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Relationship Between Self-Reported Dietary Intake and Measured Physical Activity among Male Students in the Preparatory Year in University of Dammam in Saudi Arabia

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ABSTRACT

The transition from high school to university life is associated with increased body mass. The current study examined the relationship between physical activity levels and food habits among male students in the Preparatory Year at the University of Dammam in Saudi Arabia. Participants included 67 male students (age = 20.0 ±1.2 years, and BMI = 23.9 ±6.1 kg/m^2), and the study employed a cross-sectional design and was conducted in the 2nd semester of 2014. Participants completed a dietary questionnaire and wore accelerometers (ActiGraph-wGT3X-BT) for 7 consecutive days. The active group consumed dairy products, vegetable, and fruits 4-6 times a week compared with the non-active group who consumed these types of food only 1-3 times a week. The active group had lower BMI compared to the non-active group ($p = 0.048$). A linear regression showed that living on campus was the strongest associated factor that explained change in MVPA. Active commuting through walking was associated with increased MVPA. Increasing MVPA from 30 to 60 minutes was associated with lower BMI and increased fruit and vegetable consumption in university male students in their preparatory year.

Key words: Self-reported dietary intake, MVPA, KSA.

INTRODUCTION

The transition from high school to university life is associated with increased body mass and decreased qualy of diet[1-3]. This phenomenon has been discussed under the expression 'fresher 15' which means students are expected to gain approximately up to 15 pounds of body mass after the first year of university. This decline in healthy lifestyle and increased body mass are expected to increase with the progression of university life. Increased physical activity among university students is important to tackle the problem of obesity.

Physical activity levels are associated with several positive factors including mental, psychological and behavioral aspects among college-age students. For example, meeting the moderate-vigorous physical activity (MVPA) recommendation was associated with several protective factors, including adequate daily fruit and vegetable consumption, positive perception

of general health, not smoking cigarettes, less perceived depression, and adequate sleep[4]. Another study found that university students who met the MVPA recommendation reported less frequent depressive symptoms than their peers who did not[5]. While there appears strong relationships between increased physical activity levels and diverse aspects of health such as eating behavior, most university students did not meet the guideline of physical activity and the adopt a healthy diet, including the daily servings of fruit and vegetable intake and fiber consumption[6].

The university lifestyle in Saudi Arabia may differ from Western countries in many aspects. For example, while weekly alcohol intake significantly increased among fresher students in the Western society[7] and this would have an impact on total energy intake, Saudi law does not allow alcohol consumption. Interestingly, a recent study found that perceived stress and morning cortisol levels among fresher Saudi students did not change in the Preparatory Year, which suggested good adaptation to the first year of university life, and this was contradictory to some Western studies[8]. Furthermore, differences are also apparent among different races in the same community. For example, among US high school students, TV viewing was associated with obesity and insufficient fruit and vegetable consumption among white males. However, no significant associations were found among Hispanic males, while TV viewing was associated with greater participation in physical activity among black males[9]. These differences between races and societies suggest the importance of carrying out further studies to examine the lifestyle of Saudi fresher students in order to design appropriate healthy lifestyle programs. Therefore, the aim of current study was to examine the relationship between physical activity levels and food habits among male students in the Preparatory Year at University of Dammam in Saudi Arabia.

METHODS

Participant characteristics

Participants were recruited from the Preparatory Year student at University of Dammam in Saudi Arabia via flyers posted on the students' noticeboards. The total number of students who responded to participate in the current study was 96 male students out of approximately 700 students in the Preparatory Year. A written informed consent was signed by all participants. A total of 21 participants did not achieve the required daily wearing time of the ActiGraph accelerometers used in this study. Out of the remaining 75 participants, another 8 participants were excluded. These included 5 participants who had food sensitivity, a participant who had a gland abnormality and two participants did not complete a food habits questionnaire. None of the participants had diabetes, but 14 participants had some other health concerns (mostly Asthma and Anemia). None of these health concerns prevented participants from engaging in exercise training. The total included participants was 67 (age = 20.0 ±1.2 years, height = 171.5 ±6.1 cm, weight = 70.5 ±18.5 kg, and BMI = 23.9 ±6.1 kg/m^2).The study protocol was approved by the Internal Review Board at University of Dammam (IRB No. 2014-14-077).

