A CORRELATION BETWEEN BODY MASS INDEX AND HANDGRIP STRENGTH AMONG MEDICAL STUDENTS AT NORTHERN BORDER UNIVERSITY

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Abstract

Objective: To study the correlation between body mass index (BMI) and hand grip strength (HGS) among undergraduate medical students.at Northern Border University. Saudi Arabia.

Material and methods: A cross-sectional study was utilized, a handheld dynamometer was used to measure the dominant hand's HGS, and body mass index (BMI) was determined: BMI =Weight in kilograms/(Height in meters)^2. Pearson's correlation test was used to perform the correlation analysis, and student t-test and ANOVA were used for the association of the quantitative variable.

Results: A total of 198 medical students of both sexes (98 males, 99 females) were included, their mean age 21.9±1.8. Among the male group, HGS and BMI have a very weak positive correlation (P-value >0.05), whereas among the females there is a very slight negative correlation (P-value >0.05). Male participants showed significantly higher HGS than females((P-value<0.001).

Conclusion: Among the studied participants, HGS and BMI had a very weak positive correlation in the male group and a very weak negative correlation in the female group. HGS was noticeably higher in male participants than in female participants.

Keywords: Hand grip strength, Body Mass Index, Correlation, Medical student, Saudi Arabia

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Introduction

A popular metric for classifying people into various weight classes (underweight, normal, overweight, obese) based on their weight-to-height ratio is BMI .(Dhananjaya et al., 2017) Previous research has indicated that BMI accounts for fat and lean mass which is essential for muscle power and may be related to muscle strength. (Hasan et al., 2016)

BMI is also utilized as an indicator not only for obesity but also for lean mass in population-based research. Earlier research proposed there might be a positive correlation between BMI with HGS. with a growing interest in its association with muscle strength and overall physical fitness. Previous studies have suggested that BMI may correlate with muscle strength

HGS is a broad word that describes the force and power produced by the muscles of the forearm, signifying the greatest level of tension or force that may be created.(VAIDYA and NARIYA, 2021) it can be affected by several factors such as age and BMI.(Zaccagni et al., 2020)

Low HGS is associated with a variety of metabolic and behavioral variables, including reduced metabolism, nutritional and hormonal abnormalities, and physical inactivity. (Ajay and Vatsala, 2024) HGS is an essential quantitative metric for assessing a person's muscle strength. It is affected by Age, sex, BMI, and other factors like obesity. (Salim, 2023, Ajay and Vatsala, 2024)

HGS is a trustworthy measure of overall muscular strength, and healthy people are expected to have stronger grips. (Wind et al., 2010)

Greater muscle mass may result from higher BMI readings (Pierce et al., 2017). These lead to increased HGS which is possibly linked with enhanced physical activity (Legrand et al., 2013, Roberts et al., 2011).

Males have stronger HGS than females, and there is a positive correlation between BMI and HGS, according to a study among undergraduate medical students in Nepal.(Shrestha et al., 2020) Research among medical students in Iraq showed that males had significantly (P <0.001) HGS than females.(Al-Asadi, 2018) among young people, elevated BMI is associated with low HGS and high blood pressure indices. (Salim, 2023).

HGS is a crucial metric for evaluating nutritional status and an indicator of muscle quality. (Lad et al., 2013) According to a Pakistani study, there was a statistically significant negative correlation between HGS and BMI for the dominant hand.(Gulzar et al., 2022).

A study conducted in Nepal showed that among medical students there is a significant positive correlation between normal BMI and HGS (Rai and Makaju, 2022) .

According to Indian research on teenagers. Height, weight, and HGS among normal participants were positively correlated (Gupta et al., 2017) A study of young adults (18–21 years old) in India found an insignificant correlation between BMI and HGS.(BhattacharJya and GoSwami, 2022).

Research in Lahore, Pakistan for the association of BMI and HGS discovered no significant correlation between BMI and HGS for either the dominant or non-dominant hands among university students.(Khan et al., 2024).

The current research aimed to study the correlation between BMI and HGS among undergraduate medical students.

Material and methods

Study setting and design: From February 1 to May 31, 2024, a cross-sectional study was conducted at the College of Medicine, Northern Border University. Saudi Arabia.

