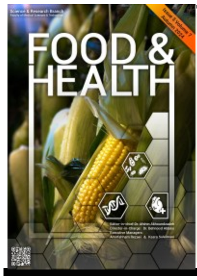
Food & Health 2024, 7(3): 1-7



Food & Health

Journal homepage: sanad.iau.ir/journal/fh

Journal

The Relationship between Mental Health Indicators and Anthropometric Profile among non-Iranian Students of the Science and Research Branch of Islamic Azad University

Elnaz Zirak Sharkesh[1], Mahsa Aghaei[1], Paniz Ahmadi[1], Niloofar Bayat[1], Mahdieh Roshan[1], Haniyeh Memarian[1], Mojtaba Abdipoor[1], Amirfaham Rezaee[1], Samira Movahed[1], Mohammad Mahdi Hajinasab[1], Behnood Abbasi[*1]

[1] Department of Nutrition, Electronic Health and Statistics Surveillance Research Center, Science and Research Branch, Islamic Azad University, Tehran, Iran.

A R T I C L E   I N F O

Original Article

Article history:
Received 18 October 2024
Revised 08 November 2024
Accepted 01 December 2024
Available online 20 December 2024

Keywords:
Anthropometry
Body Mass Index
Mental Disorder
Mental Health
Obesity

A B S T R A C T

Obesity is a major health issue, affecting over one billion people globally which leads to various health conditions and mental health disorders such as depression and anxiety. Mental disorders also affect a significant portion of the global population impacting social relationships. This study aimed to investigate the relationship between anthropometric measurements and mental health indicators of non-Iranian Students of the Science and Research Branch of Islamic Azad University. This cross-sectional study was conducted on 689 non-Iranian students. The participants underwent assessments for mental health using the GHQ questionnaire, anthropometric measurements using a body analyzer, and the level of their physical activity using the SF-IPAQ questionnaire. Data analysis was done by SPSS software including different statistical tests and correlation analysis. Also, a P-value of < 0.05 was considered significant. Based on the results, a correlation between mental health indicators and anthropometric and body composition variables was observed. BMI was positively related to anxiety/insomnia status in the men ($r = 0.01$, $p = 0.03$). General health score was negatively linked to SMM ($r = -0.12$, $\rho = 0.002$), SLM ($r = -0.11$, $\rho = 0.002$), TBW ($r = -0.11$, $\rho = 0.003$) and protein ($r = -0.11$, $\rho = 0.002$). Conversely, PBF was positively correlated with impaired general health ($r = 0.08$, $\rho = 0.03$) and social function status ($r = 0.07$, $\rho = 0.04$). The analysis of this data indicated that individuals with abnormal anthropometric measures may be at a higher risk of certain mental health issues. This finding may warrant greater attention from, health policymakers regarding the potential need for increasing mental health service tariffs and health insurance coverage for certain individuals.

1. Introduction

Obesity is defined as an uncontrolled accumulation of fat that may harm a person's health (1). Literally, the number of people affected by obesity in general is increasing rapidly. Based on the World Health Organization (WHO) report, more than one billion people worldwide are obese, 650 of whom are adults. Global estimates also show that over 4 billion people may be affected by obesity by 2035, up from more than 2.6 billion in 2020. In addition, the economic impact of obesity is projected to increase from US$1.96 trillion in 2020 to over US$4 trillion by 2035 (1, 2). Moreover, there are many obesity-related conditions including type 2 diabetes, non-alcoholic fatty liver disease, cardiovascular disease, certain forms of cancer, and mental disorders such as depression and anxiety which have made obesity a global major health problem (3, 4).

Mental disorders are marked by clinical impairment in emotion and behavior which correlated with distress and dis-functioning. These disorders have different types, the most common of which are depression and anxiety (5). As stated in the global statistics recorded in 2019, one out of every eight people was suffering from mental disorders. Also, surveys conducted in the same year showed a prevalence of 3.8% of anxiety disorders and 3.4% of depression disorders worldwide (6). These complications have a negative impact on people's social relationships and their daily work efficiency. In fact, there is a relationship between mental health and the behavior

* Corresponding author: Department of Nutrition, Electronic Health and Statistics Surveillance Research Center, Science and Research Branch, Islamic Azad University, Tehran, Iran.

E-mail address: abbasi.b@srbiau.ac.ir (Behnood Abbasi).

of people in society (7). For instance, in a study conducted by Lerner.D., et al. on a group of employees with depression, their efficiency and daily productivity were reduced by their depression (8).

Investigating the relationship between mind and body shows that anxiety and depression might be related to complications such as obesity, irritable bowel syndrome (IBS), excessive sweating, difficulty sleeping, nausea, vomiting, and psychosomatic symptoms (9-11). Psychosomatic disorders are mental disorders that lead to physical demonstration. This condition occurs through the activation of dysfunctional neural circuits and biochemical responses. Among these clinical symptoms, muscular pain, tension-type headache, and high blood pressure can be mentioned (12).

According to Mossavi and colleagues in 2020, obesity and mental health disorders were significantly correlated. Various mechanisms indicate the relationship between depression and obesity at different biological and environmental levels. In addition, with the increase of inflammatory biomarkers and disruption of the hypothalamic-pituitary-adrenal axis, obesity will lead to oxidative stress and loss in neuron function, which may probably increase the risk of depression.