Study procedure and data management

The study employed a cross-sectional design, conducted at University of Dammam during the 2nd semester of 2014. Participants attended at Training Hall at Preparatory Year College. After signing the consent form, height was measured to the nearest 0.5 cm, and weight was measured to the nearest 0.1 kg, using a digital stand scale fitted with a height column (GIMA S.p.A., code 27288, CE 0476, Italy).

Participants completed a diet and health questionnaire, which contained 24 questions distributed throughout 4 factors including; demographics, free daily activity, medical history, and food habits. This questionnaire was adapted from a previous questionnaire carried out on the Saudi population. Participants answered the questionnaire by selecting one of three to five options for each question, such that the frequency in each question was indicated by number from 1 to 5. For example, frequency of food consumption were expressed as 1, 2, 3, and 4 which respectively means $\leq$ 1, 1-3, 4-6, and $\geq$ 7 times a week.

Physical activity was measured using accelerometers (ActiGraph-wGT3X-BT) for 7 consecutive days. Accelerometers were initialized for each participant, and all participants were asked to

wear the devices on their right hip throughout the day except for sleep time and water contact. Dependent variables obtained from the accelerometers were computed using ActiLife software (ActiLife, v 6.11.6., 2009, ActiGraph, LLC, USA). Wear time validation was computed using the Troiano algorithm. A period of wearing was considered as a non-wear period when 60 minutes or more of vector magnitudes were determined to be zero (continuous inactivity), allowing 2 minutes of consecutive intervals with non-zero less than 100 counts per minute. Vector magnitude thresholds were divided into five categories according to the Freedson cut point for adults as follows: sedentary was 0-99, light was 100-1951, moderate was 1952-5724, vigorous was 5725-9498, and very vigorous was 9499 and above. A minimum of 10 hrs of wear time per day for a minimum of 3 days (including 1 weekend day) was required to be considered as the minimum inclusion criteria.

Statistical analysis

Data were analyzed using SPSS version 20 for Windows (IBM SPSS statistics 20, SPSS Inc. USA). Prior to analysis, the data were checked for normality and the existence of any outliers. Data were presented as mean values and standard deviations. Descriptive statistics and frequency of daily and/or weekly physical activity (PA) and food habits were calculated for both percentage and absolute values. One way ANOVA was used to examine differences in the dietary intake variables based on MVPA, living place and types of transportation. Multiple linear regression was used to compute the model of significant independent variables on MVPA. A mixed linear model ANOVA was used to assess the interaction between living place and transportation. Post-hoc analyses were conducted using a Scheffe test. A α-level of 0.05 was used to determine statistical significance.

RESULTS

Descriptive data of daily activity and food habits showed that 29.9% and 34.4% of participants eat fruit and vegetables only once or less per week. The same was true among 19.4% of the participants for the consumption of dairy products (Table 1 and 2).

Table 1: Descriptive data of Saudi university male students, including their daily physical activities (n=67).

Variables	%	Variables	%
Study route		Living place	
Art	34.3	Dammam &Khobar	46.3
Science	32.8	Qatif	29.9
Health	32.8	Uni-Housing	23.9
Watching TV		Using computer	
(< 1 hour a day)	62.7	(< 1 hour a day)	28.4
(1-3 hours a day)	22.4	(1-3 hours a day)	52.2
(> 3 hours a day)	14.9	(> 3 hours a day)	19.4
Video games		Sleep	
(< 1 hour a day)	62.7	(< 7 hours a day)	50.7
(1-3 hours a day)	16.4	(7-8 hours a day)	32.8
(> 3 hours a day)	20.9	(> 8 hours a day)	14.9
Daily Activity (Accelerometer)		Activity perception	
Sedentary time	66.2	Sedentary	16.4
Light physical activity	28.5	Moderately active	46.3
MVPA	5.2	Active	35.8

MVPA: moderate to vigorous physical activity. BMI: body mass index.