Study tools: Data was collected utilizing a predesigned structured questionnaire revised by staff members of the family and community medicine department. Socio-demographic information, lifestyle and food habits, weight, height, and the HGS the dominant hand were all included in the questionnaire. Every participant received assurances that the data collected would be kept private. The study excluded participants having a history of musculoskeletal disorders, systemic illnesses, and hand deformities.

Participants stood barefoot and looked straight. A stadiometer that was fixed to the wall was used to measure height. The measurement was made in centimeters and converted to meters, while their weight was measured using a digital platform weighing scale and expressed in kg.

Using the following formula, BMI was determined: BMI = Weight in kilograms/ (Height in meters)2 and classified based on the Asian population's BMI cutoff values as established by the World Health Organization as follows.

Underweight <18.5 kg/m2, Normal weight 18.5–23.0 kg/m2 , Overweight >23–27.5 kg/m2, and Obese >27.5 kg/m2 ..(Tan, 2004)

A handheld dynamometer was used to measure the HGS of the dominant hand. The respondents were told to press the dynamometer handle as hard as they could while keeping their dominant hand on the table and their elbow angle at 90 degrees. The greatest voluntary contraction maintained for at least three seconds was used to calculate the HGS, which was expressed in kilos. Each participant received verbal instructions and a test demonstration before the test. The best result was selected for analysis after three readings were taken with 10- to 20-second breaks.

HGS ≥ 35 kg was regarded as normal in males, whereas HGS less than 35 kg

was regarded as lessened HGS ≥19 kg was regarded as normal in females, while HGS less than 19 kg was regarded as diminished. (Walankar et al., 2016)

Sample size and sampling methods: A total of 198 medical students of both sexes (98 males, 99 females) the participants were selected randomly using a stratified random method

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Statistical Analysis:

Data was analyzed using the SPSS software program version 16. The categorical variables are displayed as frequency and percentage. The continuous variables are mean± SD. Pearson's correlation test was used to perform the correlation analysis, and student t-test and ANOVA were used for the association of the quantitative variable. P-value was considered significant at≤ 0.05.

Inclusion criteria: The medical students from 1st year to 6th year, those who are healthy, and willing to participate.

Exclusion criteria: The students who have congenital anomalies and a history of previous trauma or disease affecting the hand.

Ethical clearance: The study received approval from the local bioethical committee (HAP-09-A-043) Northern Border University with a decision no (21/24/H) during the 4th meeting dated on19-02-2024.

Results

Table 1 displays the socio-demographics of the participants. 197 students with a mean age of 21.9±1.8 (18–25) and a nearly equal distribution of males and females participated in the study. Approximately 60% of those involved were in their clinical years, the majority of the respondents lived with their families (86.3%), and a small percentage were smokers (14.7%).

Table 2 shows the lifestyle of the studied students. The majority of participants (80.3%) engaged in physical activity, primarily walking (50.7%); more than a quarter (28.3%) did so three times per week; and less than 30% did so for 15 to 30 minutes each day. Most students consume junk food (87.8%), little than one-third more than three times each week, and slightly less than half (48.3%) get less than eight hours of sleep each day.

Table 3 illustrates the distribution of HGS among the respondents by gender. Male participants showed significantly higher HGS (38.9±8.2), than females (19.3±4.9) (P-value<0.001).

Table 4 displays the association between HGS and BMI by gender. Although the differences are not statistically significant, males who are overweight and obese have stronger HGS than those who are underweight or normal. On the other hand, among the studied female participants, there is an insignificant increase in HGS among normal and overweight compared to underweight and obese.

Table 5 shows the correlation between BMI and HGS strength among the studied respondents. Among the male group, HGS and BMI have a very weak positive correlation (P-value >0.05), whereas among the females there is a very slight negative correlation (P-value >0.05)

Table 1. Sociodemographic characteristics of the participants.

Items	No	%
Age	Mean ±SD=21.9±1.8	
Sex		
Male	98	49.7
Female	99	50.3
Academic grade		
1st	18	9.1
2nd	34	17.3
3rd	22	11.2
4th	26	13.2
5th	33	16.8
6th	64	32.5
Living status		
University hostel	4	2
Outside	23	11.7
With family	170	86.3
Smoking habits		
Yes	29	14.7
No	166	84.3
Ex-smoker	2	1.0
BMI		
Underweight	27	13.7
Normal	102	51.8
Overweight	42	21.3

BMI = Body mass index

Table 2. Lifestyle and food habits of the participants.

