Relationship between body mass index and health-related physical fitness: a cross-sectional study

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Abstract. – OBJECTIVE: Physical fitness is seen to be a sign of overall health and happiness. The purpose of this study was to investigate the association between female Saudi student's body mass index (BMI) and health-related physical fitness.

SUBJECTS AND METHODS: 48 participants (mean age=19.60 years) were chosen for this cross-sectional study design, and their BMI, health-related physical fitness and physical fitness testing were all analyzed (cardiovascular endurance, muscular endurance, muscular strength, flexibility, and body composition).

RESULTS: The physical activity score (total-MET)-minutes/week was 1,533.88. 18.8% of the participants were underweight, 52.1% were normal weight, 27.1% were overweight, and 2.1% were obese, as per BMI. The correlation between total-MET and other physical parameters revealed a statistically significant negative correlation with muscle strength (ρ=-0.293, *p*=0.043), BMI (ρ=-0.562, *p*=0.0001), waist circumference (ρ=-0.524, *p*=0.0001), and fat mass index (FMI) (ρ=-0.589, *p*=0.0001). The relationship between BMI and physical measurements was positively correlated with waist circumference (ρ=0.877, *p*<0.0001), fat mass index (ρ=0.944, *p*<0.0001), muscular strength (ρ=0.501, *p*<0.0001), and curls per minute (ρ=0.510, *p*<0.0001) in statistically significant ways. When total-MET was compared to BMI, age, waist circumference, fat mass index (FMI), and muscular strength, the regression was statistically significant (F=3.954, *p*=0.005). Age, waist size, activity level, fat mass index, muscular strength, and curls per minute all had a significant connection with BMI (F=106.26, *p*=0.0001).

CONCLUSIONS: Physical exercise may be related to changes in BMI. Physicians and other stakeholders putting forth strategies to increase physical activity and control weight may find the data useful.

Key Words:
Human health, Physical activity, Obesity, Body mass index, BMI, Overweight.

Introduction

Obesity has been recognized as a serious public health problem, and its potential impact on the population's health has not yet been fully understood[1]. It is linked to an increased adult health burden, which includes a number of non-communicable diseases such as type II diabetes, hypertension, dementia, hypertension with lipid problems, and vascular disease[2]. In 70 nations, the prevalence of obesity has more than doubled since 1980[3]. Saudi Arabia (SA) has a greater prevalence of obesity than the rest of the world[4]. Because of this, SA has a higher rate of obesity-related death (116.7 per 100,000 *vs.* 60 per 100,000) and a larger proportion of obesity-related mortality (18% *vs.* 8%) (GBD 2017 Risk Factor Collaborators, 2018)[5]. This data highlights the need for SA to step up its efforts to reduce obesity[6]. The country should focus on tackling overweight and adolescent obesity among its young students for a brighter future[7]. Although college students are less likely to be obese (15-20%), this has a significantly bigger negative influence on quality of life[8,9]. Hence, it seems essential to inform students and families about the underlying factors that contribute to obesity, promote physical activity, improve nutrition, and execute preventive treatments[10].

Obesity is frequently assessed using the body mass index (BMI)[11]. Also, the World Health Organization recommends using it to gauge obesity and overweight. Despite its popularity and practicality, using BMI to assess overweight and obesity has some important drawbacks[12,13]. The same levels of obesity were not mirrored by BMI in adults, according to Nevill and Metsios[13], who also found that younger individuals had higher BMIs than older adults for the same levels of obesity, with variances of up to 4 and 3 BMI units for

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males and females, respectively. Moreover, it is unrelated to how body fat is distributed[14]. Despite having the same BMI as an obese person with a pear-shaped body and little central fat, some obese people have a higher amount of central fat and, as a result, a higher risk of the consequences of obesity[14]. Similar to this, regardless of their health, individuals with a high percentage of muscle mass are classified as overweight[15].