Other theories describe psychological mechanisms. Obese people may experience lower social support, which may increase the risk of anxiety disorders. Meanwhile, failed effort and periodic weight reduction may cause overeating, weight gain, and feelings of despair (13, 14).

The aim of this study was to evaluate and report the findings related to the mental health of referring non-Iranian students, as well as to explore the correlation between their anthropometric measurements and mental health scores. If this relationship is proven, the outcomes can be used to allocate additional health insurance resources to subjects with obesity. Moreover, if a connection between anthropometric measurements and mental health existed, health policymakers should significantly prioritize mental health considerations.

2. Methods

2.1. Study design

This cross-sectional study was conducted based on the Strobe checklist (15). A convenient sampling method was used to recruit 689 participants in this study. The contributors were picked among non-Iranian participants who visited the Health and Surveillance Center located in the Science and Research branch of Islamic Azad University, during February 2023 and January 2024.

Written consent was also obtained from all subjects. All referring students were included in the study, however, pregnant and lactating women and those with metal prostheses were excluded from further analysis regarding the non-accurate result. In addition, the enrolled participants were assessed in terms of mental health, anthropometric measurements, and physical activity level. Body analysis was performed for each by trained nutrition experts.

2.2. General Characteristic information

Information such as sex, education, job, marital status, smoking status, and alcohol consumption was asked by a trained questioner.

2.3. Anthropometric measurements

Body weight (kg), height (cm) and body mass index (BMI (kg/m2) were measured using a body analyzer device, with Inbody brand name and BSM37 model, barefooted in minimal clothing to the nearest 100g. The mid-arm circumference was measured at the midpoint of the distance between the tip of the shoulder bone and the tip of the elbow with light clothing, using a non-elastic measuring tape (SECA) with an accuracy of 0.1 cm. Also, waist circumference (WC) was measured midway between the lowest rib and the iliac crest in a standing position after a normal exhalation. Hip circumference was measured around the widest part of the hip with the same tape. All measurements were performed according to WHO standard protocols (16). Body composition measures were calculated with the use of X-Scan plus 970 which included visceral fat level, body fat percentage, fat mass, fat-free mass, body protein, body minerals, and total body water due to the device's standard protocol such as standing with minimal clothing, empty stomach, empty bladder, and removed shoes without sudden movement in stable condition during measurement.

2.4. Physical activity

Overall, the 689 responders, completed the short form of the International Physical Activity Questionnaire (SF-IPAQ) (17) which is reliable and valid to measure total physical activity (18). Participants reported their physical activity during the last seven days. Based on this information, coefficients were used to calculate MET, metabolic equivalent (minutes per week), to classify individuals into appropriate groups. Thus, three categories of MET level range were obtained: less than 600 = non-active, 600-3000 = active, and higher than 3000 = very active.

2.5. Mental health status

The mental health status of participants was assessed using GHQ (general health questionnaire) and its validity and reliability were reported previously (19). This questionnaire had 28 items and consisted of four subscales: somatic symptoms, anxiety and insomnia, social dysfunctions, and severe depression. Each item contained four answers that could score in several ways; a traditional scoring method that was used in this study includes a four-point scale between never=0 to much worse than usual=3;(0-1-2-3). According to this scoring, the mental health of individuals is categorized into four levels: 0-21=healthy, 22-42=mild, 43-63=moderate, 64-84=severe.

2.6. Statistical analysis

The SPSS version 24.0 software was utilized for analysis. For investigating the normal distribution data Kolmogorov–Smirnov test was used, in case of nonparametric distribution of the data, the corresponding non-parametric test was used. Continuous variables are expressed as means ± standard deviation and compared by using an independent-sample t-test and categorical variables were expressed as frequency and percentage [Frequency (%)]. Mann Whitney U test was used for comparing the mean and standard deviation (mean±SD) of non-parametric variables. Whereas the chi-square test was used for qualitative variables. For investigating the relationship between anthropometric variables and health score Spearman's rank correlation test was used. A P-value of < 0.05 was considered significant.

3. Results

The sociodemographic and lifestyle characteristics of participants are described in Table 1. Out of a total of 679 people (477 men and 202 women), the mean age of the participants in the groups was 36.45±7.22 for men and 35.67±8.14 for women, respectively. In the studied population, the frequency of married or smoker subjects was higher. Also, they reported a higher history of disease and educational status than women (ρ <0.05). On the contrary, women had a higher history of surgery (ρ <0.05).

Table 1. Sociodemographic and lifestyle characteristics of participants, overall and stratified by gender.

