Alkahtani and Awad, J Obes Weight Loss Ther 2016, 6:2
DOI: 10.4172/2165-7904.1000308

Journal of
Obesity & Weight Loss Therapy

Research Article Open Access

Comparing the Physical Activity Patterns of Male and Female Students in the Preparatory Year in Saudi Arabia

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Abstract

Objective: This study examined the differences in physical activity patterns between male and female university students in their Preparatory Year at the University of Dammam in Saudi Arabia.

Methodology: The study was a cross-sectional design that recruited 23 males and 23 females from the Art Route of the Preparatory Year at the university (mean BMI was 24.7 ± 6.4 kg/m^2 for males and 29.3 ± 8.1 kg/m^2 for females). All participants wore accelerometers for 7 consecutive days and completed a diet questionnaire.

Results: Male and female students respectively spent 66.4% and 65.8% of their daily waking time sedentary and 30.1% and 32.1% in light physical activity. Males spent significantly more time (3.5%) in moderate to vigorous physical activity (MVPA) than females did (2.1%) ($P \leq 0.01$). The average levels of MVPA for at least 10 minutes were 14.1 and 12.3 minutes for males and females, respectively. Male and female students spent 65% of their daily sedentary time in prolonged sedentary sessions of more than 20 minutes, with no differences between males and females or between weekdays and weekends. Females showed healthier food habits than males did , through greater vegetable intake ($p \leq 0.05$) and lower consumption of fast food, soft drinks, and energy drinks ($p \leq 0.05$).

Conclusion: Female university students showed lower levels of MVPA compared with males, but they chose healthier food options. Increasing MVPA among female university students should be the priority for university health educators.

Keywords: Physical activity; Males and females; Accelerometer; MVPA; Obesity; Saudi Arabia; Gender differences

Introduction

Obesity has grown worldwide, leading to the increased prevalence of metabolic syndrome and cardiovascular diseases (CVD). Data from the Eastern Province of Saudi Arabia showed that the prevalence of obesity among adults was 43.8% and that 35.1% were overweight; the data found that body mass index (BMI) was associated with diabetes, hypertension, triglycerides, cholesterol, and physical inactivity [1]. The increase in obesity is associated with decreased levels of physical activity [2]. Physical inactivity is the fourth most common risk factor of CVD and is the ultimate cause of obesity. Physical inactivity prevalence reached 96% of the Saudi population, with the highest in the central region (97.3%) and the lowest in the southern region of Saudi Arabia (94.0%); active individuals had lower body mass indexes and smaller waist circumferences [3].

Females have higher levels of obesity and lower levels of physical activity than do males. For example, women showed a higher prevalence of obesity (35–75%) than men (30–60%) in the Eastern Mediterranean region, and the increased prevalence of obesity among women was attributed to multiple factors including dietary habits, socioeconomic factors, and physical inactivity [4]. In a large survey in the Eastern Province of Saudi Arabia, conducted with 195,874 participants in 2004, the results showed that obesity among women was higher than it was among men, especially among housewives and less educated women [1]. Physical activity levels were associated with obesity levels, and female adolescents were less active than male adolescents in the Eastern Province [5]. Another study suggested that the prevalence of overweight was higher among females, whereas obesity was higher among males [6]. The International Physical Activity Questionnaire, which was administered in 20 countries including Saudi Arabia, showed that females were less active than males in early adulthood, although they reached equal levels in middle age [7]. Another review reported that the countries with the lowest prevalence of physical activity among women were Saudi Arabia (2%) and Thailand (2%) [8].

This generation of university students will be community leaders in the near future, and investigating the prevalence of physical activity among this cohort must take priority in education health research. University students are young educated individuals, and they are expected to have lower BMI and higher levels of physical activity. Unfortunately, a study from Kuwait showed that 45% of college-age students were inactive, and females were less active than males. This study recommended that physical activity be made part of the standard college day and that this be a part of academic requirements [9]. At Saudi universities, health and fitness has become a required subject in the Preparatory Year in males and females' curricula in recent years, and this subject can be used to promote physical activity among males and females. It is important to explore the patterns of physical activity among male and female university students, on campus compared with home and on weekdays compared with weekends, in order to provide appropriate recommendations to health educators and decision makers at Saudi universities.