There was no significant difference between participants who sat more than 9.5 hrs a day and those individuals who sat less than 9.5 hrs a day in all variables related to body composition, daily activity habits, and food habits. The only exception to this was the time spent playing video games (2.8 ±0.8 vs. 2.3 ±0.6 hrs/day; p = 0.03). There was also no significant difference between groups based on sedentary time in daily light physical activity as measured by the Actigraphs, however, the difference was significant for MVPA between those participants who sat less than 9.5 hrs a day and their peers who sat more than 9.5 hrs a day (55.1 ±33.0 vs. 34.9 ±16.2 mins/day; p = 0.001). Participants were also divided into 3 sedentary time groups (less than 8 hrs, 8-10 hrs, and more than 10 hrs). The significant differences were similar to the difference between the two subgroups, who sat less than and more than 9.5 hrs.

Participants were divided based on their MVPA into three groups (< 30 mins, ≥ 30 to < 60 mins, ≥ 60 mins a day). There were no significant differences between variables related to free daily physical activity habits and some food habits, whereas there were significant differences in some variables as shown in Table 3. The active group (G3) consumed dairy products, vegetable, and fruits 4-6 times a week while the non-active group (G1) consumed these types of food 1-3 times a week. In addition, the active groups (G3) had lower BMI compared with non-active group (G1) (p = 0.048).

Multiple linear regression for food independent variables (dairy products, fruit, and vegetable) showed that these variables explained 18% of changes in MVPA (F = 4.1, p = 0.01), with the highest B value for fruit intake which approached significance (B = 8.7, p = 0.052) and the lowest was

Table 2: Descriptive data of Saudi university male students, including their food habits (n=67).

Variables	%	Variables	%
Having snacks (≤ once a day)	59.7	Having breakfast	50.7
Grains intake		Fast food intake	
		Never	17.9
(≤ 1 time a week)	3.0	(≤ 1 time a week)	23.9
(1-3 times a week)	28.4	(1-3 times a week)	37.3
(4-6 times a week)	26.9	(4-6 times a week)	7.5
(≥ 7 times a week)	41.8	(≥ 7 times a week)	13.4
Soft drinks consumption		Energy drinks consumption	
Never	9.0	Never	61.2
(≤ 1 time a week)	23.9	(≤ 1 time a week)	20.9
(1-3 times a week)	25.4	(1-3 times a week)	10.4
(4-6 times a week)	19.4	(4-6 times a week)	4.5
(≥ 7 times a week)	22.4	(≥ 7 times a week)	3.0
Dairy intake		Protein intake	
(≤ 1 time a week)	19.4	(≤ 1 time a week)	7.5
(1-3 times a week)	32.8	(1-3 times a week)	19.4
(4-6 times a week)	31.3	(4-6 times a week)	17.9
(≥ 7 times a week)	16.4	(≥ 7 times a week)	55.2
Vegetable intake		Fruits intake	
(≤ 1 time a week)	34.3	(≤ 1 time a week)	29.9
(1-3 times a week)	31.3	(1-3 times a week)	38.8
(4-6 times a week)	17.9	(4-6 times a week)	19.4
(≥ 7 times a week)	16.4	(≥ 7 times a week)	11.9

MVPA: moderate to vigorous physical activity. BMI: body mass index.

the consumption of dairy products. Independent variables (living place, transportation, and BMI) were included to the model, and independent variables explained 44% of changes in MVPA (F = 6.2, p = 0.001). The highest B value was living place (B = 15.7, p = 0.001), and vegetable intake was the second which did not approach significance (B = 6.1, p = 0.06), Table 4.