	Men (n=477)	Women (n=202)	Total (n=679)	p-value*
Age, year, mean (SD)	36.45±7.22	35.67±8.14	36.22±7.54	0.06
Marital status, n (%)				
• Single	115 (24.1%)	85 (42.1%)	200 (29.5%)	<0.001
• Married	362 (75.9%)	116 (57.4%)	478 (70.4%)	
• Others	-	1 (0.5%)	1 (0.1%)	
Education level, n (%)				
• BC	1 (0.2%)	4 (2%)	5 (0.7%)	0.02
• MS	473 (99.2%)	198 (98%)	671 (98.8%)	
• PHD	3 (0.6%)	-	3 (0.4%)	
Employment status, n (%)				
• Employed	460 (96.4%)	192 (95%)	652 (96%)	0.39
• Unemployed	17 (3.6%)	10 (5%)	27 (4%)	
Physical activity level, METs- min/d, n (%)				
• Active	133 (27.9%)	40 (19.8%)	173 (25.5%)	0.05
• Moderate	48 (10.1%)	28 (13.9%)	76 (11.2%)	
• Non-active	283 (59.3%)	128 (63.4%)	411 (60.5%)	
• Missing	13 (2.7%)	6(3%)	19 (2.8%)	
Smoking status, n (%)				
• Yes	158 (33.1%)	9 (4.5%)	167 (24.6%)	<0.001
• No	319 (66.9%)	192 (95%)	511 (75.3%)	
• No Response	-	1(0.5%)	1(0.1%)	
Alcohol consumption status, n (%)				
• Yes	6(1.3%)	1 (0.5%)	7(1%)	0.20
• No	471(98.7%)	200 (99%)	671 (98.8%)	
• No Response	-	1(0.5%)	1(0.1%)	
History of disease status, n (%)				
• Yes	28 (5.9%)	24 (11.9%)	52 (7.7%)	0.007
• No	449 (94.1%)	178 (88.1%)	627 (92.3%)	
History of surgery status, n (%)				
• Yes	72 (15.1%)	76(37.6%)	148 (21.8%)	<0.001
• No	405 (84.9%)	126(62.4%)	531 (78.2%)	
Food allergy status, n (%)				
• Yes	8 (1.7%)	4(2%)	12 (1.8%)	0.78
• No	469 (98.3%)	198 (98%)	667 (98.2%)	
Drug allergy status, n (%)				
• Yes	19 (4%)	8 (4%)	27 (4%)	0.98
• No	458 (96%)	194 (96%)	652 (96%)	

Abbreviations: MET: metabolic equivalent
Continuous variables were described as mean ± standard deviation and categorical variables were described as frequency (percentage).
Continuous variables were evaluated by Independent Sample t-test and Mann-Whitney U test. Categorical variables were evaluated by the Chi-square test.
*ρ <0.05 represents a significant difference.

Body composition and anthropometric measurements of the participants are shown in Table 2. These indices include weight, height, mid-arm circumference (MAC), waist circumference (WC), waist-hip ratio (WHR), skeletal muscle mass (SMM), soft lean mass (SLM), total body water (TBW), protein and minerals which were lower in women compared to men, while women's body fat percentage (PBF) was higher than men (ρ<0.05).

The mean weight, height, mid-arm circumference (MAC), waist circumference (WC), waist-hip ratio (WHR), skeletal muscle mass (SMM), soft lean mass (SLM), total body water (TBW), protein, and mineral were 80.47±14.39, 171.48±8.89, 27.31±4.45, 31.95±3.58, 95.16±11.47, 1.01±2.91, 28.20±6.92, 31.33±5.48, 52.28±9.08, 40.87±7.10, 11.36±2.07, 4.55±.80 among women and men, respectively (ρ<0.05).

Table 2. Anthropometric and body composition characteristics of participants, overall and stratified by gender.

	Men (n=477)	Women (n=202)	Total (n=679)	p-value*
Body weight (Kg), mean (SD)	83.75±13.32	72.74±13.88	80.47±14.39	<.001
Body height (cm), mean (SD)	175.72±5.86	161.48±6.50	171.48±8.89	<.001
BMI (Kg/m2), mean (SD)	27.06±4.09	27.91±5.18	27.31±4.45	.13
MAC (cm), mean (SD)	32.12±3.48	31.57±3.80	31.95±3.58	.04
WC (cm), mean (SD)	97.42±10.68	89.79±11.51	95.16±11.47	<.001a
WHR, mean (SD)	1.08±3.47	0.83±.08	1.01±2.91	<.001
PBF (%), mean (SD)	25.63±5.61	34.41±5.76	28.20±6.92	<.001a
SMM (Kg), mean (SD)	33.77±4.15	25.45±3.44	31.33±5.48	<.001
SLM (Kg), mean (SD)	56.33±6.85	42.50±5.74	52.28±9.08	<.001
TBW (Kg), mean (SD)	43.96±5.46	33.42±4.65	40.87±7.10	<.001
Protein (Kg), mean (SD)	12.35±1.48	8.97±1.13	11.36±2.07	<.001

Mineral (Kg), mean (SD)	4.74±0.73	4.07±0.75	4.55±.80	<.001

Abbreviations: BMI: Body mass index, MAC: Mid-arm circumference, WC: Waist circumference, WHR: Waist-hip ratio, PBF: Percentage body fat, SMM: Skeletal muscle mass, SLM: Soft lean mass, TBW: Total body water.
Variables were described as mean ± standard deviation.
Continuous variables were evaluated by a Independent sample t-test and Mann-Whitney U test.
*ρ <0.05 represents a significant difference.

The data in Table 3 provides an overview of mental health status. General health status, somatic symptoms, and anxiety/insomnia symptoms were significantly different between men and women (ρ <0.05).

95.7% of enrolled participants were considered healthy, women are more anxious than men; while the rate of depression was higher in males. Severe psychosomatic wasn't seen in this group.