A large body of research supports the use of motion sensors to measure changes in physical activity levels during lifestyle interventions [10,11]. Using motion sensors during daily physical activity provides robust data on the prevalence of physical activity among university students. Whereas most studies in the region used questionnaires to assess physical activity levels in the community, the current study used the gold standard method of measuring activity levels with an accelerometer. This might be the first study that explores the prevalence of physical activity among Saudi females using an accelerometer. The aim of the current study is to assess physical

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Received March 26, 2016; **Accepted** April 20, 2016; **Published** April 23, 2016

Citation: Alkahtani S, Awad N (2016) Comparing the Physical Activity Patterns of Male and Female Students in the Preparatory Year in Saudi Arabia. J Obes Weight Loss Ther 6: 308. doi:10.4172/2165-7904.1000308

activity patterns, using accelerometers, among university male and female students in the Faculty of Education at the University of Dammam in Saudi Arabia. The secondary aim is to assess food habits using a modified questionnaire that was previously used among Saudi adults.

Methods

Participants characteristics: The participants were 46 students from the Faculty of Education at the University of Dammam, 23 males and 23 females. Female students were recruited through announcements on students' noticeboards. Thirty-six female students officially signed the consent form and started the study. The research assistant found that 3 students had a gland abnormality and 2 had food sensitivity, specifically celiac disease. Two students completed the measurement of physical activity using the accelerometer but did not complete the food habits questionnaire. Six students did not reach the required accelerometer wearing time. All of these female students were excluded from the analysis, so that the study eventually comprised 23 female students. None of the students was diabetic. The 23 male participants were extracted from data collected from the same year of the Preparatory Year at University of Dammam, with two conditions: being a registered student in the College of Education and matching the ages of the female students (19-20 years). The mean characteristics of the male and female students were respectively as follows: (height: 169.7 ± 6.5 cm *vs* 157.1 ± 5.3 cm; weight: 71.8 ± 21.2 kg *vs* 72.0 ± 18.2 kg; and BMI: 24.7 ± 6.4 kg/m^2 *vs* 29.3 ± 8.1 kg/m^2). Ethical approval for the current study was obtained from the Institutional Review Board at the University of Dammam (IRB-2015-14-058). Data were collected during the period between 15 March 2015 and 15 May 2015.

Study procedure and data management: The study was conducted at the University of Dammam and employed a cross-sectional design. Male and female participants separately attended arranged clinics at the College of the Preparatory Year. After each participant signed 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). The participants completed a diet and health questionnaire that consisted of 24 questions distributed across 4 categories: demographics, free daily activity, medical history, and food habits. Physical activity was measured using accelerometers (ActiGraph-wGT3X-BT) for 7 consecutive days. Each accelerometer was initialized for each participant, and all participants were asked to wear the devices on their right hip all day except for sleep time and when they made water contact.

The data 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 [12]. A given period of wear time was considered to be a non-wear period when the vector magnitude was zero for 60 minutes or more (continuous inactivity), allowing for 2 minutes of consecutive intervals with non-zero measures of less than 100 counts per minute. Vector magnitude thresholds in counts per minute were divided into five categories according to the Freedson cut-points for adults as follows: sedentary, 0–99; light, 100–1951; moderate, 1952–5724; vigorous, 5725–9498; and very vigorous, 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 in order to be considered valid for inclusion in the study. Additional analysis was conducted of moderate-vigorous physical activity (MVPA) for a minimum of 10 minutes and of a minimum of 20 minutes of sedentary time.

Statistical analysis

The data were analyzed using SPSS version 20 for Windows; before analysis, the data were checked for normality and outliers. The data are presented as mean values and standard deviations. Independent t-tests were conducted between males and females for the PA variables, weekdays versus weekends, minimum of 10 minutes of MVPA, and minimum of 20 minutes of sedentary time. Univariate ANOVA was used to assess the interactions of gender and BMI and of gender and weekdays/weekends with the PA variables. Frequency of food habits was calculated in percents and absolute values. Independent t-tests were also used to examine the differences between males and females in dietary intake. A α-level of 0.05 was used to determine statistical significance.