Differences between groups based on living place (Table 5) and type of commuting (Table 6) were considered. Participants were asked how they commuted in their daily life including coming to the university. A total of 39 respondents their own car, 10 walked, 2 accompanied friends, 12 used a private driver, and 3 used other methods. Comparisons were subsequently made between participants who used their own car, those who walked, and those who used a private driver. It is interesting to note that there was an interaction between living place and type of commuting on fruit intake (p = 0.004) and light activity (p = 0.013). The interactions did not approach significance for dairy intake (p = 0.06), MVPA (p = 0.07), sleep (p = 0.07), and vegetable intake (p = 0.14).

Table 3: Differences between university students in body composition and food habits, based on their daily MVPA

Variables	G1: < 30 (n=26)	G2: ≥ 30 to < 60 (n=28)	G3: ≥ 60 (n=13)	P values
BMI (kg/m^2)	25.8 ±7.8	23.5 ±4.6	20.8 ±3.2	0.048 (G1 > G3)
Transportation	1.4 ±0.8	1.5 ±0.8	2.2 ±0.9	0.04 (G3 > G1)
Living place	1.3 ±0.5	1.9 ±0.8	2.3 ±0.8	0.001 (G3 & G2 > G1)
Dairy intake per week	2.1 ±0.9	2.5 ±1.0	3.0 ±0.9	0.04 (G3 > G1)
Vegetable intake per week	1.8 ±0.8	2.1 ±0.9	2.9 ±1.0	0.02 (G3 > G1)
Fruit intake per week	1.8 ±0.8	2.1 ± 0.9	2.9 ±0.8	0.008 (G3 > G1 & G2)

Data expressed as mean ±SD. MVPA: moderate to vigorous physical activity. BMI: body mass index. Frequency of transportation was expressed as 1, 2, and 3 which respectively mean using their own cars, walk, and go with driver. ; Frequency of living places was expressed as 1, 2, and 3 which respectively mean Dammam and Al-Khobar, Qatif, and Uni-housing. ; Frequency of consumption was expressed as 1, 2, 3, and 4 which respectively mean ≤ 1, 1-3, 4-6, and ≥ 7 times a week.

Table 4: Linear regression model of significant independent variables (free living and food habit) on MVPA for Saudi university male students

Model	Independent variables	B	t	P	F	R^2
1 (All)	Living place	15.7	3.5	0.001	6.2	0.44
	Vegetable intake per week	6.1	1.8	0.06		
	Transportation	3.8	1.0	0.3		
	Diary intake per week	2.9	0.9	0.3		
	Fruit intake per week	0.8	0.2	0.8		
	BMI (kg/m^2)	0.1	0.04	0.9		
2 (Food)	Fruit intake per week	8.7	1.9	0.05	4.0	0.18
	Vegetable intake per week	4.4	1.0	0.2		
	Diary intake per week	1.9	0.5	0.6		

MVPA: moderate to vigorous physical activity. BMI: body mass index

DISCUSSION

The aim of current study was to examine the association between objectively measured PA and reported free living activities and food habits in university male students in Saudi Arabia. Results showed that active students via increased of daily MVPA had lower BMI, used active commuting, lived on campus, and consumed fruit, vegetable, and dairy products to a greater extent than inactive students. Living on campus, increased the consumption of vegetable and fruit were the most factors that explained changes in MVPA, and living on campus was the strongest. Lower BMI was found with increased PA levels, specifically ≥ 60 minutes of MVPA per day. Increased MVPA, fruit

Table 5: Differences between Saudi university male students in body composition, daily physical activity, and food habits based on their living places.