Table 3. General health and 4 subscales state of participants, overall and stratified by gender.

	Men (n=477)	Women (n=202)	Total (n=679)	p-value*
General health status, n (%)				
• Normal	464(97.3%)	186(92.1%)	650(95.7%)	
• Mild	7(1.5%)	15(7.4%)	22(3.2%)	
• Moderate	2(0.4%)	-	2(0.3%)	
• Severe	-	-	-	<0.001
• Missing	4(0.8%)	1(0.5%)	5(0.7%)	
Somatic status, n (%)				
• Normal	471(98.7%)	197(97.5%)	668(98.4%)	
• Moderate	2(0.4%)	4(2%)	6(0.9%)	
• Severe	-	-	-	
• Missing	4(0.8%)	1(0.5%)	5(0.7%)	0.04
Anxiety/insomnia status, n (%				
• Normal	467(97.9%)	195(96.5%)	662(97.5%)	
• Moderate	3(0.6%)	6(3%)	9(1.3%)	
• Severe	-	-	3(0.4%)	
• Missing	4(0.8%)	1(0.5%)	5(0.7%)	0.02
Social dysfunction status, n (%				
• Normal	468(98.1%)	196(97%)	664(97.8%)	
• Moderate	4(0.8%)	4(2%)	8(1.2%)	
• Severe	1(0.2%)	1(0.5%)	2(0.3%)	
• Missing	4(0.8%)	1(0.5%)	5(0.7%)	0.37
Depression status, n (%)				
• Normal	471(98.7%)	201(99.5%)	672(99%)	
• Moderate	1(0.2%)	-	1(0.1%)	
• Severe	1(0.2%)	-	1(0.1%)	
• Missing	4(0.8%)	1(0.5%)	5(0.7%)	0.65

Categorical variables were described as frequency (percentage).
Categorical variables were evaluated by Chi-square test.
*ρ <0.05 represents significant difference.

Table 4 shows Spearman's correlation coefficients used to determine the correlations between mental health indicators and anthropometric and body composition variables. Body mass index was correlated with anxiety/insomnia status in the men (r = 0.01, p = 0.03). There is a negative correlation between the variable general health status and SMM (r = -0.12, ρ = 0.002), SLM (r = -0.11, ρ = 0.002), TBW (r = -0.11, ρ = 0.003) and protein (r = -0.11, ρ = 0.002). Furthermore, percentage body fat had positive correlation with general health scores. (r = 0.08, ρ = 0.03) and social dysfunction status (r = 0.07, ρ = 0.04).

Table 4. The correlations between mental health indicators and anthropometric and body composition indices among non-Iranian students in Tehran.

