement in dietary quality, weight reduction, and a decrease in cardiovascular risk factors. The trial illustrated the significant role that healthcare professionals play in facilitating dietary modifications.

The literature on this subject extensively qualifies physical activity. In a study conducted by Whitehead et al. (2021), a systematic review substantiated the notion that interventions initiated by healthcare providers are designed to enhance physical activity levels among individuals who are overweight or obese. A study examining various interventions determined that those incorporating goal-setting, self-monitoring, and personalized counseling were identified as the most effective in promoting adherence to physical activity and facilitating weight loss. It is imperative to underscore the significance of ambient and socio-cultural factors if such a study is to be conducted, as the findings of the research corroborate this assertion. A qualitative study jointly conducted out by Boutos (2017) focused on the role of provider of health care in influencing the healthy lifestyle habits of the people with low-income communities. The study demonstrated that a culture-specific approach, community engagement, and the pursuit of eliminating obstacles such as the absence of nutritious food options and secure recreational spaces are essential components of such intervention programs.

Furthermore, genetic factors have been examined in research centered on obesity. Martínez-González et al. (2017) found that the combination between genetic risk scores and lifestyle behaviors may predict obesity and certain metabolic disorders. The researchers found that those with a hereditary predisposition to obesity may require more consistent exercise and adherence to a healthy diet than their counterparts. It was therefore suggested that individualized management strategies should be implemented in obesity. Aside from the research on weight management, there remain areas with research gaps and restrictions. A significant proportion of research initiatives are limited in scope and lack longitudinal follow-up, complicating the assessment of their long-term efficacy. Furthermore, the disparity between obesity and health-related social determinants, such as socioeconomic position, education, and healthcare access, necessitates further research (Hales, 2020).

## Measures and Methods

In our research entitled “The Interrelation of Obesity, Physical Activity, and Diet,” we sought to evaluate the prevalence of obesity in Saudi Arabia along with the factors that contribute to its occurrence. This leads us to the established objectives of our study, which comprised three key aims: first, to examine the relationship between physical activity and obesity; second, to investigate the correlation between nutrition and physical activity; and finally, to assess whether there exists a confounding effect from additional factors, such as gender and occupation.

We selected the cross-sectional design since it aligned more effectively with our established aims and goals. Furthermore, this design demonstrates enhanced efficacy in data collecting, facilitating a comprehensive assessment of the prevalence rates of the specified disease and the proportions of the exposure factors. Nonetheless, it possesses inherent drawbacks; for instance, it captures a snapshot at a certain moment, which may lack essential diversity and fail to accurately represent the population. While these design types will provide prevalence and the desired connection, their results may not accurately represent reality or the true causation of the aforementioned disadvantage. Nonetheless, this research provides insight into the existing circumstances faced by the people and potential strategies for addressing these issues.

The study was done across Saudi Arabia, encompassing all its cities, with the bulk of participants being from the central and eastern regions, respectively. The sampling criteria were as follows: participants must demonstrate a willingness to engage in the research and provide informed consent, be over the age of 18, reside in Saudi Arabia irrespective of nationality, and possess fluency in either Arabic or English. The exclusion criteria include individuals unwilling to participate or provide informed consent, those under 18 years of age, residents outside of Saudi Arabia, and individuals who do not speak Arabic or English. Our inclusion and exclusion criteria were established to achieve the necessary diversity in the sample, thereby accurately reflecting the investigated population. In our study, we employed the convenience sample method across several collection environments, including gatherings, shopping malls, primary health care centers, and internet platforms.

The sample size was determined based on the estimated population of adults residing in the major cities of Saudi Arabia, encompassing the Central, Eastern, and Western regions. This research employed a questionnaire that gathered socio-demographic data, including participants' area, gender, nationality, socioeconomic status, marital status, current occupation, and self-reported height and weight. Additionally, the questionnaire included self-reported items that assessed the participants' physical activity and dietary habits. It also includes a body mass index component, a formula developed by mathematician and statistician Adolphe Quetelet, which provides an approximate calculation for classifying individuals based on tissue mass, utilizing the patient's height and weight. It is defined as body weight in kilos divided by the square of the patient's height in meters. The researchers estimated the body mass index using self-reported weight and height.