Variables	G1: Dammam &Khobar (n=31)	G2: Qatif (n=20)	G3: Uni Housing (n=16)	P values
BMI (kg/m^2)	26.3 ±7.7	22.4 ±3.7	21.1 ±2.1	0.007 (G1 > G3)
Video games	2.4 ±0.7	3.0 ±0.9	2.3 ±0.7	0.02 (G2 > G1 & G3)
Transportation	1.3 ±0.8	1.5 ±0.8	2.1 ±0.9	0.04 (G3 > G1)
MVPA (mins/day)	34.9 ±25.1	40.2 ±16.9	69.7 ±28.9	0.001 (G3 > G1 & G2)
Vegetable intake per week	1.9 ±0.9	1.8 ±0.9	3.0 ±1.1	0.001 (G3 > G1 & G2)
Fruit intake per week	1.7 ±0.8	2.1 ± 0.9	2.9 ±0.9	0.001 (G3 > G1 & G2)

Data expressed as mean ±SD. MVPA: moderate to vigorous physical activity. BMI: body mass index. Frequency of playing video games was expressed as 1, 2, and 3 which respectively mean < 1, 1-3, and > 3 hours a day.; Frequency of transportation was expressed as 1, 2, and 3 which respectively mean using their own cars, walk, and go with driver. ; Frequency of consumption was expressed as 1, 2, 3, and 4 which respectively mean ≤ 1, 1-3, 4-6, and ≥ 7 times a week.

Table 6: Differences between Saudi university male students in body composition, daily physical activity, and food habits, based on transportation types (n=61).

Variables	G1: Own car (n=39)	G2: Walking (n=10)	G3: Driver (n=12)	P values
BMI (kg/m^2)	25.3 ±7.2	20.9 ±2.5	22.5 ±3.8	NS
Living places	1.5 ±0.7	2.5 ±0.7	2.0 ±0.8	0.001 (G2 > G1)
Sleep	1.6 ±0.7	1.1 ±0.3	2.1 ±0.8	0.008 (G3 > G2)
MVPA mins/day	35.0 ±16.2	60.9 ±34.1	53.0 ±30.0	0.002 (G2 > G1)
Fast food intake	3.3 ±1.1	2.1 ±0.8	2.0 ±1.2	0.001 (G1 > G2 & G3)
Soft drinks consumption	3.5 ±1.3	2.5 ±1.1	2.8 ±1.1	0.03(G1 > G2)
Energy drinks consumption	1.5 ±0.8	2.5 ±1.6	1.3 ±0.7	0.02 (G2 > G3)
Dairy intake	2.3 ±0.8	3.3 ±0.9	2.3 ±1.3	0.02 (G2 > G1)
Vegetable intake per week	1.8 ±0.9	3.0 ±0.8	2.5 ±1.3	0.01 (G2 > G1)
Fruit intake per week	1.7 ±0.8	3.4 ± 0.6	2.3 ±1.1	0.001 (G2 > G1 & G3)

Data expressed as mean ±SD. MVPA: moderate to vigorous physical activity. BMI: body mass index. Frequency of living places was expressed as 1, 2, and 3 which respectively mean Dammam and Al-Khobar, Qatif, and Uni-housing. ; Frequency of sleep was expressed as 1, 2, and 3 which respectively mean < 7 hrs/day, 7-8 hrs/day, and >8 hrs/day. ; Frequency of consumption was expressed as 1, 2, 3, and 4 which respectively mean ≤ 1, 1-3, 4-6, and ≥ 7 times a week.

and vegetable consumption are recommended and further examinations of differences between living on and off campus are warranted.

Only 23.8% of the participants engaged in more than 60 minutes of MVPA, whereas 38.8% of the participants did not engage in 30 minutes of MVPA. The current prevalence of physical inactivity among first-year university students is lower than the prevalence of a similar group from our previous study which reported 64% of inactive participants [10]. It should be noted that our previous study used a physical activity questionnaire whereas the current study used a robust objective measure. There is a possibility that participants who are dedicated to wearing accelerometers for 7 days are those students who are actually active. Lastly, the current sample size was small, and included 12 Yemenis who have not grown in Saudi Arabia, and may not represent Saudi male students. Increased sample size using objective measure of physical activity is needed to determine the prevalence of active and non-active university students.