Variables	General health status					
	Correlation Coefficient			*ρ-value		
	Men	Women	Total	Men	Women	Total
Weight	-0.04(n=473)	0.04(n=201)	-0.06(n=674)	0.30	0.55	0.08
BMI	-0.02(n=473)	-0.006(n=201)	-0.005(n=674)	0.57	0.93	0.89
MAC	-0.04(n=471)	-0.05(n=200)	-0.05(n=671)	0.31	0.45	0.14
WC	-0.05(n=472)	0.08(n=199)	-0.03(n=671)	0.22	0.23	0.40
WHR	-0.01(n=466)	0.05(n=195)	-0.04(n=661)	0.76	0.47	0.23
PBF	-0.01(n=467)	0.04(n=194)	0.08(n=661)	0.75	0.51	0.03
SMM	-0.07(n=467)	0.04(n=194)	-0.12(n=661)	0.09	0.51	0.002
SLM	-0.07(n=467)	0.05(n=194)	-0.11(n=661)	0.09	0.41	0.002
TBW	-0.07(n=467)	0.06(n=194)	-0.11(n=661)	0.08	0.34	0.003
Protein	-0.07(n=467)	0.05(n=194)	-0.11(n=661)	0.10	0.45	0.002
Mineral	-0.05(n=467)	0.06(n=194)	-0.06(n=661)	0.24	0.40	0.10
Variables	**Somatic status**					
	Correlation Coefficient			*ρ-value		
	Men	Women	Total	Men	Women	Total
Weight	-0.05(n=473)	0.06(n=201)	-0.03(n=674)	0.25	0.34	0.36
BMI	-0.04(n=473)	0.02(n=201)	-0.001(n=674)	0.36	0.73	0.97
MAC	-0.08(n=471)	-0.06(n=200)	-0.07(n=671)	0.08	0.35	0.05
WC	-0.07(n=472)	0.10(n=199)	-0.01(n=671)	0.11	0.15	0.78
WHR	-0.08(n=466)	0.08(n=195)	-0.04(n=661)	0.07	0.25	0.27
PBF	-0.04(n=467)	0.08(n=194)	0.05(n=661)	0.32	0.24	0.15
SMM	-0.04(n=467)	0.04(n=194)	-0.07(n=661)	0.33	0.53	0.06
SLM	-0.04(n=467)	0.04(n=194)	-0.07(n=661)	0.32	0.53	0.06
TBW	-0.04(n=467)	0.05(n=194)	-0.07(n=661)	0.31	0.44	0.07
Protein	-0.04(n=467)	0.03(n=194)	-0.07(n=661)	0.38	0.67	0.06
Mineral	-0.05(n=467)	0.05(n=194)	-0.04(n=661)	0.20	0.46	0.21
Variables	**Anxiety/insomnia status (N=674)**					
	Correlation Coefficient			*ρ-value		
	Men	Women	Total	Men	Women	Total
Weight	0.05(n=473)	0.01(n=201)	<0.001(n=674)	0.24	0.85	0.99
BMI	0.10(n=473)	-0.01(n=201)	0.05(n=674)	0.03	0.80	0.14
MAC	0.01(n=471)	0.008(n=200)	0.005(n=671)	0.76	0.91	0.89
WC	0.04(n=472)	0.11(n=199)	0.04(n=671)	0.38	0.09	0.23
WHR	0.02(n=466)	0.08(n=195)	0.01(n=661)	0.55	0.25	0.66
PBF	0.04(n=467)	0.01(n=194)	0.06(n=661)	0.37	0.85	0.08
SMM	-0.01(n=467)	-0.006(n=194)	-0.04(n=661)	0.81	0.93	0.24
SLM	-0.01(n=467)	0.004(n=194)	-0.04(n=661)	0.81	0.95	0.25
TBW	-0.01(n=467)	0.01(n=194)	-0.04(n=661)	0.82	0.79	0.27
Protein	-0.01(n=467)	-0.007(n=194)	-0.04(n=661)	0.77	0.92	0.22
Mineral	0.01(n=467)	0.02(n=194)	-0.01(n=661)	0.76	0.72	0.73
Variables	**Social dysfunction status**					
	Correlation Coefficient			*ρ-value		
	Men	Women	Total	Men	Women	Total
Weight	0.001(n=473)	-0.007(n=201)	-0.03(n=674)	0.99	0.92	0.37
BMI	0.05(n=473)	0.007(n=201)	0.04(n=674)	0.21	0.92	0.28
MAC	-0.03(n=471)	-0.08(n=200)	-0.05(n=671)	0.46	0.22	0.12
WC	-0.02(n=472)	0.03(n=199)	-0.01(n=671)	0.55	0.61	0.73
WHR	-0.06(n=466)	0.04(n=195)	-0.03(n=661)	0.15	0.49	0.33
PBF	0.06(n=467)	0.01(n=194)	0.07(n=661)	0.16	0.83	0.04
SMM	-0.06(n=467)	-0.04(n=194)	-0.06(n=661)	0.19	0.54	0.08
SLM	-0.06(n=467)	-0.04(n=194)	-0.06(n=661)	0.18	0.55	0.07
TBW	-0.05(n=467)	-0.03(n=194)	-0.06(n=661)	0.21	0.62	0.09

Protein	-0.07(n=467)	-0.05(n=194)	-0.07(n=661)	0.13	0.41	0.06
Mineral	-0.01(n=467)	-0.02(n=194)	-0.03(n=661)	0.82	0.70	0.31
	Depression status					
Variables	**Correlation Coefficient**			***ρ-value**		
	Men	**Women**	**Total**	**Men**	**Women**	**Total**
Weight	-0.04(n=473)	(n=201)	-0.02(n=674)	0.34	-	0.60
BMI	-0.01(n=473)	(n=201)	-0.01(n=674)	0.74	-	0.71
MAC	-0.03(n=471)	(n=200)	-0.02(n=671)	0.41	-	0.47
WC	-0.06(n=472)	(n=199)	-0.03(n=671)	0.18	-	0.34
WHR	-0.06(n=466)	(n=195)	-0.02(n=661)	0.18	-	0.53
PBF	-0.004(n=467)	(n=194)	-0.02(n=661)	0.92	-	0.51
SMM	-0.05(n=467)	(n=194)	-0.009(n=661)	0.27	-	0.81
SLM	-0.05(n=467)	(n=194)	-0.009(n=661)	0.27	-	0.81
TBW	-0.05(n=467)	(n=194)	-0.01(n=661)	0.27	-	0.78
Protein	-0.05(n=467)	(n=194)	-0.007(n=661)	0.24	-	0.85
Mineral	-0.05(n=467)	(n=194)	-0.02(n=661)	0.28	-	0.53

Abbreviations: BMI: Body mass index, MAC: Mid-arm circumference, WC: Waist circumference, WHR: Waist-hip ratio, PBF: Percentage body fat, SMM: Skeletal muscle mass, SLM: Soft lean mass, TBW: Total body water.
The correlations between the mental health indicators the anthropometric measurements and the body composition indices were assessed using the Spearman's rank correlation test.
*ρ <0.05 represents a significant difference.

4. Discussion

The present study explored the connection between mental health indicators and the anthropometric profile of non-Iranian students. To the best of our knowledge, this relationship has not been addressed in prior studies among the immigrant student demographic.

Upon analyzing the collected data, we observed a positive relationship between mental health scores and abnormal anthropometric measurements.

Herein, this study aimed to screen and expedite the diagnosis of some mental disorders, suggesting policymakers and healthcare professionals enhance the allocation of health insurance resources for individuals with abnormal anthropometric profiles.

