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RESEARCH ARTICLE

PREVALENCE AND RISK FACTORS OF OVERWEIGHT/OBESITY AMONG FEMALE UNIVERSITY STUDENTS IN TABUK, SAUDI ARABIA 2022

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Abstract

Background: Obesity and overweight are accompanied with several different chronic diseases. Both can be measured by using body mass index (BMI) and is also used widely as an index of relative adiposityamong any population.

Objectives: To estimate the prevalence and contributing risk factors of overweight and obesity amongfemale university students in Tabuk, Saudi Arabia 2022 .

Methods: Cross-sectional study the analysis was undertaken from a representative sample (N = 256) of the Tabuk University females. Anthropometric measurements including, height (in meters),and weight (in kilograms) of the subjects were undertaken by means of standard apparatus. SPSS 23.0 was utilizedfor statistical analysis of the data.

Results: Majority of respondents (59.77%) were of healthy weight (BMI of mean ±SD = 22.81±5.04). About 31.58% of the married participants were overweight and 5.26% of them were obese. While 8.03% single participants were obese and 16.46% of them were overweight. The average hours the participant spends in regular physical activity has significant reflection (p=0.048) on the participants` weight status. None of the participants who spend more than three hours daily in regular activity were obese and only 8.33% of them were overweight.As the number of sleeping hours' decrease, there was higher risk for the participant to gain weight.There was a direct impact of frequency of unhealthyfood on the body weight status of the participants.

Conclusions: The associated factors of obesity-overweight prevalence in females of the university are potentially preventable and modifiable. The regional barriers to lifestylemodifications and interventions to encourage active lifestyles,to limit the occurrenceof obesity and ultimately promote health and wellbeing, are warranted. Furthermore, prospective studies areneeded in future to confirm the etiological nature of such associations.

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Introduction:-

Obesity or excessive body fat is considered a significant public health concern, and its prevalence increases all over the world [1].Obesity has been reached an epidemic in both developing as well as developed countries [2]. Obesity is a multidimensional health issue caused by both modifiable and non-modifiable risk factors, including genetic, metabolic, behavioral, and environmental factors [3].

To assess obesity, the World Health Organization (WHO) has implemented the body mass index (BMI) scale. This scale can be obtained by dividing the total body weight in kilograms by the square of the height measured in meters[4]. With this, obesity can be well-defined if BMI value is ≥30Kg/m2. It usually correlates with the fraction of body fat in obese individuals [5].

Obesity can contribute to greater risks of non-communicable diseases causing morbidity and mortality. It is a modifiable and preventable risk factor for insulin resistance leading to impaired glucose tolerance (6), metabolic syndrome (7) and dyslipidemia (8). The relative risk after adjusting the variable of age was found to be 60.9 for the development of diabetes with a BMI ≥35Kg/m2 (9). Hypertension has a higher risk of 1.46 and 1.75 in overweight and obese young adults respectively(10).Obesity can also contribute to ischemic stroke (11).

There is a linear correlation between the obesity and obstructive sleep apnea. In obese people, fat deposits in the upper respiratory tract may narrow the airway; there is a decrease in muscle activity in this region, leading to hypoxic and apneic episodes, ultimately resulting in sleep apnea. These hypoxia/apnea episodes lead to a decrease in oxygen that is available in body tissues and blood vessels. The decreased oxygenation causes tissue hypoxia, which is the main contributing factor to atherosclerosis, the main risk factor for cardiovascular diseases. Moreover, 75% of adolescents with asthmatic emergencies are either obese or overweight(12).

On genital system, as females' obesity is related to polycystic ovarian syndrome and infertility (13).In males, obesity leads to erectile dysfunction in a considerably greater extent than aging. Mechanisms responsible for the independent influence of obesity on the erectile dysfunction are hormonal imbalance, endothelial dysfunction, insulin resistance, psychological factors, and physical inactivity.It is found that 79% of men with erectile dysfunction have BMI ≥25Kg/m2. This risk is higher with more BMI(14).

Obesity is predisposed by certain determinants that can either be environmental or genetic. Such environmental factors include physical activity, gender, marital status, job, education level and diet(15). Income also predicts obesity, particularlyin Arab countries (16). The role of education is clear when more obesity was found prevalent in the illiterate population as is found in Syria, Jordan, andLebanon(17, 18). Married people were also more susceptible to being overweight and obese (19). Regarding gender distribution, females were disproportionately affected by extreme obesity than males (6). Peeters et al (2003) concluded that a noticeable decline inlife expectancy is present in obese adolescents in comparison to non-obese individuals(17).

