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Association of Body Mass Index With Type 2 Diabetes Mellitus Among Adult Population in Ksa: A Cross-Sectional Study

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RESEARCH

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ABSTRACT

Objective

Diabetes Mellitus (DM) stands as a chronic metabolic disorder characterized by persistent hyperglycemia stemming from anomalies in insulin secretion, insulin action, or a combination thereof. Its global prevalence has soared, posing substantial public health ramifications. This scenario holds for the Kingdom of Saudi Arabia (KSA), where the prevalence of DM has surged to a critical juncture, warranting heightened attention as a paramount health challenge. In this milieu, the identification of robust markers conducive to early detection and preventive interventions for DM is a matter of paramount significance. One such marker of potential relevance is the Body Mass Index (BMI), a metric ubiquitously deployed to gauge an individual's weight status.

Methods

A cross-sectional study design will be employed to investigate the association between Body Mass Index (BMI) and Type 2 Diabetes Mellitus (T2DM) among the adult population in the Kingdom of Saudi Arabia (KSA). The study will be conducted within various urban and rural settings across different regions of KSA, aiming for a representative geographic distribution. The study population will comprise adults aged 18 years and older residing in the Kingdom of Saudi Arabia. A multistage stratified random sampling method will be used. Firstly, distinct geographical regions will be chosen as strata. Then, within each stratum, random sampling will be performed to select specific cities, neighbourhoods, and households. From these households, eligible individuals will be invited to participate. Individuals aged 18 years and older, regardless of gender, who are willing to participate and provide informed consent will be eligible for inclusion. Individuals with pre-existing medical conditions affecting BMI and T2DM status will be excluded. Data will be collected through structured interviews. Information on demographics, medical history, lifestyle factors, and dietary habits will be gathered through face-to-face interviews. Anthropometric measurements (height,

weight, waist circumference) will be obtained using standardized procedures. The data collection instruments will include a questionnaire encompassing demographic and medical history sections, lifestyle assessment, and dietary intake. Standardized instruments will be used for anthropometric measurements to ensure consistency. The questionnaire will undergo expert review and pilot testing to enhance its validity. Anthropometric measurements will be taken by trained professionals using calibrated equipment to ensure reliability. Pre-established protocols will be followed for both data collection and measurement procedures.

Results

The researchers obtained results and information from 808 adults collected from various regions of the Kingdom of Saudi Arabia. A multi-stage stratified random sampling method was used. There was no significant difference between the number of males and females in the sample, as the number of males reached 407, representing 50.4%. The average age in the study was 40 years. There was a statistical significance between gender and cumulative blood sugar. The normal blood sugar level was the most common in the study at 69%, followed by those with diabetes at 21.28%.

Conclusion

The results of the study showed that most of the study participants were Saudis, and most of them lived in the city. Most of them were women. Most of the participants have an average monthly income. Most of the study participants had thyroid disease.

Key Words

Diabetes Mellitus, Body Mass Index

Introduction

Type 2 Diabetes Mellitus (T2DM) has reached epidemic proportions globally, and Saudi Arabia is no exception. The Kingdom has witnessed a significant rise in T2DM prevalence, which is a major public health concern. Research addressing the factors contributing to this increase is essential for designing effective preventive and management strategies. Obesity is a well-established risk factor for T2DM. The Body Mass Index (BMI) is a widely used indicator of obesity and has been shown to correlate with T2DM risk. Investigating the association between BMI and T2DM within the Saudi Arabian population can provide valuable insights into the extent to which obesity contributes to the diabetes burden in the region.

The genetic, cultural, and lifestyle factors in Saudi Arabia may influence the relationship between BMI and T2DM differently than in other regions. Therefore, a specific study focusing on the Saudi adult population is necessary to understand the nuances of this relationship within the local context. While global studies have shown a clear link between BMI and T2DM, there is a paucity of up-to-date, large-scale studies within Saudi Arabia that comprehensively examine this association. Such research is crucial for accurate epidemiological assessment and for guiding targeted interventions tailored to the local population's needs. The findings of this research can have direct implications for public health policy and strategies in Saudi Arabia. If a significant association between BMI and T2DM is confirmed, it can serve as a call to action for implementing preventive measures such as health education, lifestyle modification campaigns, and policies that promote healthy eating and physical activity.