Given the well-known limitations of BMI as a measure of obesity[16], analysis of the physical fitness parameters associated with health in relation to BMI is essential because both physical fitness and BMI are pivotal elements of healthy development[17]. A few of the crucial fitness-related health indicators that are frequently assessed in clinical settings are BMI, body fat percentage, hip and waist circumferences, and maximal oxygen uptake (VO_{2max})[18]. Recent studies[19-21] have closely examined the connection between BMI and physical fitness, but from three different angles. In people who are overweight or obese, there is a first-order negative linear correlation between BMI and fitness[19]. The second viewpoint is that BMI may be a covariate that influences fitness[20]. The third is a quadratic relationship between adolescent BMI and physical fitness[21]. Yet, the majority of research focused on how having a higher BMI influenced physical fitness; underweight or malnutrition were rarely considered to have a lower BMI. Moreover, the degree of obesity in a person is adversely correlated with their level of physical fitness[22]. Hence, compared to the general population, persons who are overweight or obese have lower levels of physical fitness[23]. Many research[24] have discovered a negative correlation between BMI and aspects of physical fitness relevant to health, especially in obese individuals. However, the data contradict each other across age groups and for people with lower BMIs[16,25]. Although there is a strong correlation between BMI and physical fitness for health, the authors of one study[26] on schoolchildren in South Africa found that the effects shifted dramatically with age. In Taibah University in the Northern West of Saudi Arabia, some medical students in their last clinical years were overweight, and the majority were found to be physically inactive[27].

Female Saudi college students have not been studied enough regarding the relationship between BMI and health-related physical fitness. The current study sought to evaluate the relationship between BMI and health-related physical fitness in a sample of female Saudi college students.

Subjects and Methods

Participants and Study Settings

Using a cross-sectional study design, the research was carried out at Princess Nourah bint Abdulrahman University (PNU) , Riyadh, Saudi Arabia. Between February and September 2021, a sample of 19 to 22-year-old female students underwent health-related physical fitness tests. All college students were invited to participate in this study, and 48 students were chosen following screening. The goals and methods used to collect and process the study's data were explained to those who accepted the offer. Privacy was preserved while the data was being collected. Every student who was qualified to take part signed a written informed consent form.

Inclusion Criteria

The eligibility requirements for the study were being a PNU student between the ages of 19 and 22. All eligible students who met the study's eligibility requirements took part.

Exclusion Criteria

Students having recent musculoskeletal injuries as well as persistent medical comorbidities (such as diabetes, hypertension, cardiac conditions, and rheumatologic disorders) were not included.

Anthropometric Measurements

Each participant's height was measured using a Harpenden stadiometer to the nearest hundredth of a centimeter (Holtain Limited, London, UK). The BMI was calculated to the closest tenth of a kilogram. The weights of the participants were assessed while they were wearing casual attire. A retractable cotton tape measure was used to measure the circumferences of the waist and hips to the nearest tenth of a centimeter at the top of the iliac crest and the maximum circumference of the buttocks, respectively.

An acknowledged measurement used all across the world is the BMI, which is stated in kilograms per square meter. Hence, it is calculated by multiplying a person's height in square meters by their mass in kilos[11]. Those who are underweight score less than 18.5 kg/m^2, those who are normal weight score between 18.5-23.9 kg/m^2, those who are overweight score between 24-27.9 kg/m^2, and those who are obese score[25] more than 28 kg/m^2.

Waist circumference (WC) is a straightforward indicator of central fatness and may be more indicative of unfavorable outcomes than total fat, including lipid profile or insulin resistance. The individual is asked to stand while a tape measure is wrapped around their center, just above the hip-bones. It must be snug around the waist without pulling the skin taut. An exhalation is followed by measuring the waist. Three times were used to measure waist circumference.

Body Composition

An In Body Composition Analyzer (Seca Medical Body Composition Analyzer, USA)was used to assess various body composition characteristics. Each of the participant's five fingers came into contact with the surface of the hand electrode, and their forefoot and heels were put on the circular foot electrode. To prevent coming into contact with any other body parts while the measurements were being taken, the participants held out their arms and legs. The measurements took 30 seconds to complete and were taken by professional workers.

Health-Related Physical Fitness Components

Cardiovascular endurance

One protocol used to measure cardiovascular endurance is the Queens College Step Test. A step of 41.3 cm in height was used to administer the Queens College Step exam. Three minutes were spent stepping at the metronome-set pace of 22 cycles per minute. For three minutes, the participants were instructed to step with a "up-up-down-down" tempo. The subjects were instructed to stand up straight after the exercise, and the carotid pulse rate was recorded from the fifth to the twentieth seconds of the recovery time. This 15-second pulse rate was converted into beats per minute and the following equation was used to predict VO2 max for participants. VO2 max (ml/kg/min)=65.81 − (0.1847 × pulse rate in beats per min).

