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RESEARCH ARTICLE

CORRELATION OF BODY MASS INDEX AND LIFESTYLE PATTERNS WITH ACADEMIC ACHIEVEMENT AMONG FEMALE HIGH SCHOOL STUDENTS IN AL MADINAH, KSA: A POPULATION-BASED STUDY

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Abstract

Background: Obesity and unhealthy lifestyles have been linked to low academic performance.

Aim: To define the prevalence of obesity and unhealthy lifestyle patterns among female high school students and investigate their association with students' academic achievement.

Methods: This analytical cross section study involved 205 female high school students in Al-Madinah, Saudi Arabia. Data collection included personal data, student's grade point average (GPA), dietary habits, body weight and height. Physical activity was assessed using the Allied Dunbar National Fitness Survey "ADNFS" and quality of sleep was measured using the Arabic form of the Pittsburgh Sleep Quality Index questionnaire (PSQI). Stress was measured using the Arabic version of Perceived Stress Scale (PSS).

Results: Nearly 30% of the students were underweight, 53.7% normal weight, 11.2% overweight and only 4.9% obese. Only 13.2% eat 5 servings of fruits and vegetables daily and 29.3% never eat breakfast. Only 10.2% reported good quality sleep and 44.8% reported nil physical activity. Insignificant negative correlation exists between BMI ($r = -.002$), Perceived stress scale score ($r = -.073$), and Sleep quality score ($r = -.071$) with students' GPA. Predictors of lower students' GPA were being in a governmental school ($p = 0.041$) and tobacco smoking ($p = 0.004$).

Conclusion: Underweight is prevalent among students unlike obesity. Low quality sleep and nil physical exercise and low intake of daily vegetable and fruits are also common problems. An awareness program is required to improve diet and lifestyle patterns of students. Further research is needed to investigate underlying factors for underweight and unhealthy life styles among students.

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Introduction:-

Unhealthy lifestyle among students is a major concern worldwide. There is evidence of a direct link between unhealthy lifestyle and decreased academic achievement and cognitive functions among children and adolescents (1). Healthy lifestyle plays a major role in determining students' attention, learning abilities and school attendance therefore their academic achievement and these factors including physical activity, diet, sleep duration and pattern and video games addiction (2).

Obesity in particular is a major medical concern worldwide. According to the World Health Organization (WHO), almost at least 2.8 million die from obesity annually (3). In Saudi population, obesity increased strongly in the last two decades by alarming rates. Saudi women reportedly are suffering from overweight by 75%, and 44% are obese (4). It is reported that Saudi Arabia ranks 29 upon the fattest countries in the world on a 2007 list (5). The estimated percent of overweight and obesity among Saudi children are 23.1%, 9.3% respectively (6).

The prevalence of overweight and obesity between children and adolescents has increased extensively worldwide making it one of the most common long-lasting conditions in this age group (7).

It is reported that children who were obese have a lower score of intelligence quotients (IQs) than non-obese controls (8). Body mass index (BMI) was significantly linked with all students' educational outcomes and obese students were more likely to suffer from school problems, school absences, grade retention, and to be less engaged in school than non-obese children (9). Being obese and eating unhealthy food affects the academic achievement of school children (10).

Physical activity is also reported to be correlated with academic achievement. Physical activity and sports help to improve children academic performance and learning abilities (11). Physical activity especially aerobics were associated with behavioral, cognition and psychological aspects (12). Another study confirmed that low physical activity contributes to poor academic achievement and poor mental health (13). As regards diet, Children who do eat breakfast regularly have a higher IQ compared to those who do not, additionally, regular breakfast consumption may have nutritional as well as social benefits (14).

Adequate Sleep duration have an impact on the mental functions and students' academic achievements (15). Sleeping enough can increase positive attitude about life and improve academic accomplishment (16). Sleep quality significantly correlate with school performance among children and adolescents and sleep has an important role in memory consolidation (17, 18).