Results

There were significant differences between males and females in height (169.7 ± 6.4 cm *vs* 157.1 ± 5.3 cm; p = 0.001) and BMI (24.7 ± 6.4 kg/m^2 vs. 29.3 ± 8.0 kg/m^2; p = 0.03). Nearly half, 43.5%, of male students had BMI equal to or greater than 25 kg/m^2, with 26.1% overweight and 17.4% obese. Well over half, 69.6%, of female students had BMI equal to or greater than 25 kg/m^2, with 34.8% overweight and 34.8% obese.

Table 1 shows the differences between the male and female students in objectively measured physical activity for the whole week, on weekdays, and on weekend days. Additional analysis revealed that there were no interactions between gender and weekdays/weekend days with sedentary time (p = 0.7), LPA (p = 0.4) or MVPA (p = 0.5). Male and female students respectively spent 66.4% and 65.8% of their daily waking time sedentary, 30.1% and 32.1% in LPA, and 3.5% and 2.1% in MVPA. Nearly all, 95.7%, female students and 52.2% of male students did not engage in 30 minutes of MVPA. Analysis of MVPA for a minimum of 10 minutes, independent of a 30-minute threshold, showed that 22% of male students and 13% of female students spent a minimum of 10 minutes on MVPA more than once, and 56% of male students and 26% of female students spent a minimum of 10 minutes on MVPA at least once. Total numbers of MVPA sessions per week were 2.5 ± 2.4 and 1.8 ± 1.0 for male and female students, respectively, and the average lengths of an MVPA session were 14.1 ± 3.6 and 12.3 ± 2.2 minutes for males and females, also respectively.

Analysis of sedentary time for a minimum of 20 minutes showed that the total numbers of sedentary sessions were 50 ± 20 and 52 ± 21 for male and female students, respectively, and the average lengths of sedentary sessions were 39.9 ± 9 and 37.2 ± 4.2 minutes for males and females, also respectively Figure 1 show the hours per day of total sedentary time and sedentary time above 20 minutes per session for males and females. Comparisons of the daily hours of sedentary time above 20 minutes for males and females on weekdays (6.7 ± 2.8 *vs* 6.2 ± 2.0 hrs/day) and weekends (6.1 ± 2.3 *vs* 6.3 ± 2.3 hrs/day) revealed no significant differences.

When the variables were divided based on BMI, there were significant differences in time spent watching TV and light physical activity. Participants with BMI > 30 kg/m^2 watched significantly more TV (> 3 hrs/day) than all other BMI groups (13 hrs/day) (p = 0.03), and participants with BMI < 20 kg/m^2 spent significantly less time in light physical activity

	All days		Weekdays		Weekends	
Variables	Males	Females	Males	Females	Males	Females
Sedentary (hrs/day)	9.8 ± 2.0	9.7 ± 1.8	10.1 ± 2.5	9.9 ± 1.8	9.4 ± 2.0	9.6 ± 2.3
LPA (hrs/day)	4.4 ± 1.2	4.7 ± 1.2	4.5 ± 1.2	5.0 ± 1.5	4.2 ± 1.5	4.2 ± 1.2
MVPA (mins/day)	31.7 ± 13.5**	18.6 ± 8.9	32.1 ± 14.1**	20.4 ± 10.1	31.5 ± 16.3**	13.8 ± 9.9

Data expressed as mean ± SD. MVPA: moderate to vigorous physical activity. LPA: light physical activity.
** means males were significantly greater than females at p > 0.01.

Table 1: Differences between male and female university students in objectively measured weekdays and weekends physical activity.

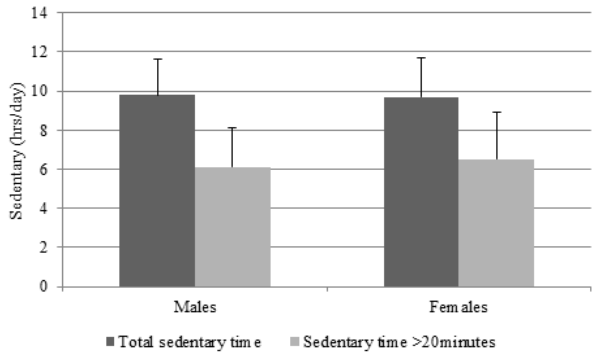

Figure 1: The hours per day of total sedentary time and sedentary time above 20 minutes per session for males and females.

compared with participants with BMI between 20- 24.9 kg/m^2 (3.9 hrs/day *vs* 5.3 hrs/day) (p = 0.04). However, there were no significant differences between groups in MVPA, and there was no interaction between BMI or gender with MVPA (p = 0.9) Figure 2 shows the individual variations in MVPA and BMI for male (a) and female (b) students.