Muscular strength

Push-ups, heavy lifts, and grip strength were among the physical fitness indications that professional testers were trained and equipped to evaluate. Each tester was in charge of one test[28]. By the use of their arm, shoulder, and trunk extensor muscles, participants in the push-up test are assessed on their capacity to stabilize their trunk while performing[29]. Physical strength was measured by counting pushups and performing big lifts with few repetitions.

Using a hand dynamometer with an adjustable grip, the handgrip test – an evaluation of the maximal handgrip strength – was carried out (TKK 5101 Grip D; Takey, Tokyo, Japan). Participants stood with their feet shoulder-width apart, arms lowered, and palms inward. Then they squeezed the dynamometer twice as hard as they could. The maximum score in kilograms for each hand was recorded, and the handgrip span was adjusted based on hand size. From 1,800 to 900, elbow flexion was permitted.[30] The test was repeated after a minimum of three minutes of rest. After putting both hands to the test, the dominant hand was identified. The study's average of the outcomes from the two handgrip tests was analyzed.

Muscular endurance

For a stable core and strong back, abdominal muscles must be strong and resilient. The 1-minute sit-up test evaluates the power and stamina of the hip-flexor and abdominal muscles. By performing sit-ups repeatedly till exhaustion, one can measure the strength of the abdominal muscles (number/min). The individual is instructed to lie on a mat with their knees bent roughly at right angles and their feet flat and unanchored to the ground. Fingers lying on legs and pointing toward knees, the arms are extended forward. In order to get their hands to touch the tops of their knees, the participant then squeezes their stomach and raises their back flat and high. They then go back to where they started. All subjects received a standard explanation and practice period of five minutes.

Flexibility

Participants removed their shoes and sat on a mat with their knees straight and toes naturally spread, putting their heels together. The individual was then told to carefully stretch forward and move the marker as far forward as possible on the scale using the middle finger of both hands. The greatest separation between the two trials was noted[31].

Outcome variable (Total physical activity MET-minutes/week)

- Walking MET-minutes/week=3.3 *walking minutes *walking days
- Moderate MET-minutes/week=4.0 *moderate-intensity activity minutes *moderate days
- Vigorous MET-minutes/week=8.0 *vigorous-intensity activity minutes *vigorous-intensity days

Table I. Distribution of sample size and the percentage of BMI categories determined by percentiles.

Variables	Mean (SD)	Median (IQR)
Total MET-minutes/week	1,533.88 (1,457.32)	1,371.00 (1,770.00)
Age	19.60 (2.10)	19.00 (3.0)
BMI	21.90 (4.05)	21.42 (6.65)
Waist circumference	67.94 (9.21)	66.00 (15)
Activity level	1.32 (0.5)	1.30 (0.00)
Fat mass index	7.37 (2.78)	7.05 (4.50)
VO_{2max}	33.80 (2.48)	33.86 (3.87)
Pulse rate	173.31 (13.41)	173.00 (21.00)
Muscular strength	42.15 (9.64)	39.50 (14.00)
Flexibility test	17.27 (4.31)	17.00 (5.62)
Number of curl per minute	18.73 (5.13)	18.50 (5.00)

METS=Metabolic equivalents; BMI=Body mass index; VO_{2max}=maximal oxygen uptake.

- Total physical activity MET-minutes/week=-sum of Walking + Moderate + Vigorous MET- minutes /week scores.

Considerations of Ethics

The Princess Nourah Bint Abdulrahman University's Ethics Committee granted permission (IRB Log Number: 21-0145) for the cross-sectional study, which was conducted in accordance with the Helsinki Declaration for Human Research.

Statistical Analysis

Software called SPSS (version 26.0) (IBM Corp., Armonk, NY, USA) was used to examine the data. Using descriptive statistics, the quantitative study's outcome variables were characterized (mean, median, interquartile range, and standard deviation). The relationship between I the Total MET scores (physical activity scores)[32] and (ii) body mass index and other physical measurements was quantified using Spearman rank correlation. To determine the independently correlated physical measurements to the outcome variable's total MET and BMI values, multiple linear regression was performed. The total regression model's significance level was evaluated using the F-test. The change in outcome variables described by the independent variables in the model was measured using the R-square value. Also, the significance of the regression coefficients of the independent variables in the model was evaluated using the student's *t*-test for one sample. A *p*-value lower than 0.05 was used to indicate the statistical significance of the results.

Results

General Characteristics

The study included 48 participants, with a mean age of 19.60±2.10 years. Table I presents a descriptive analysis of all the physical traits of research participants. The mean and median total MET-minutes/week values were, however, 1,533.88±1,457.32 and 1,371.