Aim of Work

To appraise the prevalence and the impact of overweight and obesity and other lifestyle patterns on female high school student's academic achievement in order to insight policy makers to plan interventions to improve lifestyle behaviors and subsequently, improve student's health status and their academic performance.

Objectives:-

1. To estimate the prevalence of obesity and overweight among female high school students.
2. To assess the pattern of lifestyle behaviors among female high school students.
3. To investigate the relationship of BMI and lifestyle factors with academic achievement among female high school students in Al Madinah, KSA.

Methodology:-

Study design

This is an analytical cross-sectional study.

Study setting and study period

The study was applied in two randomly selected high schools for females in Al-Madinah, KSA during the period from 1st of February 2019 to the end of June 2019.

Study participants, sample size and sampling design

A cluster sampling technique was first applied. Two high schools (one governmental and one private) for females were randomly selected from a list of high schools for females in Al-Madinah, KSA. From each high school, a stratified sample was applied, where a list of classes from each school grade was prepared and then a simple random sample of female students was selected from each class.

Sample size was manipulated using OpenEpi online sample size calculator (19). Inputs entered were prevalence of overweight and obesity among Saudi high school female students of 40.9% assuming 18% of overweight students having low academic achievement versus 7% of normal weight students, yielding a risk ratio of 2.57 (20) at a confidence level of 95%, 5% precision and 80% statistical power. This yielded a sample size of at least 276 female students. A total of 205 students agreed to participate in the study (response rate of 74.27%)

Inclusion criteria for the participants were; high school female student from grades 10 to grade 12 who completed the first term of the scholastic year 2018-2019 and had received their Grade Point Average (GPA) result.

Data collection

A modified version of the "Trent's Regional Strategic Framework for Health Promotion questionnaire" was given to the students (21). The questionnaire included **personal and socio-economic data** (academic grade in which the student is currently enrolled, school type whether governmental or private, the transportation method to/from school, family income and parent's education), **tobaccosmoking habit** (never smoker, X-smoker, current smoker (occasional or daily smoker), **Dietary habits** (weekly frequency of fast food and soft drinks, vegetable and fruit intake as well as daily breakfast intake), **stress**: was measured using the Arabic version of Perceived Stress Scale (PSS) which is composed of 14 items and meant to assess the degree to which circumstances in an individual's life are perceived as stressful and how persons found their life erratic, uncontrollable, and burdened. PSS-14 scores scope from 0 to 56 established that the greater the score the higher the stress level (22), **Physical activity** was measured by using the Allied Dunbar National Fitness Survey "ADNFS" questionnaire which measures the frequency of occasions of vigorous or moderate activity to nil activity measured as levels from Level 5 (12 or more 20-minute occasions of vigorous activity over a four-week period) to Level 0 (no occasions) (23), **quality** of sleep was measured using the Pittsburgh Sleep Quality Index (PSQI) Arabic version of which is composed of 19 items to evaluate subjects sleep quality over the past month. (24), **body Mass Index** was calculated by measuring student's weight in Kilograms by using balance beam scale and height measurement by a wall-mounted stadiometer. BMI was then calculated using the equation ($BMI = \text{weight in kg} / \text{height in m}^2$), the subjects were categorized as underweight ($BMI < 18.50 \text{ kg/m}^2$), normal weight ($BMI 18.5-24.99 \text{ kg/m}^2$), overweight $25-29.99 \text{ kg/m}^2$ and obese $> 30 \text{ kg/m}^2$. Class 1 obesity was classified as BMI of 30 to < 35 , class 2 obesity was classified as BMI of 35 to < 40 , class 3 obesity was classified as BMI of 40 or higher (25).

Outcome measures

The primary outcome estimated the prevalence of obesity between female high school students in Medina. Also, to determine the relationship of the BMI and lifestyle factors (smoking, dietary habits, stress, physical activity, sleeping patterns), type of school whether private or governmental, parent's education and socioeconomic status with the level students' academic performance.

Student's academic achievement: was evaluated by their GPA in percentage at the first semester, grades were categorized as (40-50% low, 50-69% acceptable, 70-79% good, and 80-89 % very good, 90-100% Excellent) as classified by the Ministry of Education, KSA.