The prevalence of obesity in Gulf Countries among children and adolescents ranges from 5% to 14% in males and from 3% to 18% in young females. For instance, recent surveys found thatin Kuwait, 48% of females and 36% of males were obese, whereas 77% of females and 74% of males were overweight (20).

Saudi Arabia has experienced a rapid socioeconomic change in the recent decades, which has coincided with changes in the incidence of many health problems among Saudis (21). One of the most noteworthy aspects of these changes is the steady rise in overweight and obesity prevalence among the Saudi population of various ages (22). Elevation observed in the prevalence of overweight and obesity in the Saudi community is mainly linked to increasing sedentary behaviors andunhealthy foods consumed in the usual diet (23, 24).

In Saudi Arabia, 4% prevalence of obesity was reported in rural areas. Conversely, obesity is reported to be 10% in the Western regions and 14% in the Eastern region, Jizan (12%), Riyadh (22%), and Hail (34%)] due to the consumption of more fast food and a sedentary lifestyle (25).

These indications emphasize the importance of implementing effective strategiesto combat overweight and obesity associated with aging, including nutrition education promoting healthy lifestyle patterns(26).

Therefore, the purpose ofthe study is to estimate the prevalence and the contributing factors of overweightand obesity within the females in the university ofTabuk,Saudi Arabia.

Material and Methods:-

A population based cross sectional study was conducted using the data drawn from the female students in all colleges at Tabuk university in Saudi Arabia throughout the academic year 2021-2022G.The Tabuk university was founded in 2006. It includes Medicine, Engineering, Applied Medical Sciences, Science, Computers and Information technology, Education and Arts, Business Administration, Design and Arts and Pharmacy colleges for male and female students.

The study was carried out on female students (medical and non-medical). This university lies in Tabuk city, Saudi Arabia which is located 2200 feet above sea level and has a population of 667000, according to 2021 estimated census.There were no specific criteria for exclusion, except refusal to participate.

By considering5% error margin, 95% confidence limit and estimated total population under study of approximately 20000,the sample size was256 (nearly 10% more than estimated by http://www.raosoft.com/samplesize.htmlwebsite). This was to compensate for possible none or incomplete response. Multi-stage random sampling technique was applied. In the first stage, twocollegeswere randomly selected (one medical and one non-medical) by simple random sampling technique. In the second stage, the sample of the study was equally distributed over the two colleges and over the academic levels in each college (almost 112 students from each college and 20-28 students from each academic level). In the third stage, simple random technique was applied to select students from each department through list obtained from college administration.

The researcher distributed a structured English - Arabic questionnaire to the target population either by direct contact with them or through college administrators. Thequestionnaire was subjected to content validity by three consultants in family medicine and public health.The participants filled a set of questions on Socio-demographic data including age, marital status, nationality, college, and academiclevel.Data concerning medical history of diabetes, hypertension, hypercholesterolemia, ischemic heart disease and other diseases were included in the questionnaire.Lifestylehabitsincluding average daily hours of night sleeping and of watching TV, were also included.Physical habits using the validated General Practice Physical Activity Questionnaire [GPPAQ], which developed by the London School of Hygiene and Tropical Medicine to assess adult (16 – 74 years) physical activity levels. The GPPAQ provides simple, 4-level Physical Activity Index categorizing subjects to one of four categories, inactive, moderately inactive, moderately active, and active[27]. Nutritional assessmentwas done using KomPANquestionnaire which is a valid simple tool measures the frequency of common food elements. This questionnaire includes 14 questions to score the unhealthy food consumed by the participant. The score 0 to 14 denotes the food consumption from healthyto unhealthy [28].

Anthropometric measurements body weight (in kilograms) and height (in meters) and body mass index (BMI) were measured by the researcher. Care was taken not to disturb their lectures or academic activities. The researcher was available to clarify any issue and the questionnaires were collected after a short time in the same day. The data were verified by hand then coded and entered to a personal computer.

In general practice, based on the standards for anthropometric measurements, the weight of an individual body was measured in socks and light clothes to the nearest0.1 kg, using a similar digital medical scale. Height of a participant was measured to the nearest of 0.1 cm using a stadiometer precisely noted in standing position with no shoes on. Weight was measured through a digital weighing scale. Prior to the measurement, the scale was calibrated to the zero level and was also verified for repeatability of the readings.

Operational definition

Body mass index (BMI) was computed by the dividing weight by height in meters square (kg/m2). The weight categories were demarcated following the National Institute of Health categorization as less than 18 to be underweight, 18.5- 24.9 is normal, 25-29.9 is overweight and 30 or more $kg/m^2$is considered obese.