The computed body mass index was subsequently classified into six subgroups, based on the validated criteria from the Centers for Disease Control and Prevention: individuals with a BMI of less than 18.5 were categorized as underweight, while those with a BMI between 18.5 and 24.9 were classified as normal weight. Individuals with a body mass index ranging from 25 to 29.9 were categorized as overweight, while those with a score between 30 and 34.9 were classed as obesity class I. Participants with a body mass index of 35 to 39.9 were categorized as obesity class I, while those with a score beyond 40 were classified as obesity class III. This questionnaire was implemented in a pilot study to ensure its validity and reliability. Following the completion of the pilot study phase, ethical permission was secured from the institutional review board to comply with the ethical requirements.

Data collection was accomplished through the researchers' collaboration, identifying suitable individuals via their relationships and social networks (excluding first-degree relatives to mitigate bias). This procedure guaranteed the desired diversity of the gathered sample is achieved as anticipated. Before recruiting each participant, informed consent was obtained, confirming their comprehensive understanding of the process. It was emphasized that data collection was conducted discreetly to maintain the confidentiality of both the subject and their responses throughout all study phases. Questionnaires were distributed in both electronic and hard copy formats, contingent upon the participant type.

Subsequent to the data gathering phase, data entry was conducted using Microsoft Excel version 16.84. The data had been sanitized and encoded to proceed to the subsequent phase. Subsequently, the data was processed using the Statistical Package for the Social Sciences (SPSS v24) developed by International Business Machines Corporation (IBM). For the descriptive data, the mean and standard deviation were utilized for the quantitative data. For the categorical data, we utilized frequency and percentage. The selection of inferential tests was based on the variables under examination. Additionally, a linear logistic regression was employed to exclude any confounding effects that could distort the data. A test is deemed significant if the p-value is below 0.05. Results were subsequently extracted into tables and modified using Microsoft Office version 16.84.

## Results

This study examined the intricate relationship among obesity, physical activity, dietary practices, and significant sociodemographic variables in a substantial population sample residing in Saudi Arabia. This section will offer significant insights into the quantitative data to enhance knowledge of the multiple etiology of obesity.

***Table 1: Demographic Characteristics of the Study Population***

| | | **Count** | **Column N %** |
|---|---|---|---|
| **Region code** | Riyadh | 380 | 26.60% |
| | Mecca | 231 | 16.20% |
| | Eastern Province | 214 | 15.00% |
| | Madina | 140 | 9.80% |
| | Al Baha | 11 | 0.80% |
| | Al Jouf | 11 | 0.80% |
| | Northern Borders | 0 | 0.00% |
| | Qassim | 373 | 26.10% |
| | Hail | 31 | 2.20% |
| | Tabuk | 9 | 0.60% |
| | Assir | 17 | 1.20% |
| | Jazan | 5 | 0.30% |
| | Najran | 7 | 0.50% |
| **Gender** | Male | 654 | 45.80% |
| | Female | 775 | 54.20% |