The prevalence of obesity worldwide is a significant concern within the realm of public health[1,4]. According to recent studies[5,6], a significant majority of the United States population, exceeding two-thirds, is classified as either overweight or obese. The body mass index (BMI) is a commonly utilized method for assessing obesity within a given population. Additional methods for assessing obesity encompass the waist-to-hip ratio, the proportion of body or visceral fat, and waist circumference [7]. The estimation of an individual's health state can be determined by the calculation of the Body Mass Index (BMI), which involves mathematical operations using height and weight measurements[8]. The Body Mass Index (BMI) is commonly employed as a metric to assess the likelihood of individuals getting chronic ailments, including diabetes, hypertension, depression, and cancer[9-11]. The Body Mass Index (BMI) computation yields a numerical value that corresponds to one of four distinct categories, classifying an individual accordingly. The aforementioned data is utilized by researchers and medical professionals to inform patients and the general population about potential health hazards identified within a specific classification[12]. Scholars persist in examining the relationship between Body Mass Index (BMI) and chronic illness, as well as exploring the connections between waist circumference and its potential as a health predictor[13]. This research study further investigates the

correlation between children's BMI and the increasing prevalence of childhood obesity[14].

BMI and Diabetes

A study conducted by Chan, et al.[15] in the United States examined a sample of 51,529 male individuals employed in the healthcare sector, aged 40 to 75 years. The study findings indicated that those with a body mass index (BMI) exceeding 35 kg/m2 exhibited a heightened susceptibility to the development of type II diabetes in comparison to those with BMI values below 23 kg/m2. This study supports the assertion that obesity is associated with an elevated risk of disease. However, it is important to consider the pertinence of the data, given that it was gathered almost twenty years ago in 1994. In recent times, scholars have conducted investigations to determine how these results exhibit universality and comparability across global and racial contexts.

A study conducted in Turkey examined the risk variables associated with diabetes in a sample of 26,499 participants. The study included a regional analysis encompassing the North, South, East, West, and Central areas [16]. Furthermore, the analysis incorporated data pertaining to many factors, including family history, family size, age, education, waist circumference, BMI, hypertension, smoking, and the frequency of daily meals consumed. Among the various demographic groups examined, it was observed that a rise in waist circumference equivalent to one standard deviation corresponded to a 1.16-fold increase in the probability of being diagnosed with diabetes. Similarly, the male cohort exhibited a 1.28-fold higher probability of acquiring a new diagnosis for diabetes.

In a similar vein, Satman et al. conducted a study in which they established that body mass index (BMI) serves as a significant indicator of the likelihood of developing diabetes [16]. According to this study, there is evidence to suggest that a rise in body mass index (BMI) by one standard deviation (equivalent to 5.9kg/m2) is associated with a higher likelihood of developing type II diabetes. Specifically, the probability of developing this condition increases by 1.16 for men and 1.09 for women.

A comprehensive examination was conducted within the context of a multi-ethnic, longitudinal research conducted in Canada, encompassing a sample size of 59,824 persons without diabetes. The findings of this study indicate that South Asian individuals, Black individuals, and Chinese individuals have a higher likelihood of acquiring diabetes at lower BMI levels (24kg/m2, 26kg/m2, and 25kg/m2, respectively) compared to White individuals (30kg/m2). Therefore, it may be inferred that the aforementioned racial groupings have a heightened propensity for diabetes onset at a comparatively lower body mass index (BMI) as compared to individuals of White ethnicity[17]. Gaining insight into the correlation between race and body mass index (BMI) holds significant value for healthcare practitioners and those seeking medical guidance, as it facilitates the development of tailored treatment strategies and facilitates discussions pertaining to the risk of diabetes. Furthermore, the results can be generalized to a broader population in order to tackle public health issues.

Although BMI is commonly used as a reliable indicator for chronic diseases, such as type II diabetes, several researchers argue that alternative measurement tools may offer greater use in predicting such conditions. In a study conducted by Lee et al.[18], it was found that when compared to alternative measurements like waist circumference, waist-to-hip ratio, and waist-to-height ratio, BMI demonstrated the lowest efficacy as a predictor for cardiovascular risk factors, including diabetes, hypertension, and dyslipidemia. The present meta-analysis encompassed a sample size of 80,000 individuals, as reported in 10 scholarly studies. The findings of this study revealed that the waist-to-height ratio had a much superior ability in prognosticating the aforementioned disorders. The achievement can be ascribed to the waist-to-height ratio's capacity to account for central obesity, a feature that is absent in BMI.