Table 2 shows the frequency of free daily activity and the food habits of the male and female students, and Table 3 shows the significant differences between the male and female students in food habits.

Discussion

The main finding of the current study is that although female students were more obese and less active than males, there was no association between obesity and physical inactivity; other obstacles prevented females from reaching the recommended daily minimum amounts of MVPA. Increasing MVPA in females should be the priority of health promotion programs at Saudi universities, especially at the University of Dammam, where the current study was conducted.

The current data revealed that females were more overweight than males by 8.7%, and they were more obese by 17.4%. Some studies have reported similar rates of overweight among male and female university students and also found that obesity was substantially greater in females than males [13]. The average height of the current female participants was similar to that of other female Saudi university students of the same age, but the weights and BMI of the current cohort were higher [14]. The current small sample size is not representative of university female students, and obese female students may be more inclined to participate in a study that is related to measuring their physical activity and food habits. It is important that the aim of the current study was to compare physical activity patterns among male and female university students, not to establish a prevalence of obesity among Saudi female students.

Physical activity patterns were comparable between males and females on both weekdays and weekends, with high individual variations in MVPA and significantly greater levels of MVPA in males. These results were in agreement with those from a previous study that found similar physical activity patterns between males and females except for MVPA and high individual variations in physical activity [15]. A number of studies have reported that males achieved higher levels of physical activity than females, including university students in Arab countries [16], Asian countries [17], and Western countries [18,19]. Increased MVPA among females should be the first priority at Saudi universities. Changing students' weekend lifestyle habits requires additional studies to investigate the factors that interact with

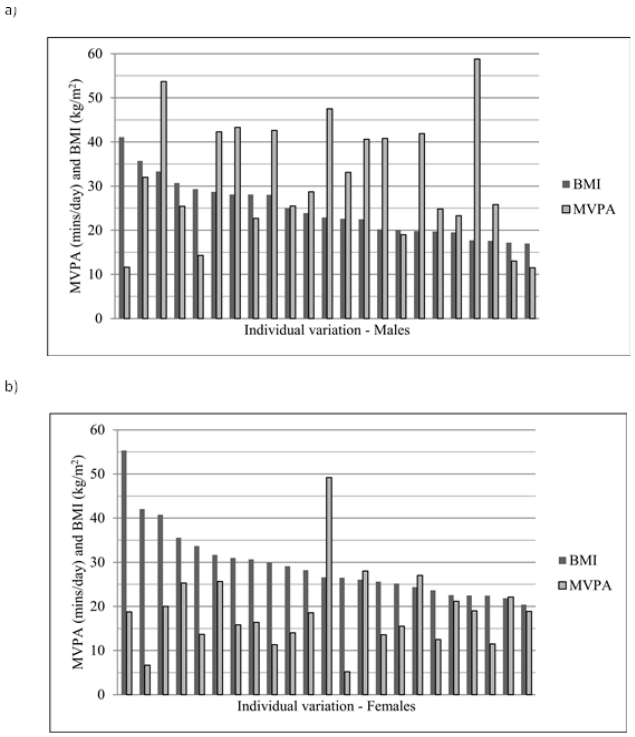

Figure 2: Individual variations in moderate-vigorous physical activity (MVPA) in minutes per day and body mass index (BMI) in kg/m in kg/m^2 for male (a) and female (b) students.

PA patterns on weekends, although it is known that a number of factors can affect physical activity patterns between weekdays and weekends, such as age, residence, and school curriculum. For example, Canadian school students engaged in more MVPA on weekdays than on weekends [20], whereas American male and female university students were more active on weekdays than on weekends [18]. American non-student males and females were more active on weekends than on weekdays [21]. Thus, it is suggested that changes in females' lifestyles to promote physical activity should begin at university, especially the subject of Health and Fitness, which at the university in this study is delivered as a lecture for males and females. The subject can be taught using a different path for females to increase their opportunities to engage in physical activity. It is also suggested that the Deanship of Student Affairs promote physical activity among female students.