The first main finding of the current study was that an increased level of MVPA from 30 to 60 minutes was significantly associated with decreased BMI, and the significant difference in BMI was found between the active group who spent more than 60 minutes per day in MVPA and the non-active group who spent less than 30 minutes per day of MVPA. General recommendations have suggested that all adults should engage in moderate intensity exercise for 30 minutes, 5 days per week and preferably, this recommendation duration should be reached every day. To lose weight the duration of exercise should increase to 60 minutes. It is known that to prevent weight gain MVPA has to increase from 30 to 60 minutes per day[11]. In addition, the result showed that sedentary and light physical activities were not associated with BMI. A recent study found that there was no significant differences in energy expenditure (EE) from sedentary and light activity in obese and normal weight adults, whereas EE from moderate physical activity (MPA) was significantly lower among overweight and obese adults[12]. It could be concluded that the level of MPA is an indicator of weight control because it appears that it is difficult for adults to maintain lower energy balance, whereas maintaining higher energy balance through increasing the level of MPA is practical with daily lifestyle.

The second main finding of the current research is that MVPA was associated with increased fruit, vegetable and dairy intake. The National College Health Assessment II that recruited 67,861 college students found that meeting the MVPA recommendation was associated with adequate daily fruit and vegetable consumption and healthy BMI[4]. A recent study reported that youth participants who met recommended daily physical activity and muscle strengthening were more likely than those who did not reach these levels, to eat fruit and vegetables[13]. It is important that among undergraduate college students, an attempt to lose weight or to prevent weight gain is associated with the participation in MVPA and vigorous physical activity (VPA) and increased consumption of fruit and vegetable servings[14]. This healthy practice was more pronounced among male students, representing 41% of male students who tried losing weight[15]. Increased MVPA, fruit intake, and vegetable intake are a healthy behavioral cluster that are associated with decreased risk factors of the Metabolic Syndrome[16]. Studies have shown that the majority of adolescents[17] and college-age students[6] did not meet the guideline of physical activity as well as the required servings of fruits and vegetables. Increased physical activity and the consumption of fruit and vegetables are synergistic healthy habits that health promoters use to promote good health in communities. For example, some programs trained adult school site leaders to improve their skills to specifically promote physical activity and fruit and vegetable consumption[18]. Behavioral health programs that promote MVPA and fruit and vegetable consumption among university students are recommended.

Living on campus was the strongest factor that explained changes in MVPA, and was associated with the time spent in walking for transportation. Students usually have to walk from their university residence to lecture classes, and also have to walk to the main student restaurant, in addition to activities after class hours in the green and open spaces of the main campus. There is evidence that neighborhoods containing green

and accessible built environment can encourage physical activity and also promote weight loss[19]. It has been reported that increased body weight at the transition from high school to university is attributed to decreased physical activity and increased sedentary time[7]. The current results, on the other hand, showed that there was an interaction between active commuting through walking and living on campuses on increased fruits and vegetables intake. Some previous studies have suggested that living on campus, or with parents, was better than living off campus with respect to healthy food choice[20]. This appears to be related to the type of restaurants such as dining halls, student unions and snack cafés [21]. Although fruit and vegetable intake increased among students who lived on campus, they are still under the cut off recommended vegetables and fruits intake. Furthermore, the relationship between living on campus and diet may also be affected by the specific eating genera of some students. For example, the most vulnerable students gaining an average of 4.1 kg in the first year of the university life were restrained eaters who lived on campus[22]. It appears that enhanced availability of food, increased portion size, and financial incentives, are all factors that enhanced restrained eaters to increase food intake and gain weight. Future studies should use some methods such as the Three Factor Eating Questionnaire to examine the effect of living on campus on psychological eating behavior.