Statistical Analysis

Data were entered and analyzed using the Statistical Package for Social Scientists (SPSS) software version 21. Descriptive statistics displayed categorical variables as frequency and percentage. Continuous variables were normally distributed. Correlation of students' GPA with BMI and stress scale score and sleep quality score was performed using Pearson correlation. Correlation of the level of physical exercise with students' GPA was performed using Spearman's correlation. Multivariate analysis using linear regression was performed to investigate for predictors of students' GPA. A P value of less than 0.05 is considered to be statistically significant.

Ethical Approval

An ethical approval was given from Taibah University ethical committee. An administrative approval was obtained from the educational facilities included in the study. An informed consent was obtained from the students' parents. All ethical considerations were followed according to the declaration of Helsinki on ethical values for medical research involving humans were followed (26).

Results:-**Table 1:-** Students' characteristics, distribution of obesity and lifestyle patterns of the studied groups.

variable	No (=205)	Percentage
Academic year:		
10 th grade	59	28.8%
11 th grade	57	27.8%
12 th grade	89	43.4%
School type:		
Public school	120	58.5%
Private school	85	41.5%
Transportation to school:		
Private car	181	88.3%
School bus	13	6.3%
Walking	11	5.4%
Father's education:		
University graduate	136	63.3%
High school	45	22%
Middle school	14	6.8%
Primary school	9	4.4%
Illiterate	1	0.5%
Mother's education:		
University graduate	101	49.3%
High school	65	31.7%
Middle school	24	11.7%
Primary school	11	5.4%
Illiterate	4	2%
Family income:		
<5000 SR	17	8.3%
5000 -< 10000 SR	38	18.5%
10000-<15000 SR	43	21%
15000 SR or more	107	52.2%
Having breakfast:		
Never/rarely	60	29.3%
Usually (3-4 times/week)	100	48.8%
Daily	45	22%
Eating five servings of fruits and vegetables		
Rarely		
1-3times/week	91	44.4%
4-6 times/week	67	32.7%
daily	20	9.8%
	27	13.2%
Fast food intake:		
Rarely	81	39.5%
4-6 meals / week	15	7.3%
1-3meals/week	98	47.8%
Daily meal	11	5.4%
Soft drink intake:		

Rarely	118	57.6%
4 -6cans/week	18	8.8%
1-3 cans/week	47	22.9%
At least 1 can/day	22	10.7%
Tobacco smoking:		
Non- smokers	198	96.6%
Smokers	6	2.9%
GPA		
Acceptable	9	4.4%
Good	16	7.8%
Very good	51	24.9%
excellent	129	62.9%
	Mean	S.D
	3.4634	.81942
Sleep quality index		
Good	21	10.2%
poor	184	89.8%
Sleep quality score	Mean	SD
	8.33	3.25
Perceived stress scale score	Mean	SD
	29.41	7.47
Physical activity		
Nil	102	49.8%
Level one	48	23.4%
level two	23	11.2%
Level three	12	5.9%
Level four	4	2%
Level five	16	7.8%
BMI		
Underweight	62	30.2%
Normal	110	53.7%
Overweight	23	11.2%
Obese	10	4.9%
	Mean	S.D
	21.38	4.68
Obesity class		
class 1 obesity	6	2.9%
class 2 obesity	4	2%

Table 2:- correlation of BMI, perceived stressscore and sleep quality score with students' GPA.