Subsection

There are four categories of BMI (Table II). Most participants were found to have a normal BMI (52.1%), while 27.1% of participants were found to be overweight and 18.8% of the participants were underweight. Only 2.1% were obese (Table II).

Association of Physical Activity and Other Variables

A statistically significant negative connection was found between physical activity scores

Table II. Distribution of sample size and the percentage of BMI categories determined by percentiles.

BMI categories			
Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)
9 (18.8)	25 (52.1)	13 (27.1)	1 (2.1)

BMI=Body mass index.

Table III. Correlation between physical activity score (Total MET-minutes/week) and other physical measurements of study subjects.

Physical measurements	Physical activity score (Total MET-minutes/week)	*p*-value
Age	-0.129	0.382
BMI	-0.562	<0.0001*
Waist circumference	-0.524	<0.0001*
Fat mass Index	-0.589	<0.0001*
VO_{2max}	-0.006	0.970
Pulse rate	0.003	0.982
Muscular strength	-0.293	0.043*
Flexibility test	0.120	0.416
Number of curls per minute	-0.245	0.094
Activity level	-0.053	0.721

*Statistically significant; VO_{2max}=maximal oxygen uptake.

and all other physical parameters, including BMI (ρ=-0.562, $p<0.0001$), waist circumference (ρ=-0.524, $p<0.0001$), fat mass index (FMI) (ρ= -0.589, $p<0.0001$), and muscle strength (ρ=-0.293, $p=0.043$). There is a substantial negative link between the physical activity scores and the values of BMI, waist circumference, FMI, and muscle strength. The link between physical activity scores and age, VO_{2max}, pulse rate, flexibility test, number of curls per minute, and activity level was not determined to be statistically significant (Table III).

Using physical activity score (Total-MET) as the dependent variable and BMI, age, waist circumference, fat mass index, and muscular strength as the independent variables, a multiple regression model was created. The model's significance was demonstrated (F=3.954, $p=0.005$). These 5 independent variables each have significant variations that account for 32% of the change in the physical activity score, according to the R-square value (0.320). Only the fat mass index is independently correlated with physical activity score, according to regression coefficients. The coefficient value of -328.66 for fat mass index indicates that the physical activity score typically drops by -328.66 units for every 1-unit change in fat mass index, which is statistically significant ($t=-2.223$, $p=0.032$). Age, BMI, waist size, and muscular strength are the other four independent factors that are not statistically substantially connected to the physical activity score (Table IV).

Association of BMI with Other Variables

The correlation between BMI and all other physical parameters revealed a strong positive correlation with waist circumference (ρ=0.877, $p<0.0001$), fat mass index (ρ=0.944, $p<0.0001$), muscular strength (ρ=0.501, $p<0.0001$), and number of curls per minute (ρ= 0.510, $p<0.0001$). In other words, there is a substantial positive link between the physical activity scores and the values of BMI, waist circumference, FMI, and muscle strength. Age, degree of activity, VO_{2max}, pulse

Table IV. Relationship between physical activity score (total MET-minutes/week) and other physical measurements of study subjects (using multiple regression analysis).

Variables in the Model	Unstandardized coefficients				95% Confidence interval for B	
	B	Std. Error	*t*-test	*p*-value	Lower bound	Upper bound
(Constant)	2,591.810	1,792.190	1.446	0.156	-1,024.975	6,208.595
BMI	176.787	118.319	1.494	0.143	-61.990	415.565
Age	-42.237	60.382	-0.699	0.488	-164.094	79.620
Waist Circumference	-30.019	28.667	-1.047	0.301	-87.871	27.833
Fat Mass Index	-328.660	147.877	-2.223	0.032*	-627.087	-30.233
Muscular strength	-10.153	15.367	-.661	0.512	-41.165	20.859

*Statistically significant; VO_{2max}=maximal oxygen uptake.

Table V. Correlation between Body Mass Index and other physical measurements of study subjects.

Physical measurements	Body Mass Index	
	Spearman's rho	*p*-value
Age	-0.007	0.961
Waist circumference	0.877	<0.0001*
Activity level	-0.017	0.906
Fat mass Index	0.944	<0.0001*
VO_{2max}	0.023	0.875
Pulse rate	-0.024	0.872
Muscular strength	0.501	<0.0001*
Flexibility test	0.207	0.158
Number of curl per minute	0.510	<0.0001*

*Statistically significant.

rate, and flexibility test do not significantly correlate with BMI (Table V).