Data Analysis

The data were collected and verified by hand then coded before computerized data entry. The statistical Package for Social Sciences (SPSS) software version 26.0 was used for data entry and analysis. Descriptive statistics (e.g.,

number, percentage, mean, range, standard deviation) and analytic statistics using chi-square test were applied. Other statistical tests were used as appropriate to fulfill the study objectives and p-values ≤0.05 were considered as statistically significant.

Results:-

A total of 256 female students in university of Tabuk participated in this study, 136 (53.13%) are in medical faculties and 120 (46.87%) are in non-medical faculties. Most of them are single 237 (92.58%), while 19 (7.42%) are married. They are aged mainly 21 or 22 years 116(46.15%) or 18-20 years 86 (33.59%) while only 36 (14.06%) are 23 or 24 years old. Females who exceed 24 years old are only 19 (7.42%). Most of them are in third 63 (24.6%) and fourth 67 (26.17%) academic years. Less are in first 31 (12.11%) and second 36 (14.06%) years. Minority are in fifth 20 (7.81%) and sixth 39 (15.23%) years. The mean BMI ± SD of the participants is 22.81 ± 5.04. Most of them are of healthy weight 153 (59.77%) or overweight 44 (17.19%). Less are underweight 39 (15.23%). The least 20 (7.81%) are obese. (Table 1)

The weight status of the participants according to the demographic data is presented in (Tables 2 & 3). Concerning age groups, about 18.6% (N=16) of girls aging 18-20 years are overweight and 9.3% (N=8) are obese. While 12.93% (N=15) of girls aging 21, 22 years are overweight and 6.9% (N=8) are obese. Females aged 23, 24 years, 27.78% (N=10) of themare overweight and 2.78% (N=1) are obese.Girls aged more than 24 years,15.79% (N=3) of them were obese and 21.05% (N=4) of them were overweight.More than 30 % were obese or overweight in age group 23 & 24 years old and more than 35% were obese or overweight in age group more than 24 years old (Table 2).While the highest percentageof obese girls is within 18-20 years (40%) and 21, 22 years (40%). Overweight girls also are highest (35.6%) within 18-20 years and(33.3%) within 21, 22 years (Table 3).

Most participating college girls are single. About 31.58% (N=6) of the married participants are overweight and 5.26% (N=1) of them are obese. While the single participants 8.02% (N=19) of them are obese and 16.46% (N=39) of them are overweight (Table 2).Overweight and obesity are much more prevalent within single (88.9%, 95%) females than married (11.1% & 5%) ones(Table 3).

About 9.56% (N=13) of females in medical faculties are obese and 15.44% (N=21) of them are overweight. While in non-medical faculties, 5.79% of them are obese and 19.83% of them are overweight (Table 2).Distribution of obese girls was more inmedical colleges (65%) while the overweight (53.3%) girls were more in non-medical faculties (Table 3).

It is observed that 29.03% (N=24) of females in first year are overweight and 6.45% (N=2) of them are obese (Table 2).The highest percentage of overweight (31.1%) and obese (35%) girls was within fourth year(Table 3).

The weight status of the participants according to the medical history is presented in (Tables 4&5).Concerning diabetes, one third of the participating diabetics were obese and none of them are overweight.While 7.2% (N=18) of non-diabetics are obese and 18% (N=45) are overweight.Moreover,25% of who don't know their blood sugar level were obese. There is an intimate relation of higher BMI of the participants with their blood cholesterol level. About 22.2% (N=2) of females with high blood cholesterol level are obese. While 23.53% (N=4) of who don't know their blood cholesterol level are obese.Regarding blood pressure, none of the diagnosed hypertensive are neither overweight nor obese. While 18.03% (N=44) of participating girls with normal blood pressure are overweight and 7.79% (N=19) are obese.About 9.09% (N=1) of the girls who are not knowing whether hypertensive or not are obese and another 9.09% (N=1) are overweight(Table 4).

It is observed that 90% of obese participants are neither suffer from diabetes or ischemic heart diseases. About 95% of obese have no hypertension and 70% of them have normal cholesterol level in blood. Regarding over weighted participants, all of them have neither diabetes nor ischemic heart diseases. About, 97.5% of the overweight participants have normal blood pressure and 95.6% of them are with normal blood cholesterol level(Table 5).