As we found in this study, there was a correlation between BMI and anxiety among men, even though this relationship hasn't been seen in women's group. Obesity and anxiety have been associated in several studies (20, 21). As Lizeth Cifuentes and colleagues concluded in their study, adults with obesity who had confirmed symptoms of anxiety had more emotional eating, more uncontrolled eating, and less eating self-efficacy. Uncontrolled eating and stress-caused eating which was observed in anxious patients, is one of the factors that are linked to obesity. High levels of stress induce the intake of high-fat and high-carbohydrate meals. Chronic stress might have an association with impairment in the hypothalamic-pituitary-adrenal axis (21).

The HPA axis (hypothalamic-pituitary-adrenal) is stimulated by stressful factors and its activity is inhabited by a long-cycle adrenal glucocorticoid (GC) secretion. Mary F. Dallman and colleagues have mentioned that treatment with GCs decreased both corticotropin-releasing factor (CRF) and adrenocorticotropin (ACTH). In the presence of GCs with stress and insulin, taking pleasurable foods is increased. Indeed, corticosterone may be the motivation for comfort food by increasing the secretion of dopamine from n. Accsh. GCs also affect energy reserves and increase central fat to promote central obesity. The exact signal to the brain that induced enhancing abdominal fat is uncertain, but it seems that this signal is recruited for feeling better under the stress condition (22).

Our study showed that there is an association between total mental health score with TBW, SMM, SLM, and protein. We found that a lower total mental health score, which means a healthier mental status, leads to a higher level of TBW, SMM, SLM, and protein. The balance between the secreted components and different types of cells in muscle fibers like muscle satellite cells (MuSCs), motor neurons, and interstitial cells, such as vascular cells, fibroblasts, PW1-expressing interstitial cells (PICs), and fibro-adipogenic progenitors (FAPs) is essential. Changes in the cellular environment lead to some changes in the compound and interaction of these cells which activated some responses to recover the imbalance. Meanwhile, prolonged changes break skeletal muscle homeostasis and cause atrophy (23). Inflammation is a crucial biological response that is prevalent in chronic diseases (23, 24). Prolong inflammatory secreted can activate several pathways in skeletal muscle cells such as nuclear factor (NF)-κB, Janus-activated kinase/signal transducer and activator of transcription (JAK/STAT), and p38 mitogen-activated protein kinase (MAPK) pathways, which can disturb the balance between protein synthesis and proteolysis. The NF-κB pathway is one of the pro-inflammatory signaling pathways. Escalating the expression of inflammatory factors including cytokines, chemokines, and adhesion molecules, NF-κB plays a key role in the atrophy process. NF-κB is activated by binding the pro-inflammatory cytokines such as TNF-α and IL-1 to their receptors which come down to transcription of target genes and expression products like UPS-related molecules, cytokines, chemokines, cell adhesion molecules, and growth factors. These genes and UPS induced proteolysis which ultimately caused atrophy (23).

Besides, as observed in this cross-sectional study, a higher level of PBF is related to social dysfunction and mental impairment. Obesity, defined as an excess in adipose tissue, may be linked to the concomitant occurrence of inflammation. The adipose tissue produces different bioactive molecules including pro-inflammatory cytokines and adipokines which are crucial parts of the endocrine system (25). Obesity and excess fat tissue may exacerbate chronic inflammation (26). The adipocytokines released into the bloodstream by both visceral and subcutaneous adipose tissue influence multiple metabolic processes (27).

Obesity leads to the accumulation and infiltration of immune cells such as macrophages in the stromovascular compartment of adipose tissue. Adipose tissue macrophages play a vital role in the production of pro-inflammatory cytokines secreted by adipose tissue. There are two types of macrophages: M1, which produces pro-inflammatory cytokines such as IL-1b, IL-6, TNF- α; and M2, which produces anti-inflammatory cytokines such as IL-10. In addition to the infiltration of adipose tissue macrophages, in obesity conditions, there is a phenotypic shift from M2 to M1 leading to insulin resistance. The signals produced by M1 macrophages can interfere with insulin signaling and adipogenesis in adipocytes (28). Along with our results, a study conducted by Haiyan Xu et al. highlights the significant role of macrophages in morbid obesity and their relationship with inflammatory processes, causing chronic inflammation in adipose tissue due to insulin resistance (29).

As tumor necrosis factor-alpha (TNF-α), a pro-inflammatory cytokine is an important link between inflammation and obesity, which was found to be overexpressed in the adipose tissues of rodent models suffering from obesity and may influence the development of insulin resistance (30).

In fact, the overproduction of TNF-α within adipose tissue is an important characteristic of obesity and significantly contributes to insulin resistance (30). In adipose tissue, TNF-α impairs the activity of enzymes associated with the metabolism of fatty acids and glucose and reduces the secretion of some adipokines, including adiponectin which confirms its proinflammatory role (27).

Interleukin 6 (IL-6) is a cytokine produced in the immune system cells, that plays an important role in inflammatory processes. The role of IL-6 in obesity is not fully understood but the probable hypothesis is that IL-6 inhibits the expression of insulin receptors and reduces adipogenesis as well as adiponectin levels in peripheral tissues (27).