Participants who relied on active commuting through walking had better healthy diet habits such as including lower soft drink and fast food intake, but they increased energy drink consumption and decreased daily sleep hours. Increased energy drink consumption is common among university students, and reasons for consuming these drinks include insufficient sleep, increased energy, and to drink with alcohol[23]. There are some attitudes related to PA and energy drinks that were not examined in the current study. For example, frequency of energy drink consumption was positively associated with risky and careless behaviors[24]. There also exists an association between physical activity and some risky health habits, including alcohol consumption [25]. Total energy expenditures for the current active participants and their needs and beliefs in relation to the benefits of energy drinks were not examined. Investigating the relationship between increased energy drinks, decreased sleep time, and study time is also warranted.

A limitation of the study was that it did not investigate the role of university duties and its associated factors on physical activity and eating habits. Chronic life stress may lead to greater preference of energy-dense food, with a greater effect being found in men[26]. A self-reported questionnaire was the sole instrument used to investigate the food intake pattern of participants in this study, and this increases errors and inaccuracy. Future studies should examine the association between physical activities and food habits on living on campus in different universities. Programs that promote MVPA and active transportation are highly needed among university students. The impact of physical activity and food intake on health markers among university students should be examined separately and synergistically. In conclusion, increasing MVPA from 30 to 60 minutes was associated with lower BMI and increased fruit and vegetable consumption in university male students in their Preparatory Year. These clustered healthy habits were greater among students living on campus.

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REFERENCES

1. Brunt A, Rhee Y, Zhong L. Differences in dietary patterns among college students according to body mass index. *Journal of American College Health.;* **56**(6):629-34 (2008).
2. Pullman AW, Masters RC, Zalot LC, Carde LE, Saraiva MM, Dam YY, *et al*. Effect of the transition from high school to university

on anthropometric and lifestyle variables in males. *Applied Physiology Nutrition and Metabolism-Physiologie Appliquee Nutrition Et Metabolisme.* **34**(2):162-71 (2009).