Lifestyle habits affect the weight status of the participants as shown in (Tables 6 & 7). As the number of sleeping hours decrease, there will be higher risk for the participant to gain weight. Obese girls were about 8.33% (N=8) of girls who sleep less than 6 hours/day and8.59% (N=11) of who sleep from 6 to 9 hours/day. On the other hand, only 3.03% (N=1) of girls who sleep more than 9 hours/ day are obese. The hours the participants spend daily watching TV or smart devices don't affect their weight status. It is found that obese girls were 7.04% (N=5), 10.29%

(N=7)&6.78% (N=8) of who spend more than five, 2-5 and less than 2 hours per day watching TV or smart devices. Obviously, the nature of the participant work is reflected on their BMI. The overweight and obese girls which almost sit are about 18.37% (N=27) and 10.88% (N=16) respectively. On the other hand, the overweight and obese girls which almost stand, or walk are about 16.36%(N=18) and 3.64%(N=4) respectively. The average hours the participant spends in regular physical activity has significant reflection (p=0.048) on her weight status. None of the participants who spend more than three hours daily in regular activity are obese and only 8.33% (N=1) of them are overweight. While 10.14% (N=14) of who are not practicing regular physical activity are obese and 18.12% (N=25) of them are overweight(Table 6).

Riding bicycle and gardening are not habits of most of the participants. Walking is reflected on the BMI of the participants. The hours the participants spend in walking are reflected on their weight status. About 10.53% (N=8) of the females who walk less than one hour/ day, only 1.61% (N=1) who walk more than 3 hours/ day are obese(Table 6).

Prevalence of obese (95%) and overweight (88.9%) is mainly in females who sleep less than 9 hours. Most of obese (80%) and overweight (60%) females sit in their work. As expected, the time the participant spends is physical activity reflects positively on the weight status. All obese and 95.6% of overweight females don't ride bicycle, 70% of obese and 55.6% of overweight females don't perform regular physical activity(Table 7).

The weight status of the participants reflects the physical activity levels according to [GPPAQ] questionnaire. It is found that most of the obese (65%) and overweight (43.2%) participants are inactive. On the other hand, the least percentage of obese (5%) and overweight (6.8%) and highest percentage of health weight (32%) and underweight (46.2%) are active (Table 8).

The participants are asked about the frequency, they consume 12 unhealthy food staffs according to KomPAN questionnaire. Eachquestion gains 0-1 according to the frequency. The mean score of each question is measured for each weight status.The total score is summated to be of minimum 0 (means least frequency ofunhealthy food) and maximum 14 (means high frequency of unhealthy food).The analysis reflects the effect of unhealthy food on the body weight status of the participants. The total score descends gradually (9.667, 8.741, 8.183 and 6.458) from obese to those of healthy weight(Table 9).

Discussion:-

Our study findings showed that most of the participantsof females in the university of Tabuk are of healthy weight 153 (59.77%) or overweight 44 (17.19%). Less are underweight 39 (15.23%). The least 20 (7.81%) are obese. These findings are in contrary to those obtained by Al-Hamdi et al.,(29) who mentioned that overweight and obese are nearly 54.3% of the participants.However, both researches were done in the kingdom of the Saudi Arabia but the low prevalence in our study may be attributed to that the data were collected only from the university students. This suggestion is augmented by Sobal et al., (6) that suggested that education level was found to be a significant and vital predictor of high weight for Americans. As in the USA, with each year of education, the possibility of being overweight or obese was reduced by 2–9%. Likewise, in Turkey, 62% university students had normal weight while 31% were obese(19), while, in Lebanon, less education was associated with high BMI (30).

The current study points that there is a linear and positive trend was obtained between increasing age and high BMI. About one third of participants higher than 24 years old are obese or overweight. Likewise, large population studies indicate that BMI gradually increases during adult life reaching a peak at 50–59 years, showing a declining BMI trend after the age of 60 (31, 32). Consistently, in Lebanon, adults had a linear association between increasing age and obesity in 20– 60 years (30). In Spain, high BMI figures amplified continuously from 10% as identified in the age cluster of 18 to 25 years to more than 50% in above 55 years of age (33).In these studies, the age element was more manifested than in ours, as we study the university population which is mainly occurs in young age.

Concerning the marital status, most participating college girls are single. However, 31.58% of the married participants are overweight and 5.26% of them are obese. While the single participants 8.02% of them are obese and 16.46% of them are overweight.In the same context, in Greek (34), Turkish (19)and Spanish (33)countries, marital status was found significantly related to obesity. As per Kilicarslan and colleagues (19), risk of being obese was 2.5 times greater in individuals who were married as compared to those who were single, divorced, or widowed. Similarly, in Iran, threefold higher risk was found for married women (7). In Americans, married were 21% more

prone to become overweight, whereas wedded females had a 21% decreased probability of being obese. However, a study conducted in Japan showed no relationship between body weight and marriage (35). On the contrary, this relationship was not evident in Malaysians and Americans (36).

The current study pointed that there is no significant difference between the students whether in medical or non-medical faculty. The prevalence of obese and overweight in medical faculties was 25% however in non-medical faculties were 25.62%. These findings don't run with those of Yar et al., (37) who claimed that medical information guide the students to watch their weight and minimize risk of obesity in medical students. The findings in Tabuk University may be attributed to high level of medical information within all students medical or non-medical.