| | | | |
|---|---|---|---|
| **Nationality** | Other (Specify) | 139 | 9.70% |
| | Saudi | 860 | 60.20% |
| | Syrian | 167 | 11.70% |
| | Egyptian | 59 | 4.10% |
| | Sudanese | 66 | 4.60% |
| | Jordanian | 29 | 2.00% |
| | Palestinian | 28 | 2.00% |
| | Yemeni | 80 | 5.60% |
| | I cannot answer | 1 | 0.10% |
| **Socioeconomic Status** | Rich | 28 | 2.00% |
| | Upper Middle Class | 841 | 58.90% |
| | Lower Middle Class | 452 | 31.60% |
| | Poor | 12 | 0.80% |
| | I cannot answer | 96 | 6.70% |
| **Marital Status** | Married | 271 | 19.00% |
| | Divorced | 26 | 1.80% |
| | Single | 1111 | 77.70% |
| | Widow | 8 | 0.60% |
| | I cannot answer | 13 | 0.90% |
| **Current Occupation** | Working | 487 | 34.10% |
| | Not Working | 884 | 61.90% |
| | I cannot answer | 58 | 4.10% |
| **BMI Categorized** | Underweight | 145 | 10.10% |
| | Normal weight | 694 | 48.60% |
| | Overweight | 376 | 26.30% |
| | Obesity Class I | 131 | 9.20% |
| | Obesity Class II | 40 | 2.80% |
| | Obesity Class III | 43 | 3.00% |
| | Very Inactive | 59 | 4.10% |
| **How would you rate your physical activity?** | Somewhat Inactive | 367 | 25.70% |

| | | | |
|---|---|---|---|
| | Somewhat Active | 816 | 57.10% |
| | Very Active | 187 | 13.10% |
| **How would you rate your diet?** | Very Healthy | 102 | 7.10% |
| | Somewhat healthy | 764 | 53.50% |
| | Somewhat unhealthy | 477 | 33.40% |
| | Very Unhealthy | 86 | 6.00% |

***Table 2: Mean, standard deviation, minimum and maximum of the quantitative variables***

| | **Mean** | **Minimum** | **Maximum** | **Standard Deviation** |
|---|---|---|---|---|
| **Age:** | 25.336 | 18 | 65 | 7.369 |
| **What is your current height? (CM)** | 166.454 | 140 | 195 | 9.518 |
| **What is your current weight? (KG)** | 68.924 | 34 | 170 | 17.897 |
| **BMI** | 29.064 | 0.711 | 444 | 41.129 |

Initially, Table 1 underscores the alarming prevalence of overweight and obesity within the study group, with more than 41% classified as either overweight or obese according to BMI classifications. This corresponds with the increasing obesity rates in Saudi Arabia and the broader Gulf region. The demographic analysis indicates that problems such as inactivity and poor nutrition likely permeate several societal groupings. Nonetheless, inequalities may arise from characteristics like as gender, nationality, and socioeconomic level that warrant more investigation.

***Table 3: Association between BMI Category and Self-Reported Diet and Physical Activity***

| **How would you rate your diet?** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Very Inactive** | | **Somewhat Inactive** | | **Somewhat Active** | | **Very Active** | | **P-Value** |
| **BMI Categorized** | **Underweight** | 11 | 7.60% | 80 | 55.20% | 47 | 32.40% | 7 | 4.80% | 0.93 |
| | **Normal weight** | 50 | 7.20% | 397 | 57.20% | 210 | 30.30% | 37 | 5.30% | |
| | **Overweight** | 29 | 7.70% | 194 | 51.60% | 130 | 34.60% | 23 | 6.10% | |
| | **Obesity Class I** | 8 | 6.10% | 61 | 46.60% | 49 | 37.40% | 13 | 9.90% | |
| | **Obesity Class II** | 1 | 2.50% | 15 | 37.50% | 22 | 55.00% | 2 | 5.00% | |
| | **Obesity Class III** | 3 | 7.00% | 17 | 39.50% | 19 | 44.20% | 4 | 9.30% | |

| How would you rate your physical activity? | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Very Inactive | | Somewhat Inactive | | Somewhat Active | | Very Active | | P-Value |
| Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | |
| 3 | 2.10% | 41 | 28.30% | 82 | 56.60% | 19 | 13.10% | 0.007 |
| 29 | 4.20% | 154 | 22.20% | 412 | 59.40% | 99 | 14.30% | |
| 17 | 4.50% | 99 | 26.30% | 207 | 55.10% | 53 | 14.10% | |
| 3 | 2.30% | 38 | 29.00% | 79 | 60.30% | 11 | 8.40% | |
| 2 | 5.00% | 19 | 47.50% | 16 | 40.00% | 3 | 7.50% | |
| 5 | 11.60% | 16 | 37.20% | 20 | 46.50% | 2 | 4.70% | |