	Correlation Coefficient	P- value
BMI	-.002	.982
Perceived stress scale score	-.073	.300
		.300
Sleep quality score	-.071	.310
Physical exercise	.068	.335

Table 3:- Predictors of student's GPA.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% CI	
	B	Std.	Beta			Lower	Upper

		Error				Bound	Bound
School type	.261	.127	.157	2.059	.041*	.011	.510
transportation	-.159	.161	-.066	-.982	.327	-.477	.160
Father education	.085	.074	.087	1.145	.254	-.061	.231
Mother education	.090	.062	.108	1.465	.145	-.031	.212
Family income	-.025	.059	-.031	-.428	.669	-.141	.091
tobacco smoking	-.422	.143	-.194	-2.94	.004*	-.704	-.139
Eating breakfast	.085	.078	.074	1.091	.277	-.069	.238
Fruits and vegetables intake (.106	.054	.147	1.977	.049	.000	.212
Fast food	.076	.056	.096	1.349	.170	-.035	.187
Soft drinks	.093	.052	-.126	-1.789	.075	-.196	.010
Perceived stress scale score	-.002	.008	-.017	-.242	.809	-.017	.013
Sleep quality scores	-.021	.020	-.082	-1.034	.302	-.060	.019
Sleep quality index	.067	.210	.025	.318	.750	-.348	.482
Physical exercise	-.004	.038	-.007	-.100	.920	-.079	.071
BMI	-.010	.012	-.0057	-.824	.411	-.034	.014

* P less than 0.05 is statistically significant

Table 1 shows that Students from governmental schools constituted 58.5% of the studied group. As regards parents' educational level, 63.3% of fathers and 49.3% of mothers were university graduates. Nearly 52% of the students claimed their family income is 15000 or more Saudi Riyal (SR). Student who have daily breakfast represent only 22% of the group, while 29.3% never eat breakfast. Those who claimed rarely eating 5 daily servings of vegetable and fruits represented 44.4% of the participants. As regards fast foods, 47.8% eat fast food meals 1-3 times/week and 57.6% reported drinking soft drink rarely while those consuming it on daily basis (at least 1 can/day) represented 10.7% of the participants. Tobacco smokers represented 2.9% of the participants. Only 10.2% reported having good quality sleep, and 49.8% of the students reported nil physical activity. The mean (\pm SD) perceived stress scale score is 29.41 ± 7.47 . As regards the BMI, 53.7% of the students were classified as normal, while 30.2% were classified as being underweight. Only 4.9% of the students were obese (2.9% class 1 obesity, 2% class 2 obesity). The mean (\pm SD) overall GPA for all students were 3.46 ± 0.8 . Nearly 63% of the students had an excellent grade at the last term.

Table 2 shows a negative correlation between BMI ($r = -.002$), Perceived stress scale score ($r = -.073$), and Sleep quality score ($r = -.071$) with students' GPA and a positive correlation between physical exercise level and students' GPA ($r = .068$). However, these factors were statistically insignificant.

Table 3 displays the predictors of student's GPA. It showed that being in a governmental school ($p = 0.041$) and tobaccosmokers ($p = 0.004$) were statistically significant predictors of lowered students' GPA. All other socioeconomic and lifestyle factors were statistically insignificant.

Disussion:-

This study demonstrates that 53.7% of the female students have normal weight and only 4.9% are obese, while underweight is prevalent among them (30.2%). These figures are close to those reported by Sabra, 2014 who investigated nutritional problems among female intermediate nursing schools in Dammam, KSA and reported 51.5% had normal weight, and only 3.8% were obese while 19.2% were underweight, a figure that is lower than that reported in the current study (27).

As regards body mass index, a study in Hail, Saudi Arabia documented a mean BMI of 23.5 ± 5.28 kg/m² among Saudi teenagers (12-16 years), which is close to current study's findings of a mean BMI 21.38 ± 4.68 among female high school students (28).

Concerning tobacco smoking, a study in Dammam City, KSA enrolled 1020 female non-medical college students reported that 8.6% are tobacco smokers, a figure that is higher than that reported in the current study (2.9%). This may be due to population differences as the current study enrolled high school students while the Dammam study enrolled older college students (29).

Sleep quality was reported as poor by most of the participants in this study (89.9%). This agrees with a study done in Riyadh including Al-Mareefa college students which reported that approximately 71% of the students experienced tiredness in most days and had a day time sleepiness(30). Also, in accordance with the present study, a study by AlZamil et al, 2019, who investigated lifestyle patterns among female college students and reported that 95% of females had insufficient sleep (<8 h/night). They also reported that approximately 50% of the participated females were inactive, a finding agreed with the current study results which reported 49.8% of the participants being physically inactive (31).