It was found that one third of diabetic participants are obese. This is supported by other international and national published work in India (38), USA (6, 9), China (39), Lebanon (34)and Saudi Arabia (36).

There is an intimate relation of higher BMI of the participants in the present work with their blood cholesterol level. About 22.2% of females with high blood cholesterol level are obese. This is in conjunction with the results mentioned by Klop et al., (7). They observed that higher concentrations of mean total cholesterol and triglycerides whereas low level of High-Density lipoproteins (HDL) in obese persons when compared to normal weight subjects (40). An imperative link amongst dyslipidemia and obesity seems to be the development of insulin resistance (7). This mechanism along with Obesity, hypo HDL cholesterolemia, hypertriglyceridemia and glucose intolerance are characteristics of insulin resistance disorder which is also extensively widespread among the Saudi inhabitants of age 40 years and above (41)in addition to Australians and residents of the Pacific Islands (42).

The current study found that none of the diagnosed hypertensive are neither overweight nor obese. While 18.03% of participating girls with normal blood pressure are overweight and 7.79% are obese. These findings are not convenient with those of Gao et al., (43) who published thatin rural Lanzhou, higher BMI had larger associations with the increased prevalence of hypertension than central obesity indices. Only when general obesity or overweight coexisted with central obesity, the prevalence of hypertension was significantly increased. So, central obesity indices should be used jointly with BMI in evaluating the risk of hypertension.

Lifestyle habits affect the weight status of the participants in the present work. As the number of sleeping hours' decrease, there will be higher risk for the participant to gain weight. Obese girls were about 8.33% of girls sleep less than 9 hours/day. On the other hand, only 3.03% of girls who sleep more than 9 hours/ day are obese. The hours the participants spend daily watching TV or smart devices don't affect their weight status. These findings are in line to those obtained by Alghadir et al., (44) who reported that physical activity had a significantly higher mean body mass index. However, they found that increasing hours in watching TV or smart devices has positive correlation with increasing the BMI.

Obviously, the nature of the participant work is reflected on her BMI. The overweight and obese girls which almost sit are about 18.37% and 10.88% respectively. On the other hand, the overweight and obese girls which almost stand, or walk are about 16.36% and 3.64% respectively.

These findings are in line with those of Burgard and Sonnega, (45) who found that compared with women in professional occupations, women managers were significantly less likely to be obese. Moreover, Bonauto and Fan,(46) found that for adults in Washington State, health lifestyle factors like leisure-time physical activity helped to explain the difference in obesity risk across occupational groups. In contrast to our findings, a study of working-aged Canadians found no relation between occupational prestige and BMI for women(47).

The average hours the participant in the current work spends in regular physical activity has significant reflection ($p=0.048$) on her weight status. None of the participants who spend more than three hours daily in regular activity are obese and only 8.33% of them are overweight. While 10.14% of who are not practicing regular physical activity are obese and 18.37% of them are overweight. Walking is reflected on the BMI of the participants. The hours the participants spend in walking are reflected on their weight status. About 10.53% of the females who walk less than one hour/ day, only 1.61% who walk more than 3 hours/ day are obese.The same results were published by Alghadir et al., (44) who stated that less frequent physical activity is accompanied by higher risk of obesity.

The present work reflects the effect of unhealthy food on the body weight status of the participants. The total score

descends gradually (9.667, 8.741, 8.183 and 6.458) from obese to those of healthy weight. However, there is narrow difference between the total score in the four categories of body mass index. This narrow difference may be attributed to the fixation of the other parameters asmostof participants are single, in college in narrow range of age difference. These findings run in line with those of Al-Shehri et al., (48) who found that irregular and infrequent meals together with lowvegetables and fruits intake were the most common unhealthyeating habits of the participants. The unhealthy lifestyles are the most alarming signs triggering high BMI.

Limitations

This study had some limitations that should be considered when interpreting the data. The first one the sample size was below the optimum as the data were collected only from who agreed to participate in the study. Another limitation, the quality of life and psychological profile were not included in the study which might have effect on results. Moreover, the academic performance was not included which might affect the feeding habits and BMI.

Conclusion:-

Obesity is preventable and understanding its prevalence, contributing factors is the key to our efforts in designing culturally suitable and relevant health promotionactivities. Obesity in adulthood can be taken as a powerful predictor for mortality in older ages. Additionally,important risk factors like being married; increasing age,high cholesterol, diabetes was also highlighted. Sedentary lifestyle, sitting within the work, and unhealthy food have a noteworthy influence on increase of the BMI of the participants.Analysis in the studyshowed that BMI significantly increased with age, andthis might elevate the risk of non-communicable diseases in the next adultgeneration and have a noteworthy influence on thefinancing and provision of future health-care services inSaudi Arabia. Therefore, in the light of such findings itis now particularly vital to speed up health-promotionbehaviors to construct effective interventions.Well-designed prospective studies are needed in the future to study the etiological nature of this relationship.Further studies are also required to make causal inferences and to examine certain barriers to physical activity and economic, social, cultural, and behavioral factorsleading to high BMI in the Saudi population.