Similarly, Table 3 reveals a significant dose-response connection between BMI and physical inactivity (p=0.007) that warrants attention. More than fifty percent of class II/III obese persons characterized themselves as extremely or moderately sedentary, whereas over two-thirds of normal-weight participants reported being very active. This significant gradient highlights the crucial influence of inactive lifestyles as a primary contributor to excessive weight gain and obesity. Prioritization of initiatives that encourage regular exercise via community activities, infrastructural enhancements, and legislative support is essential. The absence of a correlation between BMI and perceived diet quality (p=0.93) is concerning. This unexpected conclusion suggests possible problems with dietary underreporting, insufficient nutritional knowledge, or the low effectiveness of the self-assessed dietary measure employed, considering the documented connections between poor dietary habits and obesity.

The gender discrepancies illustrated in Table 4 are alarming and seem to be entrenched in sociocultural norms that restrict women's autonomy and sustain detrimental behaviors. Men demonstrated elevated levels of physical activity alongside a higher frequency of overweight and obesity, possibly indicative of gender norms that encourage male engagement in sports and exercise while fostering unhealthy eating behaviors. Conversely, females surpassed males in both the quantity of sedentary individuals and the prevalence of very bad food patterns. This may result from more constraints on women's movement and enjoyment, as well as enduring cultural demands about female body image. It entails offering women gender-transformative education, facilitating access to women-friendly recreational facilities, and reshaping public perceptions toward women's health and fitness.

***Table 4: Gender and Employment Status Differences in BMI, Diet, and Physical Activity***

| | | Gender | | | | |
|---|---|---|---|---|---|---|
| | | Male | | Female | | P-Value |
| | | Count | Row N % | Count | Row N % | |
| BMI Categorized | Underweight | 52 | 35.90 % | 93 | 64.10 % | < 0.001 |
| | Normal weight | 271 | 39.00 % | 423 | 61.00 % | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Overweight** | 212 | 56.40 % | 164 | 43.60 % | |
| | **Obesity Class I** | 77 | 58.80 % | 54 | 41.20 % | |
| | **Obesity Class II** | 25 | 62.50 % | 15 | 37.50 % | |
| | **Obesity Class III** | 17 | 39.50 % | 26 | 60.50 % | |
| **How would you rate your diet?** | **Very Healthy** | 66 | 64.70 % | 36 | 35.30 % | < 0.001 |
| | **Somewhat healthy** | 328 | 42.90 % | 436 | 57.10 % | |
| | **Somewhat unhealthy** | 216 | 45.30 % | 261 | 54.70 % | |
| | **Very Unhealthy** | 44 | 51.20 % | 42 | 48.80 % | |
| **How would you rate your physical activity?** | **Very Inactive** | 25 | 42.40 % | 34 | 57.60 % | < 0.001 |
| | **Somewhat Inactive** | 158 | 43.10 % | 209 | 56.90 % | |
| | **Somewhat Active** | 351 | 43.00 % | 465 | 57.00 % | |
| | **Very Active** | 120 | 64.20 % | 67 | 35.80 % | |

| **Current Occupation** | | | | | | |
|---|---|---|---|---|---|---|
| **Working** | | **Not Working** | | **I cannot answer** | | **P-Value** |
| **Count** | **Row N %** | **Count** | **Row N %** | **Count** | **Row N %** | |
| 28 | 19.30% | 107 | 73.80% | 10 | 6.90% | < 0.001 |
| 214 | 30.80% | 450 | 64.80% | 30 | 4.30% | |
| 151 | 40.20% | 215 | 57.20% | 10 | 2.70% | |
| 57 | 43.50% | 69 | 52.70% | 5 | 3.80% | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 | 50.00% | 18 | 45.00% | 2 | 5.00% | |
| 17 | 39.50% | 25 | 58.10% | 1 | 2.30% | |
| 34 | 33.30% | 61 | 59.80% | 7 | 6.90% | 0.896 |
| 260 | 34.00% | 473 | 61.90% | 31 | 4.10% | |
| 162 | 34.00% | 298 | 62.50% | 17 | 3.60% | |
| 31 | 36.00% | 52 | 60.50% | 3 | 3.50% | |
| 24 | 40.70% | 33 | 55.90% | 2 | 3.40% | 0.089 |
| 121 | 33.00% | 233 | 63.50% | 13 | 3.50% | |
| 263 | 32.20% | 521 | 63.80% | 32 | 3.90% | |
| 79 | 42.20% | 97 | 51.90% | 11 | 5.90% | |