3. Small M, Bailey-Davis L, Morgan N, Maggs J. Changes in Eating and Physical Activity Behaviors Across Seven Semesters of College: Living On or Off Campus Matters. *Health Education & Behavior.;* **40**(4):435-41 (2013).
4. Dinger MK, Brittain DR, Hutchinson SR. Associations Between Physical Activity and Health-Related Factors in a National Sample of College Students. *Journal of American College Health.;* **62**(1):67-74 (2013).
5. Harbour VJ, Behrens TK, Kim HS, Kitchens CL. Vigorous physical activity and depressive symptoms in college students. *J Phys Act Health.* **5**(4):516-26 (2008).
6. Huang TTK, Harris KJ, Lee RE, Nazir N, Born W, Kaur H. Assessing Overweight, Obesity, Diet, and Physical Activity in College Students. *Journal of American College Health*.; **52**(2):83-6 (2003).
7. Carde LE, Dam YY, Duncan AM, Masters RC, Pullman AW, Saraiva MM, *et al*. Effect of the transition from high school to university on anthropometric and lifestyle variables in males. *Applied Physiology, Nutrition, and Metabolism.* (2009).
8. Al-Daghri NM, Al-Othman A, Albanyan A, Al-Attas OS, Alokail MS, Sabico S, *et al*. Perceived Stress Scores among Saudi Students Entering Universities: A Prospective Study during the First Year of University Life. *International Journal of Environmental Research and Public Health.* **11**(4):3972-81 (2014).
9. Lowry R, Wechsler H, Galuska DA, Fulton JE, Kann L. Television viewing and its associations with overweight, sedentary lifestyle, and insufficient consumption of fruits and vegetables among US high school students: differences by race, ethnicity, and gender. *Journal of school health.;* **72**(10):413-21 (2002).
10. Al-Hariri MT, Alkahtani SA, Abdelgayed AM. Impact of Life Behaviour on Students Physical Fitness at University of Dammam in Saudi Arabia. 2014.
11. Westerterp KR, Plasqui G. Physical activity and human energy expenditure. *Current Opinion in Clinical Nutrition & Metabolic Care.,* (6):607-13 (2004).
12. Drenowatz C, Jakicic JM, Blair SN, Hand GA. Differences in correlates of energy balance in normal weight, overweight and obese adults. *Obesity Research & Clinical Practice.* (2015).
13. Lowry R, Michael S, Demissie Z, Kann L, Galuska DA. Associations of Physical Activity and Sedentary Behaviors with Dietary Behaviors among US High School Students. *Journal of Obesity*.;2015.
14. Lowry R, Galuska DA, Fulton JE, Wechsler H, Kann L, Collins JL. Physical activity, food choice, and weight management goals and practices among U.S. college students. *American Journal of Preventive Medicine.* **18** (1):18-27 (2000).
15. Lowry R, Galuska DA, Fulton JE, Wechsler H, Kann L. Weight management goals and practices among U.S. high school students: associations with physical activity, diet, and smoking. *Journal of Adolescent Health.* ; **31**(2):133-44 (2002).
16. Pan Y, Pratt CA. Metabolic Syndrome and Its Association with Diet and Physical Activity in US Adolescents. *Journal of the American Dietetic Association.* ;**108**(2):276-86 (2008).
17. Sanchez A, Norman GJ, Sallis JF, Calfas KJ, Cella J, Patrick K. Patterns and Correlates of Physical Activity and Nutrition Behaviors in Adolescents. *American Journal of Preventive Medicine.* **2**;32(2):124-30 (2007).
18. Dzewaltowski DA, Estabrooks PA, Welk G, Hill J, Milliken G, Karteroliotis K, *et al*. Healthy Youth Places: A Randomized Controlled Trial to Determine the Effectiveness of Facilitating Adult and Youth Leaders to Promote Physical Activity and Fruit and Vegetable Consumption in Middle Schools. *Health Education & Behavior.*; **36**(3):583-600 (2009).
19. Li F, Harmer PA, Cardinal BJ, Bosworth M, Acock A, Johnson-Shelton D, *et al*. Built Environment, Adiposity, and Physical Activity in Adults Aged 50–75. *American Journal of Preventive Medicine* ;**35**(1):38-46 (2008).
20. Brunt AR, Rhee YS. Obesity and lifestyle in U.S. college students related to living

arrangemeents. **51**(3):615-21.

21. Horacek TM, Erdman MB, Byrd-Bredbenner C, Carey G, Colby SM, Greene GW, *et al*. Assessment of the dining environment on and near the campuses of fifteen post-secondary institutions. Public Health Nutrition. 2013 Jul ; **16**(7):1186-96 (2013).
22. Pliner P, Saunders T. Vulnerability to freshman weight gain as a function of dietary restraint and residence. *Physiology & Behavior.* 1/28/;93(1–2):76-82 (2008).
23. Malinauskas BM, Aeby VG, Overton RF, Carpenter-Aeby T, Barber-Heidal K. A survey of energy drink consumption patterns among college students. *Nutr J.* ; **6**(1):35-41 (2007).
24. Miller KE. Energy Drinks, Race, and Problem Behaviors Among College Students. *Journal of Adolescent Health*.; **43**(5):490-7 (2008).
25. Anna K. Piazza-Gardner, Adam E. Barry. Examining Physical Activity Levels and Alcohol Consumption: Are People Who Drink More Active? *American Journal of Health Promotion.* **26**(3):e95-e104 (2012).
26. Torres SJ, Nowson CA. Relationship between stress, eating behavior, and obesity. *Nutrition.* ;**23**(11–12):887-94 (2007).