The average levels of MVPA for at least 10 minutes were 14.1 and 12.3 minutes for males and females, respectively, which was similar to the findings from a previous study that recruited college-age males and females [18]. Interestingly, when the condition of a minimum of 10 minutes was applied to active college students who achieved 53.9 minutes of moderate physical activity (MPA) and 5.2 of vigorous physical activity (VPA) per day, the average time spent in MPA and VPA per day dropped to 12.5 minutes and 1.4 minutes, respectively [22]. Thus, health education practitioners at Saudi universities should encourage students, independent of gender, to increase their levels of MVPA through activities that require 10 to 15 minutes per session.

There is evidence for associations between prolonged sedentary time and adverse health outcomes. Our results showed that university male and female students spent 65% of their daily sedentary time in sessions longer

Variables	Males	Females	Variables	Males	Females
	%	%		%	%
Watching TV			Using computer		
(< 1 hour a day)	52.2	52.2	(< 1 hour a day)	39.1	21.7
(1-3 hours a day)	39.1	26.1	(1-3 hours a day)	47.8	43.5
(> 3 hours a day)	8.7	21.7	(> 3 hours a day)	13.0	34.8
Video games			Sleep		
(< 1 hour a day)	69.6	78.3	(< 7 hours a day)	43.5	30.4
(1-3 hours a day)	21.7	13.0	(7-8 hours a day)	39.1	52.2
(> 3 hours a day)	8.7	8.7	(> 8 hours a day)	13.0	17.4
Grains intake			Fast food intake		
(≤1 time a week)	0.0	8.7	(≤1 time a week)	30.4	82.6
(1-3 times a week)	30.4	8.7	(1-3 times a week)	56.5	13.0
(4-6 times a week)	34.8	43.5	(4-6 times a week)	13.0	4.3
(≥7 times a week)	34.8	39.1	(≥7 times a week)	0.0	0.0
Soft drinks consumed			Energy drinks consumed		
Never	17.4	8.7	Never	65.2	91.3
(≤1 time a week)	13.0	47.8	(≤1 time a week)	17.4	8.7
(1-3 times a week)	21.7	34.8	(1-3 times a week)	13.0	0.0
(4-6 times a week)	26.1	8.7	(4-6 times a week)	4.3	0.0
(≥7 times a week)	21.7	0.0	(≥7 times a week)	0.0	0.0
Diary intake			Protein intake		
(≤1 time a week)	17.4	26.1	(≤1 time a week)	4.3	8.7
(1-3 times a week)	34.8	30.4	(1-3 times a week)	26.1	21.7
(4-6 times a week)	39.1	21.7	(4-6 times a week)	30.4	39.1
(≥7 times a week)	8.7	21.7	(≥7 times a week)	39.1	30.4
Vegetable intake			Fruits intake		
(≤1 time a week)	43.5	17.4	(≤1 time a week)	39.1	47.8
(1-3 times a week)	30.4	39.1	(1-3 times a week)	52.2	26.1
(4-6 times a week)	21.7	26.1	(4-6 times a week)	8.7	17.4
(≥7 times a week)	4.3	17.4	(≥7 times a week)	0.0	8.7
Having snacks (≤1 a day)	69.5	65.2	Having breakfast	47.8	34.8

Table 2: Descriptive data of free daily activity and food habits for university male and female students, including their food habits. Data is expressed as percentage.

Variables	Males	Females	P values
Fast food intake per week	3.2 ± 0.8	2.4 ± 1.0	0.02
Soft drink consumption per week	3.2 ± 1.4	2.4 ± 0.7	0.02
Energy drinks consumption per week	1.5 ± 0.8	1.0 ± 0.2	0.02
Vegetable intake per week	1.8 ± 0.9	2.4 ± 0.9	0.05

Frequency of consumption were expressed as 1, 2, 3, and 4 which respectively means ≤1, 1-3, 4-6, and ≥7 times a week.