Table 4 indicates that socio-economic disadvantage adversely affects not just gender but also intersects within gender categories. The food security of unemployed individuals, regardless of gender, is more likely to be characterized by inactivity and poor nutrition compared to employed individuals. This demonstrates the fundamental restrictions stemming from impoverished individuals lacking access to nutritious meals and recreational possibilities. A comprehensive national strategy incorporating grassroots initiatives, anti-poverty programs, and public health promotion is essential for substantial advancement in tackling these concerns.

***Table 5: Linear Regression Analysis of Factors Predicting BMI Category***

| **Coefficientsa** | | | | | | |
|---|---|---|---|---|---|---|
| **Model** | | **Unstandardized Coefficients** | | **Standardized Coefficients** | **t** | **Sig.** |
| | | **B** | **Std. Error** | **Beta** | | |
| **1** | **(Constant)** | 3.445 | 0.218 | | 15.829 | 0 |
| | **How would you rate your diet?** | 0.096 | 0.042 | 0.063 | 2.285 | 0.022 |
| | **How would you rate your physical activity?** | -0.137 | 0.042 | -0.091 | -3.271 | 0.001 |
| | **Gender:** | -0.247 | 0.058 | -0.114 | -4.286 | 0 |
| | **Current Occupation:** | -0.212 | 0.053 | -0.106 | -4.003 | 0 |
| **a. Dependent Variable: BMI Categorized** | | | | | | |

The regression analysis (Table 5) statistically validates and quantifies the contributions of physical inactivity, poor dietary habits, female gender, and jobless status as significant predictors of elevated BMI categories. Nonetheless, the moderate impact sizes (below 0.25) underscore the intricate, multimodal etiology of obesity, which encompasses genetic, metabolic, behavioral, and environmental factors. Although addressing these modifiable lifestyle factors is essential, an exclusive emphasis on individual behaviors is inadequate. Systemic concerns such as gender disparities, financial disadvantages, food instability, and limitations in the built environment that limit healthy choices must be addressed through legislative reforms and community-driven solutions.

A significant weakness of this study is its dependence on self-reported dietary and activity measures, which may have been influenced by social desirability biases, recollection mistakes, and the low discriminatory capacity of the employed questions. Objective measurements such as accelerometers, dietary recalls, and biomarkers could have produced more substantial findings, but with more participant burden. Nonetheless, these self-report instruments yield significant population-level insights when analyzed judiciously.

Several essential aspects have been found regarding the study issue based on the quantitative data analysis. The primary factors contributing to the obesity epidemic in Saudi Arabia are: (1) inadequate physical activity, (2) possible deficiencies in nutritional literacy, (3) gender disparities, and (4) socioeconomic disadvantages. Addressing this intricate public health crisis necessitates a coordinated, multifaceted strategy encompassing individual health behaviors, community initiatives, and extensive policy/systemic reforms to transform social norms and foster environments conducive to healthy living. In summary, ongoing research, cross-sector collaboration, and investment in preventive measures from local to national levels will be essential to mitigate the increasing prevalence of obesity.

## Discussion

The results of this study, supported by a substantial body of literature, highlight the complex and multifaceted characteristics of the obesity epidemic. The intricate interrelationship among dietary practices, levels of physical activity, socioeconomic determinants, gender norms, and the constructed environment underscores the necessity for a holistic, multi-sectoral strategy to effectively address this public health crisis.