Methods

Study type and design

A cross-sectional study design will be employed to investigate the association between Body Mass Index (BMI) and Type 2 Diabetes Mellitus (T2DM) among the adult population in the Kingdom of Saudi Arabia (KSA).

Study duration and timeline

Stage 1: Project planning and setup, define research objectives, develop research proposal, obtain ethical approval, and finalize study design and tools – 15 days.

Stage 2: Data collection, training data collectors, pilot testing, and full-scale data collection – 92 days.

Stage 3: Data analysis, data cleaning and preparation, and statistical analysis – 31 days.

Stage 4: report writing and finalization, drafting of research report, review and revisions, and finalizing research report – 31 days.

Stage 5: presentation and submission, prepare the presentation, practice presentation, and submit research report – 16 days.

Study population

Individuals aged 18 years and older, regardless of gender, who are willing to participate and provide informed consent will be eligible for inclusion. Individuals with pre-existing medical conditions affecting BMI and T2DM status will be excluded.

Inclusion criteria

Individuals aged 18 years and older, regardless of gender, who are willing to participate and provide informed consent will be eligible for inclusion. Individuals with pre-existing medical conditions affecting BMI and T2DM status will be excluded.

Exclusion criteria

Individuals with pre-existing medical conditions affecting BMI and T2DM status will be excluded.

Data collection Methods

Data will be collected through structured interviews. Information on demographics, medical history, lifestyle factors, and dietary habits will be gathered through face-to-face interviews. Anthropometric measurements (height, weight, waist circumference) will be obtained using standardized procedures.

Sample Size: 808 adults (estimated sample, no need for sample size Calculation).

Data entry and Statistical Analysis: Data Entry was done to the Personal Computer, and analysis of the Data was done Using SPSS Version 23.

Ethics and Confidentiality: All Data were Kept Confidential and protected; authors of this research solely have access to the data.

Acknowledgment

We thank the participants who all contributed samples to the study.

Ethical approval for study protocol /study design /Methodology

Ethical approval will be sought from an accredited institutional review board prior to the commencement of the study. Informed consent will be obtained from all participants, ensuring their understanding of the study's objectives and procedures and their right to withdraw at any time without consequences. Data confidentiality and anonymity will be strictly maintained throughout the study.

Conflicts of interest

The authors declare that they have no conflict of interest.

Results

The researchers obtained 808 questionnaires, and there were 407 males (50.7%). Figure 1 shows the distribution of participants based on gender. The average age in the study was 40 years, and the ages were 18 years and above. The study included 808 adults and studied several variables, and it became clear that the most significant variable that affects HbA1c is body mass index, followed by blood pressure. The following table shows the number of frequencies and percentages for the independent variables that affect the dependent variable HbA1c. Table (1) shows the most significant variables.

Discussion

A study conducted in the Kingdom of Saudi Arabia for adults aims to identify the most common causes (MBI). The Body mass index was the most influential indicator we encountered in the study. Defined the Body Mass Index as levels where the first one was underweight (the lowest thru 18.5) was 25 person with 3.1%, the second was normal weight (between 18.5 and 24.9 BMI) was 218 with 27%, the third level is overweight (30 – 34.9) was 287 person with 35.5%, obesity class1 the BMI was between (30 – 34.9) is 169 with 20.9%, obesity class 2 (35 – 39.9) it was 80 with 9.9%. The last level is obesity class 3, with 29 persons and 3.6%.

Conclusion

This study and most previous studies showed that the most common cause of Type 2 Diabetes is BMI. Although this research has some limitations as most of the study participants were adults in Saudi Arabia, to have a better understanding of the Topic, further study is required.

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Tables & Figures

Table 1: The frequency and percentage of a statistically significant variable.

variable		Frequency	Percent
BMI	Underweight	25	3.10%
	Normal weight	218	27.00%
	Overweight	287	35.50%
	Obesity class 1	169	20.90%
	Obesity class 2	80	9.90%
	Obesity class 3	29	3.60%
blood pressure	low	5	0.60%
	Normal	770	95.30%
	high	33	4.10%
family history	No	319	39.50%
	Yes	489	60.50%

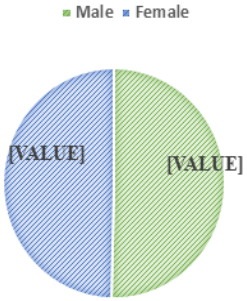

Figure 1: Distribution of study participants based on gender.

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