Items	No	%
Do you practice physical activity?		
Yes	159	80.7
No	38	19.3
The type of physical activity *		
Walking	80	50.3
Gym	44	27.7
Football	24	15.1
Other sports	11	6.9
How many times weekly do you engage in physical activity?		
Once	43	27
Twice	41	25.8
Three times	45	28.3
More than three times	30	18.9
Time spent during each physical activity		
less than 15 minutes	21	13.2
15-30 minutes	46	28.9
30-45 minutes	33	20.8
45-60 minutes	33	20.8
more than one hour	26	16.4
Do you eat junk food?		
YES	173	87.8
NO	15	7.6
Sometimes	9	4.6
If yes how many times per week#		
Daily	22	12.7
Twice	63	36.4
Three times	33	19.1
More than Three times	55	31.8
Sleep duration per day		
4 or less	10	5.1
5	15	7.6
6	33	16.8
7	37	18.8
8	65	33
9	19	9.6
10	14	7.1
12	4	2.0

*no =159 # no=173

Table 3. Distribution of HGS by gender among the studied participants.

Items	Males(n=98)	Females(n=99)	P-value
HGS	39.3±9.6	20.47±9.6	<0.001

Discussion

Regarding the correlation between HGS and BMI the study findings show that, among males, there is a non-significant weak positive correlation whereas; among females, there is a very weak non-significant negative correlation. Similarly, a study conducted among Indian medical students showed that HGS did not show a significant difference between the three (normal, underweight, and overweight) groups in both males and females (P-value >0.05). (Ajay and Vatsala, 2024) in the same country, among young individuals (18–21 years old), there is no discernible relationship between BMI and HGS (BhattacharJya and

Table 4. The association between HGS and BMI index by gender.

Item	Underweight	Normal	Overweight	Obese	P-Value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
HGS among males	36.3±6.2	38.2±7.4	41.8±8.9	39.2±9.2	0.2
HGS among females	18.8±3.7	19.4±5	19.2±5.8	18.8±5.2	0.9

Table 5. Correlation between BMI and HGS among the studied participants.

BMI and HGS	R	P-value
Males (no= 98)	0.14	0.1
Females (no= 98)	-0.004	0.9

GoSwami, 2022)

There was no clear connection between BMI and HGS for either the dominant or non-dominant hands among university students, according to a study conducted in Lahore, Pakistan.(Khan et al., 2024), other studies (Hardy et al., 2013, Krakauer and Krakauer, 2020) demonstrated a positive correlation between BMI and HGS.

Research in Australia observed that BMI and HGS were weakly related in adults below 30 and above 70 years.(Massy-Westropp et al., 2011)On the other hand research among adult males aged 20–74 years in Saudi Arabia found that BMI significantly correlated with HGS.(Alahmari et al., 2017). According to a study done in Nepal, there is a significant positive correlation between normal BMI and HGS among medical students.(Rai and Makaju, 2022).

Several studies conducted in India among medical students revealed a statistically significant negative correlation between BMI and HGS ($r = -0.513$; $P < 0.01$) (Salim, 2023), and a significant positive correlation was seen between female BMI and HGS (P= 0.0257; r= 0.06260), and a negative correlation was seen between male BMI and HGS (p= <0.001 and r = -0.2226).(Moirangmayum et al., 2024)

A study among Taiwanese university students revealed a strong positive correlation between HGS and BMI (P-value<0.01), and sex was the most significant factor affecting HGS. (Liao, 2016) A research among Ghanaian university students revealed a significant correlation between HGS and BMI ($r = 0.290$; $p < 0.01$).(Agtuahene et al., 2023).

According to an Indian study, there is a negative correlation between BMI and HGS for male participants with normal BMI and a weakly negative correlation for male participants with obesity. However, there is no correlation between HGS and BMI for normal and obese female participants, and there is a weak negative correlation for overweight.(Dhananjaya et al., 2017).

Conclusion

Among the male group, HGS and BMI have a very weak positive correlation. whereas among the females there is a very slight negative correlation. Even though the differences are not statistically significant, males who are overweight and obese have stronger HGS than those who are underweight or normal. On the other hand, among the studied female participants, there is an insignificant increase in HGS among normal and overweight compared to underweight and obese.

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