Age, waist circumference, activity level, fat mass index, muscular strength, and number of curls per minute were the independent factors in the multiple regression model, with BMI as the dependent variable. The model's significance was demonstrated by the F=106.26, $p<0.0001$ result. With an R-square of 0.940, it is highly statistically significant that these 6 independent factors account for 94% of the change in BMI. Only three factors – waist circumference, fat mass index, and number of curls per minute – are statistically substantially independently associated with BMI, according to the regression coefficients of these six independent variables. The coefficient value of 0.104 for waist circumference indicates that the BMI values typically increase by 0.104 units for every unit change in waist circumference, which is significant (t=3.272, p=0.002). The coefficient value of 0.087 for the number of curls per minute shows that for every 1-unit change in the number of curls per minute, the BMI values on average change by 0.087 units, which is significant (t=2.210, p=0.033), while the coefficient value of 0.994 for fat mass index indicates that for every 1-unit change in fat mass index value, the BMI values on average change by 0.994 units, which is significant (t=9.312, p=0.0001). Age, exercise level, and muscle strength are the other 3 independent factors that are not statistically substantially connected to BMI values (Table VI).

Discussion

The aim of physical fitness is to inspire students to take part in physical activities, develop consistent exercise habits, and enhance their physical and mental well-being. The goal of the current study was to determine whether there is a relationship between BMI and physical fitness among

Table VI. Relationship between body mass index values and other physical measurements of study subjects (using multiple regression analysis).

Variables in the Model	Unstandardized coefficients				95% Confidence interval for B	
	B	Std. Error	*t*-test	*p*-value	Lower bound	Upper bound
(Constant)	6.246	5.142	1.215	.231	-4.139	16.631
BMI	-0.035	0.076	-0.466	0.644	-0.188	0.118
Age	0.104	.032	3.272	0.002*	0.040	0.169
Waist Circumference	-0.677	3.635	-0.186	0.853	-8.017	6.664
Fat Mass Index	0.994	0.107	9.312	<0.001*	0.778	1.209
Muscular strength	0.029	0.019	1.516	0.137	-0.010	0.067
Number of curl per minute	0.087	0.039	2.210	0.033*	0.007	0.166

*Statistically significant.

female Saudi college students. For routine clinical and public health reasons, the BMI is a reliable indicator of adiposity in children and adolescents. The discrepancies between studies, between nations, and different times should also be kept in mind while analyzing different data; interpretation should be done with caution when comparing BMI levels across different age groups[26,31,32].

The individuals in the current study had BMI levels that were mostly normal (18.5-23.9 kg/m^2) and were highly focused. Several students (27.1%), including those who were obese (2.1%), had bad eating patterns or lifestyles that affected the way their bodies looked. The prevalence of obesity increased from 1.6% to 2.8% in women and from 5.2% to 6.7% in men, according to other studies[25]. A study[25] on the prevalence of obesity among Chinese university students found that 2.8% of female students and 8.4% of male students were obese. According to a study conducted on Saudi children and teenagers[33], 18.4% of the male and 14.2% of the female participants were found to be obese, while 12% of the male and 18.4% of the female participants were found to be overweight. In comparison to earlier research and the findings of the current study, which found a prevalence of obesity of just 2.1%, this percentage of obesity is relatively high. According to a study by Khanam and George[34], 38.66% of the Saudi female respondents were overweight or obese. Another study by Rasheed et al[35] (1994) indicated that among Saudi female medical and nursing students, the prevalence rate of overweight and obesity by body mass index was 30.6%. These percentages are greater than the results of the current study, where overweight and obesity predominately affect roughly 29.2% of all individuals.

Regardless of the estimating method, the prevalence of obesity in these young Saudi women was particularly high, which validates past studies' results that female obesity is a major problem in this area. The importance of preventive programs for weight management and a healthy lifestyle among Saudi females should start in their early 20s if not earlier[36]. Although the majority of study participants had normal BMIs, many of them were overweight, which could eventually cause problems with inactivity and obesity. Genetics still have a substantial impact on obesity, even if environmental and lifestyle factors, including physical exercise and eating habits, are equally important[37]. An abrupt change in dietary and activity habits may be the cause of this increase. Except for dates, which are a typical Saudi Arabian lunch, most students only eat fruit and vegetables twice per week on average. Furthermore, approximately half of students eat prepared meals at least three times per week. These customs must be changed to support a healthy diet in SA[38].