In addition, adiponectin is a hormone produced by adipocytes. In obesity conditions, serum levels of adiponectin are found in low levels. Previous studies have shown insulin-sensitizing and anti-inflammatory effects of adiponectin. As Choi et.al stated, obese subjects with high levels of IL-6 and TNF-α showed decreased secretion of mentioned proinflammatory cytokines, with an increased adiponectin level (31). Indeed, adiponectin contributes to the suppression of IL-6 and TNF-α expression through different pathways leading to an anti-inflammatory role in obesity and metabolic disorders.

Furthermore, adiponectin has a tissue-specific signaling pathway which has different effects on every tissue. Specifically, patients with metabolic diseases such as T2 diabetes and obesity showed chronic inflammation with low serum adiponectin levels (29, 30).

Hepsomali et al. reported that pro-inflammatory cytokines such as IL-6 and TNF- α, which were associated with obesity, increased in a variety of mental disorders, including depression, anxiety, schizophrenia, and bipolar disorder (32, 33).

Several studies have implicated the idea that inflammation may play a role in depression through the activation of the hypothalamic-pituitary-adrenal axis (34, 35). In addition, pro-inflammatory adipokine directly stimulates the HPA axis, and overactivation of the chronic HPA axis leads to excessive secretion of cortisol, which ultimately affects the immunological, endocrine, and neurological systems (36). Moreover, higher HPA axis reactivity may lead to a damaging effect on the hippocampus, psychological stress, and increased vulnerability to depression (34, 37).

Furthermore, Milano et al. study observed a significant increase of IL-6 and TNF- α in both serum and brain levels in individuals suffering from chronic depression.

Additionally, from a psychosocial perspective, obesity can play a critical role in self-image with self-deprecation and social isolation. Conversely, depression can also contribute to promoting obesity through unhealthy habits including physical inactivity, excessive alcohol consumption, and poor diet choices.

Overall, psychological factors had a significant impact on this connection. For instance, emotional eating has been linked to both depression and obesity. Also, mood disorders can frequently disrupt the sleep cycle, as well as affect neuroendocrine functions by elevated cortisol levels, impaired glucose metabolism, increased ghrelin, reduced leptin, and, as a result, an increase in appetite (38).

This study has some limitations. This assessment was based on self-reported data in which participants filled out the questionnaire by themselves, so there were no biochemical markers for investigating the effect of anxiety and depression. Another limitation of this study is that the sample includes university students, and we do not have access to society's delegate and, perhaps in terms of age, it is not representative of the community. However, our methodology can be useful for our target population of non-Iranian students.

5. Conclusion

Following our analysis, BMI was correlated with anxiety/insomnia status among non-Iranian students. Additionally, higher general health status was related to lower levels of SMM, SLM, TBW, and protein. Meanwhile, PBF showed a positive link to both impaired general health and social dysfunction status. From these results, we concluded that anthropometric measurements can be used as a cost-effective and efficient method for screening at-risk individuals with impaired mental scores. Ultimately, further investigations are needed to confirm our findings.

6. Acknowledgement

We would like to appreciate the cooperation of the participants.

7. Conflict of interest

The authors had no conflict of interest to declare.

References

1. *organization wh. Obesity and overweight 2021 [Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.*
2. *Atlas WO. World Obesity Atlas report 2023 [Available from: https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2023.*
3. *Safaei M, Sundararajan EA, Driss M, Boulila W, Shapi'i A. A systematic literature review on obesity: Understanding the causes*

& consequences of obesity and reviewing various machine learning approaches used to predict obesity. Comput Biol Med. 2021;136:104754.