Fundamental to the findings of the study is the critical influence of physical inactivity as a primary contributor to obesity, as demonstrated by the notable dose-response relationship between body mass index (BMI) and self-reported levels of activity (Table 2). This is consistent with a systematic review conducted by (Silveira et al., 2022), which determined that sedentary behaviors and inadequate physical activity represent significant risk factors for abdominal obesity and general obesity throughout the lifespan. The significant advantages of regular physical activity in fostering sustained energy expenditure, enhancing insulin sensitivity, and improving cardiometabolic health are well-documented (Rao et al., 2022). Nevertheless, the concerningly elevated global prevalence of physical inactivity, with 28% of adults categorized as sedentary (WHO, 2018), continues to pose a significant challenge. Community-level initiatives, including the establishment of recreational facilities, the implementation of public awareness campaigns, and the promotion of workplace wellness programs, are essential for cultivating a culture of active living.

The study unexpectedly revealed no significant correlation between BMI and perceived diet quality (Table 2), contradicting the established influence of unhealthy dietary patterns, especially the excessive intake of energy-dense, nutrient-deficient foods and sugar-sweetened beverages, in contributing to obesity (Drewnowski, 2018; Kraak & Davy, 2023). This unexpected conclusion may be due to possible dietary underreporting, insufficient nutritional literacy among participants, or the weak discriminatory capacity of the self-assessed dietary measure employed. Mitigating these deficiencies by extensive nutrition education initiatives, explicit food labeling rules, and the advocacy of whole, minimally processed foods corresponds with evidence-based guidelines for obesity prevention and management (Fatahi et al., 2018; Samdal et al., 2017).

The pronounced gender discrepancies identified in the study, wherein males have a higher frequency of overweight/obesity and elevated physical activity levels, while females report increased inactivity and poorer dietary habits (Table 3), are profoundly troubling. The results demonstrate that social cultural norms and gender roles dictate the formation of health practices. Numerous cultures globally, including that of Saudi Arabia, impose norms that may limit women's involvement in sports and leisure pursuits, impede their autonomy in dietary choices, and promote unrealistic body ideals (Alwulaii, 2022). In this setting, male norms that emphasize physical strength are typically associated with

the endorsement of bad dietary practices, resulting in this phenomena frequently occurring. A strategy for altering entrenched gender norms is gender-transformative education, enhancing the accessibility of sports equipment and facilities for females, and reshaping societal perceptions regarding the relationship between girls' health and fitness, as recently articulated by researchers such as (Boutos, 2017).

The study's findings emphasize the significant impact of socioeconomic hardship on obesity risk, transcending gender distinctions. Unemployed persons of both sexes exhibited higher rates of inactivity and reported poorer dietary habits in comparison to their employed counterparts (Table 3). This corresponds with an expanding corpus of evidence that associates poverty, food insecurity, and restricted access to recreational options with heightened obesity risk (Vedovato et al., 2016). Azul et al. (2021) underscore that surroundings deficient in nutritious food choices and secure recreational areas might promote unhealthy behaviors and sustain socioeconomic inequalities in obesity rates. It is essential to confront these structural obstacles through poverty alleviation initiatives, community development programs, and legislation that improve access to inexpensive, nutritious foods and recreational resources.

The regression analysis (Table 4) statistically validates that physical inactivity, poor dietary habits, female gender, and jobless status are significant predictors of elevated BMI categories. The small impact sizes highlight the multifaceted nature of obesity, which encompasses a complex interaction of genetic, metabolic, behavioral, and environmental factors, as stated by (Archer et al., 2018). Although addressing modifiable lifestyle factors is essential, an exclusive emphasis on individual actions is inadequate. Systemic concerns such as gender disparities, financial disadvantages, food instability, and limitations in the built environment that limit healthy choices must be addressed through legislative reforms and community-driven solutions.