With a mean BMI of 21.90 kg/m^2, the mean MET min/week in the current study was 1,533.88 minutes, translating to 25.55 hours/week and showing a moderate level of activity. In contrast, Tiusanen and Saltychev's research[39] found high levels of activity in participants with BMIs of less than 25 kg/m^2 and 30-35 MET-hours/week. Also, the correlation between physical activity scores and all other physical parameters, including BMI, waist circumference, FMI, and muscle strength, is extremely statistically significant (p= 0.0001). A rise in weight that ultimately results in an increase in waist size may be the cause of this observation. This could be attributed to the quantitative role of fat mass, which works as an inert load, restricting physical activity and movement[40]. Another important element is the body fat percentage. Healthier people have an ideal body fat percentage.

The current study indicated that across all age groups, study participants had a higher mean fat index than the general population. Over aging, body fat percentage increased. As would be expected, there is a strong positive association between BMI and body fat %. The results are in line with past studies[41].

In this study, it was discovered that there is a substantial correlation between factors affecting body fat level and physical activity. The physical activity score decreases by an average of -328.66 units for every unit change in the fat mass index, according to the fat mass index coefficient value of -328.66. These associations have been found to be similar or stronger than in this study in previous studies[42,43]. Variations in the peoples' body types and degrees of physical fitness may be the cause of this. Previous research participants were healthy and fit, and they might have had more muscle mass and less fat mass than the participants in this study, who had a wide range of body compositions and degrees of physical fitness. In the present study, the multiple regression model demonstrated inverse and non-significant associations between muscular strength and BMI. In fact, these findings may contribute to the understanding of why overweight and obese persons do poorly in dynamic muscle fitness testing, such as the muscular endurance tests employed in this study, when compared to their own body weight.

While lighter people may score poorly in tests that measure force created by an external force, they may perform better in tests of dynamic muscle strength[44]. Contrarily, the relationship between BMI and flexibility, as measured by the sit-and-reach test, revealed consistency in non-significant results across studies[45-47] and was in line with research by Deforche et al[48] (2003), which showed there was no difference in hamstring and lower back flexibility between obese and non-obese adults. In contrast, university students and teenagers had a significant association between BMI and lower back and hamstring muscle flexibility[26,49]. The reasons for this disparity should be further investigated. Some of these explanations include gender and maturational state inequalities. Additionally, the relationship between within-person BMI and flexibility scores was typically inverse, regardless of gender. As a result, a person's body mass does not significantly affect their flexibility.

The study's findings point to the necessity for a preventative program to address the issues of obesity and eating disorders among female Saudi students. These programs must be based on food education and the inclusion of physical education sessions in the school curriculum. A multi-country study on female student growth and maturation, with longitudinal and cross-sectional components, should be prioritized in order to create relevant reference data. Such data are required to determine not only cut-off thresholds, but also rates of too-low or too-high values that should prompt action at the programmed or individual level. Therefore, research into the origin, treatment, and prevention of obesity in young female students should be prioritized.

Conclusions

In order to investigate the relationship between weight status, BMI, and physical fitness, this study examined their prevalence and trends. The study found that there was a significant association between female students' BMI and health-related physical fitness variables (waist circumference, fat mass index, and No. of curl per minute). This demonstrates that the earlier an intervention is implemented, the more beneficial it will be. It will take more prospective, long-term cohort studies to fully comprehend the causal linkages and pertinent mechanisms.

Conflict of Interest

The authors declare that they have no conflict of interests.

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Ethics Approval

The study was approved by the Institutional Review Board (or Ethics Committee) of Princess Nourah bin Abdulrahman University, Riyadh, KSA (IRB Log Number: 21-0145).

Informed Consent

Written informed consent was obtained from all participants. All participants were informed about the study, the anonymity of data, and the possibility to withdraw at any point.

Availability of Data and Materials

The data presented in this study are available on request from the corresponding author.

Authors' Contributions

Conceptualization: Zahra A. Alsharif; Data curation: Zahra A. Alsharif, Rahaf E. Alsubaei, Sahab A. Alrowaished; Formal analysis: Kholood M. Shalabi; Methodology: Zahra A. Alsharif, Rahaf E. Alsubaei, Sahab A. Alrowaished; Project administration: Kholood M. Shalabi; Supervision: Kholood M. Shalabi; Writing – original draft: Kholood M. Shalabi; Writing – review and editing: Kholood M. Shalabi, Zahra A. Alsharif, Rahaf E. Alsubaei, Sahab A. Alrowaished.

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