Table 3: Differences between male and female university students in food habits. Data expressed as mean ± SD.

than 20 minutes, with no differences between males and females or between weekdays and weekends. The National Health Examination and Nutrition Survey examined the association between different lengths of sedentary time and cardiovascular risk factors and found that 5 minutes or less was associated with reduced cardiovascular risk factors whereas durations longer than 10 minutes were associated with increased cardiovascular risk factors [23]. Another study used the cut-off of 20 minutes of sedentary time and found that middle-age participants spent 3.1 hours in sedentary sessions of 20 minutes or more, with men spending more time in long sedentary sessions than women [24]. The 20-minute threshold was also used to examine the effect of interrupted sitting on glucose and insulin in overweight and obese adults [25]. University-based programs that encourage interrupted sedentary behaviors in classes and on university campuses are suggested, and techniques such as sit-stand workstations [26] can be examined.

There were no associations between BMI and MVPA in the current non-active cohort; that is, overweight and obesity did not keep individuals from engaging in MVPA. This was in agreement with a study that found that there were no significant differences between university students in MPA or VPA based on BMI. The mean values showed that the healthy weight group achieved the most MPA and VPA, the underweight groups had the least MPA, and the class I obese group had the least VPA [27]. It was reported that BMI did not distinguish university students based on their physical activity levels, although the highest quartiles of physical activity had lower percent body fat and higher lean-tissue mass, independent of gender [28]. Another study also confirmed that BMI was not a significant predictor of physical activity among university students [29]. However, time spent in MVPA was inversely related to BMI among active adolescents who spent more than 60 minutes in MVPA per day [30]. Although female students in the current study were on average overweight and inactive, which was not manifest in the relationship between MVPA and BMI, there was no association between BMI and MVPA among males, who were fitter and leaner than females. It is important to note that obesity and physical activity are parallel health factors, such that underweight and normal weight male and female college students may not be more active than their overweight and obese peers.

The secondary finding of the current study was that female students had better food habits than males. Males more frequently consumed fast food, soft drinks, and energy drinks and less frequently consumed vegetables compared with females. This was in agreement with a study that examined gender differences among young adults from 23 countries in food choices and found that women were more likely than men to make healthy food

choices through avoiding high-fat food and salt and eating fruits and fibers [31]. University male students are more likely to adopt westernized dietary patterns, whereas females are more likely to adopt vegetarian low-calorie dietary patterns [32]. Previous national studies from Australia [33], Canada [34], and the USA [35] reported that women consumed more servings of fruits and vegetables per day than men reported consuming. Increased vegetable consumption among females is expected to be associated with a number of positive health aspects [36]. This eating behavior should be promoted among current male university student, who showed a number of unhealthy eating behaviors such as increased soft drink consumption, energy drink consumption, and fast food intake.

The increased consumption of sugar-sweetened carbonated beverages has been associated with unhealthy dietary choices, including increased fast food intake, among Saudi boys and girls and was associated with increased BMI among boys [37]. Limited studies in the eastern Mediterranean region, such as a study conducted with Kuwaiti university students, showed that increased fast food consumption is associated with overweight [38]. Saudi adolescent males consumed sugar-sweetened drinks, fast foods and energy drinks more frequently than did females [39]. Saudi male university students from the same university as that of the current participants reported a higher frequency of energy drink consumption per week compared with female students, and the prevalence of males who were energy drink consumers was significantly higher than that of females [40]. Similar results were found among male and female university students from Jeddah in Saudi Arabia [41]. Thus, rationales for this eating habit should be monitored among male university students.

Limitations of the current study included the small sample size, which did not represent the Preparatory Year at the University of Dammam. In addition, the patterns of prolonged sedentary behavior such as sitting and standing were not examined. Future studies are suggested to measure PA among male and female university students at different grade levels, and follow-up studies are greatly needed. Investigation of psychological stress and its effects on PA during university life is also suggested. The relationship between prolonged sedentary behavior and health markers such as risk factors for metabolic syndrome is also an important topic for future studies.

Conclusion

The patterns of PA among male and female university students were comparable on both weekdays and weekends except for MVPA, which was substantially greater in males than females. Males and females spent long periods of time sedentary. Females had better food habits than males. Increased MVPA among female university students in Saudi Arabia is encouraged.

Acknowledgment

We acknowledged that there is no conflict of interests. We appreciate kind participation of all students in the study. This is a study project was supported by a grant from Research Center at College of Sport Sciences and Physical Activity and Scientific Research Deanship at King Saud University.