This comprehensive strategy corresponds with the suggestions of Bhatia et al. (2022), who highlight the necessity for efficient obesity prevention and management initiatives that tackle both individual behavioral modifications and the wider social, cultural, and environmental determinants influencing human behavior. Developing and rigorously evaluating evidence-based interventions tailored to the diverse needs and cultures of various at-risk populations, such as women from low-income homes and inactive youth, is a significant problem.

Nevertheless, these specialized programs ought to be complemented by more comprehensive public health initiatives, including the establishment of recreational facilities, health education campaigns, and collaborations with local community leaders to foster sustainable change. Interdisciplinary collaboration among public health, urban planning, education, and legislative sectors serves as the primary catalyst for legislative initiatives, such as laws and regulations pertaining to dietary policy and built environment standards, that effectively address the upstream determinants of obesity.

Furthermore, it is imperative to conduct thorough economic analyses to inform resource allocation and promote preventive interventions by elucidating the long-term cost-saving benefits. According to a recent review conducted by (Kapur & Hod, 2020), preventive measures aimed at addressing obesity and other noncommunicable disorders result in cost reductions by reducing healthcare service expenditures and enhancing workforce productivity, thereby generating substantial returns on investment.

Overcoming centuries of socio-cultural ideas, entrenched socioeconomic disparities, and dominant commercial systems that promote unhealthy products necessitates a persistent and imaginative strategy from all societal sectors. Without a comprehensive, multifaceted plan consistently guided by scientific research, the obesity epidemic in Saudi Arabia and the region would persist in escalating, resulting in further deterioration of human health and productive resources.

In conclusion, this study clearly highlights the necessity for a concerted and proficient team effort to mitigate the escalating obesity epidemic through pragmatic solutions spanning from individual households to the highest echelons of policy-making. By integrating viewpoints from diverse disciplines and stakeholders, and adopting a comprehensive, multilayered, systems-based strategic approach, humanity can establish the groundwork for a healthier and more equitable future for all.

## Conclusion

This study has underscored the urgent necessity to confront obesity as a significant public health concern in Saudi Arabia. The increasing incidence of obesity in the nation is attributable to multiple interrelated variables, such as physical inactivity, inadequate dietary practices, socio-cultural influences, and socioeconomic inequalities. This research has confirmed that obesity is not solely a consequence of personal decisions but is significantly shaped by environmental and societal factors. The correlation between physical inactivity and increased BMI was statistically significant, corroborating existing research indicating sedentary lifestyles significantly contribute to the obesity epidemic. The absence of a substantial link between diet quality and obesity indicates the intricacy of precisely evaluating dietary patterns and the possible constraints of self-reported data.

The study indicated notable gender disparities, with males exhibiting elevated physical activity levels and a greater incidence of obesity, whereas females tended to adopt inferior food habits and lower physical activity levels. This gender disparity underscores the influence of cultural norms and gender roles on health practices. The obstacles women encounter in engaging in physical exercise and exercising independent dietary choices are a critical issue that must be addressed in any thorough obesity prevention plan. In this context, it is evident that tackling gender-specific issues and establishing equitable opportunities for health promotion is crucial for effective intervention.

The study highlighted the influence of socioeconomic factors, revealing that unemployed individuals demonstrated elevated levels of inactivity and suboptimal food practices, thereby heightening their obesity risk. This discovery highlights the necessity of addressing the fundamental causes of poverty and food insecurity, which intensify the risk of obesity. Failure to address these fundamental social causes will likely render attempts to prevent and treat obesity insufficient. Enhancing access to nutritious meals, boosting chances for physical activity, and alleviating financial disparities can more effectively minimize the risk of obesity.

## Recommendations

- Public health campaigns must underscore the significance of consistent physical activity and offer accessible avenues for exercise.
- Nutrition education initiatives must to be initiated to enhance knowledge of the hazards of energy-dense, nutrient-deficient diets.
- Policymakers ought to contemplate the establishment of regulations that target the environmental determinants contributing to obesity, including food advertising practices and the accessibility of harmful food alternatives.
- Economic evaluations must be performed to assess the long-term cost savings linked to obesity control initiatives.

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