4. Westbury S, Oyebode O, van Rens T, Barber TM. Obesity Stigma: Causes, Consequences, and Potential Solutions. Curr Obes Rep. 2023;12(1):10-23.
5. Organization WH. Mental disorders 2022 [Available from: https://www.who.int/news-room/fact-sheets/detail/mental-disorders.
6. Saloni Dattani LR-G, Hannah Ritchie and Max Roser. Mental Health: Our World in Data; 2023 [Available from: https://ourworldindata.org/mental-health.
7. Alegría M, NeMoyer A, Falgàs Bagué I, Wang Y, Alvarez K. Social Determinants of Mental Health: Where We Are and Where We Need to Go. Curr Psychiatry Rep. 2018;20(11):95.
8. Lerner D, Adler DA, Rogers WH, Chang H, Lapitsky L, McLaughlin T, Reed J. Work performance of employees with depression: the impact of work stressors. Am J Health Promot. 2010;24(3):205-13.
9. Malik S, Stead TS, Mangal R, Ganti L. General Anxiety Disorder in Youth: A National Survey. Health Psychol Res. 2022;10(4):39578.
10. Milaneschi Y, Simmons WK, van Rossum EFC, Penninx BW. Depression and obesity: evidence of shared biological mechanisms. Mol Psychiatry. 2019;24(1):18-33.
11. Peirce JM, Alviña K. The role of inflammation and the gut microbiome in depression and anxiety. J Neurosci Res. 2019;97(10):1223-41.
12. Satsangi AK, Brugnoli MP. Anxiety and psychosomatic symptoms in palliative care: from neuro-psychobiological response to stress, to symptoms' management with clinical hypnosis and meditative states. Ann Palliat Med. 2018;7(1):75-111.
13. Gariepy G, Nitka D, Schmitz N. The association between obesity and anxiety disorders in the population: a systematic review and meta-analysis. Int J Obes (Lond). 2010;34(3):407-19.
14. Pereira-Miranda E, Costa PRF, Queiroz VAO, Pereira-Santos M, Santana MLP. Overweight and Obesity Associated with Higher Depression Prevalence in Adults: A Systematic Review and Meta-Analysis. J Am Coll Nutr. 2017;36(3):223-33.
15. Checklists S. STROBE Checklists. 2024.
16. de Onis M, Onyango AW, Van den Broeck J, Chumlea WC, Martorell R. Measurement and standardization protocols for anthropometry used in the construction of a new international growth reference. Food Nutr Bull. 2004;25(1 Suppl):S27-36.
17. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF): a systematic review. Int J Behav Nutr Phys Act. 2011;8:115.
18. Gholami Fesharaki M, AzadMarzabadi E. Evaluation of the reliability and validity of Azad-Fesharaki's physical activity questionnaire (AFPAQ). Journal of Arak University of Medical Sciences. 2011;14(3):36-44.
19. Malakouti SK, Fatollahi P, Mirabzadeh A, Zandi T. Reliability, validity and factor structure of the GHQ-28 used among elderly Iranians. Int Psychogeriatr. 2007;19(4):623-34.
20. Li Y, Cheng Y, Zhou Y, Du H, Zhang C, Zhao Z, et al. High fat diet-induced obesity leads to depressive and anxiety-like behaviors in mice via AMPK/mTOR-mediated autophagy. Exp Neurol. 2022;348:113949.
21. Cifuentes L, Campos A, Silgado MLR, Kelpin S, Stutzman J, Hurtado MD, et al. Association between anxiety and eating behaviors in patients with obesity. Obes Pillars. 2022;3:100021.
22. Dallman MF, Pecoraro NC, la Fleur SE. Chronic stress and comfort foods: self-medication and abdominal obesity. Brain Behav Immun. 2005;19(4):275-80.
23. Ji Y, Li M, Chang M, Liu R, Qiu J, Wang K, et al. Inflammation: Roles in Skeletal Muscle Atrophy. Antioxidants (Basel). 2022;11(9).
24. Mukund K, Subramaniam S. Skeletal muscle: A review of molecular structure and function, in health and disease. Wiley Interdiscip Rev Syst Biol Med. 2020;12(1):e1462.
25. Carrillo JLM. Adipose Tissue and Inflammation2018.
26. Firth J, Veronese N, Cotter J, Shivappa N, Hebert JR, Ee C, et al. What Is the Role of Dietary Inflammation in Severe Mental Illness? A Review of Observational and Experimental Findings. Front Psychiatry. 2019;10:350.
27. Kojta I, Chacińska M, Błachnio-Zabielska A. Obesity, Bioactive Lipids, and Adipose Tissue Inflammation in Insulin Resistance. Nutrients. 2020;12(5).
28. Esser N, Legrand-Poels S, Piette J, Scheen AJ, Paquot N. Inflammation as a link between obesity, metabolic syndrome and type 2 diabetes. Diabetes Res Clin Pract. 2014;105(2):141-50.
29. Bruun JM, Lihn AS, Verdich C, Pedersen SB, Toubro S, Astrup A, Richelsen B. Regulation of adiponectin by adipose tissue-derived cytokines: in vivo and in vitro investigations in humans. Am J Physiol Endocrinol Metab. 2003;285(3):E527-33.
30. Wellen KE, Hotamisligil GS. Inflammation, stress, and diabetes. J Clin Invest. 2005;115(5):1111-9.
31. Choi HM, Doss HM, Kim KS. Multifaceted Physiological Roles of Adiponectin in Inflammation and Diseases. Int J Mol Sci. 2020;21(4).
32. Hepsomali P, Coxon C. Inflammation and diet: Focus on mental and cognitive health. Advances in Clinical and Experimental Medicine. 2022;31(8):821-5.
33. Al-Mansoori L, Al-Jaber H, Prince MS, Elrayess MA. Role of Inflammatory Cytokines, Growth Factors and Adipokines in Adipogenesis and Insulin Resistance. Inflammation. 2022;45(1):31-44.
34. Sánchez-Villegas A, Ruíz-Canela M, de la Fuente-Arrillaga C, Gea A, Shivappa N, Hébert JR, Martínez-González MA. Dietary inflammatory index, cardiometabolic conditions and depression in the Seguimiento Universidad de Navarra cohort study. Br J Nutr. 2015;114(9):1471-9.
35. Zunszain PA, Hepgul N, Pariante CM. Inflammation and depression. Curr Top Behav Neurosci. 2013;14:135-51.
36. Maeng SH, Hong H. Inflammation as the Potential Basis in Depression. Int Neurourol J. 2019;23(Suppl 2):S63-71.
37. Mikulska J, Juszczyk G, Gawrońska-Grzywacz M, Herbet M. HPA Axis in the Pathomechanism of Depression and Schizophrenia: New Therapeutic Strategies Based on Its Participation. Brain Sci. 2021;11(10).
38. Milano W, Ambrosio P, Carizzone F, De Biasio V, Di Munzio W, Foia MG, Capasso A. Depression and Obesity: Analysis of Common Biomarkers. Diseases. 2020;8(2)