References

1. Al-Baghli NA, Al-Ghamdi AJ, Al-Turki KA, El-Zubaier AG, Al-Ameer MM, et al. (2008) Overweight and obesity in the eastern province of Saudi Arabia. Saudi medical journal 29: 1319-1325.
2. Al-Mahroos F, Al-Roomi K (2001) Obesity among adult Bahraini population: impact of physical activity and educational level. Ann Saudi Med 21: 183-187.
3. Al-Nozha MM, Al-Hazzaa HM, Arafah MR, Al-Khadra A, Al-Mazrou YY, et al. (2007) Prevalence of physical activity and inactivity among Saudis aged 30-70 years: a population-based cross-sectional study. Saudi medical journal 28: 559-568.
4. Musaiger AO (2004) Overweight and obesity in the Eastern Mediterranean Region: can we control it? East Mediterr Health J 10: 789-793.
5. Al-Nuaim AA, Al-Nakeeb Y, Lyons M, Al-Hazzaa HM, Nevill A, et al. (2012) The Prevalence of Physical Activity and Sedentary Behaviours Relative to Obesity among Adolescents from Al-Ahsa, Saudi Arabia: Rural versus Urban Variations. J Nutr Metab 2012: 417589.
6. Al-Almaie SM (2005) Prevalence of obesity and overweight among Saudi adolescents in Eastern Saudi Arabia. Saudi Med J 26: 607-611.
7. Bauman A, Bull F, Chey T, Craig CL, Ainsworth BE, et al. (2009) The International Prevalence Study on Physical Activity: results from 20 countries. The international journal of behavioral nutrition and physical activity 6: 21.
8. Sisson SB, Katzmarzyk PT (2008) International prevalence of physical activity in youth and adults. Obes Rev 9: 606-614.
9. Al-Isa AN, Campbell J, Desapriya E, Wijesinghe N (2011) Social and Health Factors Associated with Physical Activity among Kuwaiti College Students. J Obes 2011: 512363.
10. Colley R (2007) Quantifying the effect of exercise on total energy expenditure in obese women, QLD: Queensland University of Technology
11. De Vries SI, Van Hirtum HW, Bakker I, Hopman-Rock M, Hirasing RA, et al. (2009) Validity and reproducibility of motion sensors in youth: a systematic update. Med Sci Sports Exerc 41: 818-827.
12. Troiano RP (2007) Large-scale applications of accelerometers: new frontiers and new questions. Med Sci Sports Exerc 39: 1501.
13. Mohlala M, Ramalivhana F (2014) Anthropometric and physical activity profiles of University of Venda students, South Africa. African Journal for Physical Health Education, Recreation and Dance: Towards achievement of millennium development goals 20: 435-445.
14. Al-Eisa E, Buragadda S, Melam GR (2014) Association between physical activity and psychological status among Saudi female students. BMC Psychiatry 14: 238.
15. Wickel EE, Eisenmann JC (2005) Within- and between-individual variability in estimated energy expenditure and habitual physical activity among young adults. Eur J Clin Nutr 60: 538-544.
16. El Ansari W, Khalil K, Crone D, Stock C (2014) Physical activity and gender differences: Correlates of compliance with recommended levels of five forms of physical activity among students at nine universities in Libya. Cent Eur J Public Health 22: 98-105.
17. Goje M, Salmiah MS, Azuhairi AA, Jusoff K (2014) Physical Inactivity and Its Associated Factors among University Students
18. Dinger MK, Behrens TK (2006) Accelerometer-determined physical activity of free-living college students. Med Sci Sports Exerc 38: 774-779.
19. Fountaine CJ, Liguori GA, Mozumdar A, Schuna Jr JM (2011) Physical activity and screen time sedentary behaviors in college students. International Journal of Exercise Science 4: 3.
20. Comte M, Hobin E, Majumdar SR, Plotnikoff RC, Ball GD, et al. (2013) Patterns of weekday and weekend physical activity in youth in 2 Canadian provinces. Appl Physiol Nutr Metab 38: 115-119.
21. Young DR, Jerome GJ, Chen C, Laferriere D, Vollmer WM (2009) Peer Reviewed: Patterns of Physical Activity Among Overweight and Obese Adults. Preventing chronic disease 6: A90
22. Raynor DA, Jankowiak NM (2010) Accelerometry-determined adherence to the 2008 physical activity guidelines for Americans among college students. American Journal of Health Education 41: 353-362.
23. Kim Y, Welk GJ, Braun SI, Kang M (2015) Extracting objective estimates of sedentary behavior from accelerometer data: measurement considerations for surveillance and research applications. PLoS One 10: e0118078.
24. Ekblom-Bak E, Olsson G, Ekblom Ö, Ekblom B, Bergström G, et al. (2015) The Daily Movement Pattern and Fulfilment of Physical Activity Recommendations in Swedish Middle-Aged Adults: The SCAPIS Pilot Study. PLoS One 10: e0126336.
25. Dunstan DW, Kingwell BA, Larsen R, Healy GN, Cerin E, et al. (2012) Breaking up prolonged sitting reduces postprandial glucose and insulin responses. Diabetes Care 35: 976-983.
26. Alkhajah TA, Reeves MM, Eakin EG, Winkler EA, Owen N, et al. (2012) Sit-stand workstations: a pilot intervention to reduce office sitting time. Am J Prev