As regards predictors of lowered academic performance, the current study revealed that smoking is significantly independently related with lower GPA ($P = 0.004$). This outcome is consistent a review including 28 studies, concluding that all researches found an inverse relationship between tobacco use and academic accomplishments and stated that students with good academic achievement have good cognitive ability to decide being away from unhealthy behavior(32).

A positive correlation was found in previous studies between academic achievements and family income(33). However, family income and GPA showed insignificant correlation ($p=0.66$) in the current study.

Parents' educational level was insignificantly correlated to student's GPA. This finding is in agreement with many other studies (34,35), all documented no significant relationship between parents' level of education and academic performance among College students.

The current study also shows that being in a public school is a predictor of lower GPA. This is in line with a study which reported that academic achievement of private school students is higher than those in public schools(36).

In the current study, obesity was not a predictor of student's GPA. A study conducted in Taif, Saudi Arabia, reported a similar finding but noted that obese students got lower grades in physics specifically compared to normal weight students (37).

Across-sectional study found that students who eat breakfast regularly, fruits, vegetables, and milk products contributed to high school achievements (38). In the current study, results showed that fast food consumption, breakfast, soft drinks and physical activity is not a predictor of students' GPA ($P>0.05$). As regards to physical activity, the finding of the current study is consistent with a study conducted in Japan reporting no significant relation between overall grade point average of junior high school girls and fitness score (39). As regards diet, Ruthiget al, 2011 found that diet and academic performance are not related to each other (40). However, other studies showed that unhealthy dietary habits such as increasing fast food consumption, skipping breakfast and drinking beverages is associated with decreased academic performance (41,42,43,44). This controversy may be due to methodological differences as the current study is a cross sectional one.

Many studies found a investigate stress and its impact on students academically. Students afraid of failure at school, difficult exams, too many requirements, and tasks, their parental expectations and their fear about the future career (45). However, the results of present study showed an insignificant correlation between perceived stress scale scores and students' GPA ($P\text{-value} = 0.300$). In accordance with the findings of the current study, Shah et al, 2010 showed that perceived stress and medical student's academic achievement were insignificantly correlated (46). Shalaby et al, 2017 also found that among critical care nursing students, the academic achievement is not significantly correlated with the students' perceived stressors (47).

Low school achievement by students was studied to be associated with inadequate sleep duration or poor-quality sleep. It is reported that inadequate sleep can result in increased daytime sleepiness and, therefore, lead to problems with attention, concentration and cognitive functioning (48). In the current study there was no significant association between poor sleep quality and decreased academic performance. This is compatible with Howell et al, 2004, who reported no correlation between sleep quality scores and GPA scores for 414 college students using Pittsburgh Sleep Quality Index (49).

Coordinated efforts of school health programs and primary care services can help students attain full academic potential and healthy life. School health program can provide students with the skills, social support, and environmental reinforcement they need to adopt long-term, healthy lifestyle behaviors. While, Primary care

physicians are capable of preventing and treating nutritional problems in children and improving lifestyle behaviors by coordinating efforts within the primary care setting and resources within the community settings by adopting interventions such as healthy lifestyle promotion, weight assessment and monitoring, community health education and policy advocacy.

Conclusion:-

There is low prevalence of obesity among female high school students in Al-Madinah, while underweight is a noticeable nutritional problem among them. Never eating breakfast or daily vegetables and fruits, nil physical exercise and poor sleep quality are prevalent lifestyle problems among them. BMI is not correlated with students' GPA as indicator of academic achievement. Only tobacco smoking and being in a governmental school are predictors of poor academic performance among female students in high school in Al-Madinah. An awareness program is required to improve dietary habits and lifestyle patterns of female students. Provision of school meals for the students as a component of the school health service program would be of value in controlling for malnutrition problems among them. Further research is needed to investigate underlying factors for underweight and unhealthy life styles among these students.

Conflict of interest:

None.

Source of funding:

None.

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