Table 1:- Distribution of categories (frequency&percentage) within the participants.

Faculty	Category	Medical	Non-medical				
	N (%)	136 (53.13%)	120 (46.87%)				
Marital status	Category	Single	Married				
	N (%)	237 (92.58%)	19 (7.42%)				
Age group	Category	18-20	21,22	23,24	> 24		
	N (%)	86 (33.59%)	116 (46.15%)	36 (14.06%)	19 (7.42%)		
Academic year	Category	First year	Second year	Third year	Fourth year	Fifth year	Sixth year
	N (%)	31 (12.11%)	36 (14.06%)	63 (24.60%)	67 (26.17%)	20 (7.81%)	39 (15.23%)
Weight status	Category	Underweight	Healthy weight	Overweight	Obese		
	N (%)	39 (15.23%)	153 (59.77%)	44 (17.19%	20 (7.81%)		

Table 2:- Weight distribution within university female students according to demographic data (% per row).

				Underweight		Healthy weight		Overweight		Obese		p-value
				N	%	N	%	N	%	N	%	
Demographic Data	1	Age group	18-20	18	20.93 %	44	51.16 %	16	18.60 %	8	9.30%	0.195
			21,22	16	13.79 %	77	66.38 %	15	12.93 %	8	6.90%	
			23,24	3	8.33%	22	61.11 %	10	27.78 %	1	2.78%	
			More than 24	2	10.53 %	10	52.63 %	4	21.05 %	3	15.79 %	

	2	Marital status	Married	1	5.26%	11	57.89 %	6	31.58 %	1	5.26%	0.653
			Single	38	16.03 %	141	59.49 %	39	16.46 %	19	8.02%	
	3	Faculty	Medical	23	16.91 %	79	58.09 %	21	15.44 %	13	9.56%	0.466
			Non-medical	16	13.22 %	74	61.16 %	24	19.83 %	7	5.79%	
	4	Academic year	First	3	9.68%	17	54.84 %	9	29.03 %	2	6.45%	0.513
			Second	8	22.22 %	21	58.33 %	5	13.89 %	2	5.56%	
			Third	10	15.87 %	42	66.67 %	5	7.94%	6	9.52%	
			Fourth	9	13.43 %	37	55.22 %	14	20.90 %	7	10.45 %	
			Fifth	2	10.00 %	15	75.00 %	3	15.00 %	0	0.00%	
			Sixth	7	17.50 %	21	52.50 %	9	22.50 %	3	7.50%	

Table 3:- Distribution of obese and overweight girls according to demographic data (% per column).

		Overweight		Obese		p value
		N	%	N	%	
Age group	18-20	16	35.6%	8	40.0%	0.195
	21, 22	15	33.3%	8	40.0%	
	23,24	10	22.2%	1	5.0%	
	> 24	4	8.9%	3	15.0%	
Marital status	Single	40	88.9%	19	95.0%	0.653
	Married	5	11.1%	1	5.0%	
Faculty	Medical	21	46.7%	13	65.0%	0.466
	Non-medical	24	53.3%	7	35.0%	
Academic years	First	9	20.0%	2	10.0%	0.513
	Second	5	11.1%	2	10.0%	
	Third	5	11.1%	6	30.0%	
	Fourth	14	31.1%	7	35.0%	
	Fifth	3	6.7%	0	0.0%	
	Sixth	9	20.0%	3	15.0%	

Table 4:- Weight distribution within university female students according to medical history (% per row).

		Underweight		Healthy weight		Overweight		Obese		p-value
		N	%	N	%	N	%	N	%	
1- Are you diabetic?	Yes	1	33.33%	1	33.33%	0	0.00%	1	33.33%	0.305
	No	38	15.20%	149	59.60%	45	18.00%	18	7.20%	
	I don't know	0	0.00%	3	75.00%	0	0.00%	1	25.00%	
2- Do you have high cholesterol?	Yes	0	0.00%	7	77.78%	0	0.00%	2	22.22%	0.043
	No	37	16.02%	137	59.31%	43	18.61%	14	6.06%	
	I don't know	2	11.76%	9	52.94%	2	11.76%	4	23.53%	
3- Are you hypertensive?	Yes	1	50.00%	1	50.00%	0	0.00%	0	0.00%	0.837
	No	36	14.75%	145	59.43%	44	18.03%	19	7.79%	
	I don't know	2	18.18%	7	63.64%	1	9.09%	1	9.09%	
4- Do you suffer from	Yes	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0.108

ischemic heart disease?	No	39	15.73%	146	58.87%	45	18.15%	18	7.26%	
	I don't know	0	0.00%	7	77.78%	0	0.00%	2	22.22%	

Table 5:-Distribution of obese and overweight girls according to medical history (% per column).