Med 43: 298-303.

27. Deng X, Castelli D, Castro-Pinero J, Guan H (2011) University Students Meeting the Recommended Standards of Physical Activity and Body Mass Index. ICHPER-SD Journal of Research 6: 20-6.
28. Zanovec M, Lakkakula AP, Johnson LG, Turri G (2009) Physical activity is associated with percent body fat and body composition but not body mass index in white and black college students. International Journal of Exercise Science 2: 175-185.
29. Keating XD, Ayers SF, Liu J, Zhou K, Guan J, et al. (2013) Physical activity patterns, perceived health, and BMI among university students. American Journal of Health Studies.
30. Neto AS, Castilho G, Sena JS, Campos WD (2013) Correlation between physical activity measured by accelerometry and BMI in adolescents. Revista Brasileira de Cineantropometria and Desempenho Humano 15: 174-183.
31. Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, et al. (2004) Gender differences in food choice: the contribution of health beliefs and dieting. Ann Behav Med 27: 107-116.
32. Salameh P, Jomaa L, Issa C, Farhat G, Salamé J, et al. (2014) Assessment of Dietary Intake Patterns and Their Correlates among University Students in Lebanon. Front Public Health 2: 185.
33. Sodergren M, McNaughton SA, Salmon J, Ball K, Crawford DA, et al. (2012) Associations between fruit and vegetable intake, leisure-time physical activity, sitting time and self-rated health among older adults: cross-sectional data from the WELL study. BMC Public Health 12: 551.
34. Dehghan M, Akhtar-Danesh N, Merchant AT (2011) Factors associated with fruit and vegetable consumption among adults. J Hum Nutr Diet 24: 128-134.
35. Lutfiyya MN, Chang LF, Lipsky MS (2012) A cross-sectional study of US rural adults' consumption of fruits and vegetables: do they consume at least five servings daily? BMC Public Health 12: 280.
36. Takaoka Y, Kawakami N (2013) Fruit and vegetable consumption in adolescence and health in early adulthood: a longitudinal analysis of the Statistics Canada's National Population Health Survey. BMC public health 13: 1206.
37. Collison KS, Zaidi MZ, Subhani SN, Al-Rubeaan K, Shoukri M, et al. (2010) Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. BMC public health 10: 234.
38. Musaiger AO (2011) Overweight and obesity in eastern mediterranean region: prevalence and possible causes. J Obes 2011: 407237.
39. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO (2011) Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. The international journal of behavioral nutrition and physical activity 8: 140.
40. Alsunni AA, Badar A (2011) Energy drinks consumption pattern, perceived benefits and associated adverse effects amongst students of University of Dammam, Saudi Arabia. J Ayub Med Coll Abbottabad 23: 3-9.
41. Ibrahim NKR, Iftikhar R, Murad M, Fida H, Abalkhaeil B, et al. (2014) Energy Drinks Consumption amongst Medical Students and Interns from Three Colleges in Jeddah, Saudi Arabia. Journal of Food and Nutrition Research 2: 174-179.