		Overweight		Obese		p value
		N	%	N	%	
1- Are you diabetic?	Yes	0	0.0%	1	5.0%	0.305
	No	45	100.0%	18	90.0%	
	I don't know	0	0.0%	1	5.0%	
2- Do you have high cholesterol?	Yes	0	0.0%	2	10.0%	0.043
	No	43	95.6%	14	70.0%	
	I don't know	2	4.4%	4	20.0%	
3- Are you hypertensive?	Yes	0	0.0%	0	0.0%	0.837
	No	44	97.8%	19	95.0%	
	I don't know	1	2.2%	1	5.0%	
4- Do you suffer from ischemic heart disease?	Yes	0	0.0%	0	0.0%	0.108
	No	45	100.0%	18	90.0%	
	I don't know	0	0.0%	2	10.0%	

Table 6:- Weight distribution within university female students according to lifestyle habits (% per row).

		Underweight		Healthy weight		Overweight		Obese		p-value
		N	%	N	%	N	%	N	%	
1- How many hours you sleep at night?	Less than 6	13	13.54 %	60	62.50 %	15	15.63 %	8	8.33%	0.528
	6 to 9	23	17.97 %	69	53.91 %	25	19.53 %	11	8.59%	
	More than 9	3	9.09%	24	72.73 %	5	15.15 %	1	3.03%	
2- How many hours you watch TV or smart devices?	Less than 2	18	15.25 %	70	59.32 %	22	18.64 %	8	6.78%	0.977
	2-5 hours	10	14.71 %	41	60.29 %	10	14.71 %	7	10.29 %	
	More than 5	11	15.49 %	42	59.15 %	13	18.31 %	5	7.04%	
3- What is the nature of your work?	I almost sit	22	14.97 %	82	55.78 %	27	18.37 %	16	10.88 %	0.157
	I almost stand or walk	17	15.45 %	71	64.55 %	18	16.36 %	4	3.64%	
4- How many hours per day you spend in regular physical activities?	None	24	17.39 %	75	54.35 %	25	18.12 %	14	10.14 %	0.048
	Less than 1 hour	4	6.35%	46	73.02 %	11	17.46 %	2	3.17%	
	1-3 hours	10	22.73 %	25	56.82 %	5	11.36 %	4	9.09%	
	More than 3 hours	4	33.33 %	7	58.33 %	1	8.33%	0	0.00%	
5- How many hours per day you spend in riding bicycle?	None	37	15.81 %	134	57.26 %	43	18.38 %	20	8.55%	0.192
	Less than 1 hour	2	9.52%	18	85.71 %	1	4.76%	0	0.00%	
	1-3 hours	0	0.00%	1	50.00 %	1	50.00 %	0	0.00%	
	More than 3 hours	0	0.00%	0	0.00%	0	0.00%	0	0.00%	

6- How many hours per day you spend in walking?	None	4	20.00 %	12	60.00 %	2	10.00 %	2	10.00 %	0.549
	Less than 1 hour	9	11.84 %	48	63.16 %	11	14.47 %	8	10.53 %	
	1-3 hours	17	17.17 %	53	53.54 %	20	20.20 %	9	9.09%	
	More than 3 hours	9	14.52 %	40	64.52 %	12	19.35 %	1	1.61%	
7- How many hours per day you spend in home duties and children care?	None	24	21.62 %	62	55.86 %	18	16.22 %	7	6.31%	0.093
	Less than 1 hour	11	14.67 %	40	53.33 %	15	20.00 %	9	12.00 %	
	1-3 hours	3	6.38%	32	68.09 %	10	21.28 %	2	4.26%	
	More than 3 hours	1	4.17%	19	79.17 %	2	8.33%	2	8.33%	
8- How many hours per day you spend in gardening ?	None	35	15.22 %	139	60.43 %	39	16.96 %	17	7.39%	0.121
	Less than 1 hour	2	10.53 %	12	63.16 %	2	10.53 %	3	15.79 %	
	1-3 hours	2	25.00 %	2	25.00 %	4	50.00 %	0	0.00%	
	Moderate	0	0.00%	0	0.00%	0	0.00%	0	0.00%	
9- How do you describe your walk?	Slow (less than 3 miles per hour)	3	10.00 %	14	46.67 %	8	26.67 %	5	16.67 %	0.402
	Moderate	21	15.00 %	86	61.43 %	23	16.43 %	10	7.14%	
	Active	13	17.81 %	44	60.27 %	13	17.81 %	3	4.11%	
	Fast (more than 4 miles per hour)	2	14.29 %	9	64.29 %	1	7.14%	2	14.29 %	

Table 7:- Distribution of obese and overweight girls according to lifestyle habits (% per column).

		Overweight		Obese		p value
		N	%	N	%	
1- How many hours you sleep at night?	Less than 6 hours	15	33.3%	8	40.0%	0.528
	6-9 hours	25	55.6%	11	55.0%	
	More than 9 hours	5	11.1%	1	5.0%	
2- How many hours you watch TV or smart devices?	Less than 2 hours	8	40.0%	22	48.9%	0.977
	From 2- 5 hours	7	35.0%	10	22.2%	
	More than 5 hours	5	25.0%	13	28.9%	
3- What is the nature of your work?	I almost sit	27	60.0%	16	80.0%	0.132
	I almost stand or walk	18	40.0%	4	20.0%	
4- How many hours per day you spend in regular physical activities?	None	25	55.6%	14	70.0%	0.057
	Less than 1 hour	11	24.4%	2	10.0%	
	1-3 hours	5	11.1%	4	20.0%	
	More than 3 hours	4	8.9%	0	0.0%	
5- How many hours per day you spend in riding bicycle?	None	43	95.6%	20	100.0%	0.192
	Less than 1 hour	1	2.2%	0	0.0%	
	1-3 hours	1	2.2%	0	0.0%	

	More than 3 hours	0	0.0%	0	0.0%	
6- How many hours per day you spend in walking?	None	2	4.4%	2	10.0%	0.549
	Less than 1 hour	11	24.4%	8	40.0%	
	1-3 hours	20	44.4%	9	45.0%	
	More than 3 hours	12	26.7%	1	5.0%	
7- How many hours per day you spend in home duties and children care?	None	18	40.0%	7	35.0%	0.093
	Less than 1 hour	15	33.3%	9	45.0%	
	1-3 hours	10	22.2%	2	10.0%	
	More than 3 hours	2	4.4%	2	10.0%	
8- How many hours per day you spend in gardening?	None	39	86.7%	17	85.0%	0.121
	Less than 1 hour	2	4.4%	3	15.0%	
	1-3 hours	4	8.9%	0	0.0%	
	More than 3 hours	0	0.0%	0	0.0%	
9- How do you describe your walk?	Slow (less than 3 miles per hour)	8	17.8%	5	25.0%	0.402
	Moderate	23	51.1%	10	50.0%	
	Active	13	28.9%	3	15.0%	
	Fast (more than 4 miles per hour)	1	2.2%	2	10.0%	

Table 8:- GPPAQ4-level Physical Activity Index according to the body weight status.

	Obese	Overweight	Healthy weight	Underweight
Inactive	13 (65%)	19 (43.2%)	39 (25.5%)	4 (10.3%)
Moderately inactive	5 (25%)	17 (38.6%)	21 (13.7%)	7 (17.9%)
Moderately active	1 (5%)	5 (11.4%)	42 (27.5%)	10 (25.6%)
Active	1 (5%)	3 (6.8%)	49 (32%)	18 (46.2%)

Table 9:- Scoring system for frequency of unhealthy food consumption in KomPAN questionnaire according to body weight status.

	Obese (Mean score)	Overweight (Mean score)	Healthy weight (Mean score)	Underweight (Mean score)
Q1	0.703	0.578	0.703	0.323
Q2	0.689	0.689	0.495	0.495
Q3	0.628	0.628	0.628	0.28
Q4	0.499	0.499	0.628	0.628
Q5	0.802	0.592	0.581	0.581
Q6	0.9	0.506	0.667	0.667
Q7	0.635	0.635	0.578	0.578
Q8	0.703	0.703	0.592	0.409
Q9	0.603	0.603	0.624	0.323
Q10	0.696	0.696	0.538	0.538
Q11	0.9	0.703	0.495	0.495
Q12	0.689	0.689	0.667	0.409
Q13	0.628	0.628	0.578	0.323
Q14	0.592	0.592	0.409	0.409
Total score	9.667	8.741	8.183	6.458

Ethical Approval

This was gained from the local Research Ethics Committee (LREC) of University of Tabuk. Approval number UT-175-39-2022. Written permission and verbal consent were sought from the respondents before commencement of the study. Participants were also guaranteed of the confidentiality as well as were notified that the participation would be voluntary in the study.

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