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Lifestyle behaviours, dietary habits, physical activity and biochemical measurements in Saudi University students

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ABSTRACT

Introduction: Students worldwide are affected by lifestyle-related diseases. Hence, it was planned to study the association among dietary habits, physical activity, other lifestyle behaviours and biochemical measurements in Saudi university students. *Materials and Methods:* This cross-sectional study consisted of 747 (347 males and 400 females) 18 to 21-year-old healthy students enrolled in the introductory year. Anthropometric measurements, behavioural risk factors (physical activity, dietary pattern, sleep duration and screen time etc) and biochemical variations were assessed using a validated questionnaire. *Results:* Significant differences for male vs. female were found for systolic blood pressure (SBP), diastolic blood pressure (DBP), body mass index (BMI), total cholesterol (TC), fasting blood glucose (FBG), intracellular water (ICW), extracellular water (ECW), skeletal muscle mass (SMM) and percent body fat (PBF). Other measurements showing significant variation were the sum of moderate-intensity activity (METs-min/week), sum of vigorous-intensity activity (METs-min/week), total screen time (hour/day), sleep duration (hour/day), fruit intake (day/week), French fries/potato chips intake (day/week), cake, donut or biscuits intake (day/week) and sweets or chocolates intake (day/week). *Conclusion:* The present study reveals significant impact of unhealthy diet (sweets and fries) and obesity status, low levels of physical activity and high screen time with less sleep duration among university students. Hence, promoting positive physical activity and healthier eating habits should be implemented throughout university education in Saudi Arabia.

Keywords: Lifestyle behaviours, young adults, dietary habits, physical activity, biochemical measurements

1. INTRODUCTION

Association among dietary habits, physical activity and other lifestyle behaviours have been studied from various perspectives. Researchers have found that the body mass index (BMI) is an indicator of good physical function (Peltzer et al., 2014) and sleep quality (Kabel et al., 2018). However,

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an increase in BMI can be explained by the observation that most university students experience lifestyle changes, i.e., staying in university for an extended period of 6-8 hr/day and living autonomously. Other factors include a modified dietary intake (less fibre intake, higher consumption of fried items and fast food, the avoidance of breakfast and frequent meals in the form of snacks), as well as the consumption of sweetened beverages.

Besides the mentioned factors, other significant components among university students are physical inactivity (Peltzer et al., 2014), reduced sleep duration (Velde et al., 2012), lengthened screen time (Wilkie et al., 2016) and increased stress (Kim, 2016). The physical activity, dietary habits and a sedentary lifestyle are vital components and variable aspects of known associations of obesity and other chronic diseases exist. Although participation in physical activity and sedentary lifestyle behaviours usually occur voluntarily, both types of physical activity-related actions may be linked with altered eating patterns.

It was shown that female University students display greater concern in managing their weight, increasing their intake of vegetables and fruits, significantly engaging in exercise, choosing lower sugar and fat foods, maintaining lower calorie intake and becoming more health-conscious in general (Radzi et al., 2019). Previously investigators have found a high prevalence for obesity and overweight in female and male university students (Jiang et al., 2018). Obesity has emerged as a leading factor of public health issues i.e., morbidity and fatality in different parts of the world (Radzi et al., 2019). Abdominal obesity, with a high waist-to-height-ratio (WHtR) and high waist-circumference (WC), was characterized as general obesity having an enhanced risk for cardiometabolic syndrome in adolescents and children. There is an increased risk for many severe diseases and health conditions (musculoskeletal and psychological disorders, cancer) in obese persons and the obesity is a well-known cause of sleeping problems and lower quality of life.

The adult population, especially University students has recently been found to be affected by a growing epidemic of obesity. It is projected that by 2030, almost 573 million and 1.35 billion adults will have obesity and overweight problems respectively and studies conducted in the Arab nations have also shown that obesity among adults is especially high (Ng et al., 2011). In particular, the Kingdom of Saudi Arabia showed an increase in obesity greater than in most other Arab countries.

Data on lifestyle aspects related to obesity among young people in Saudi Arabia is currently limited. Also, existing information indicates that inactivity and unhealthy diet selections are usually associated to BMI in adolescents and children in Saudi Arabia (Al-Hazzaa et al., 2012). Education in university is however associated with a comprehensive change in undergraduate students' life patterns. The students experience enhanced sovereignty, modifications in age groups, a new social life and increased academic responsibilities. These challenges are closely linked to an unhealthy lifestyle and sleep disorders and daily lifestyle habits further transform body composition.

In Saudi Arabia, unhealthy dietary choices were reported in university students (Al-Qahtani, 2016) but the association between lifestyle factors related to body composition parameters and lifestyle behaviours in young adult subjects is unknown. Hence, the present study was planned for the determination of the lifestyle behaviours/factors and biochemical measurements in Saudi (males and females) young university students 18 to 21-year-old enrolled in the preparatory year.

2. MATERIALS AND METHODS

Participants and research design

A total of 965 female and 753 male students were enrolled in the introductory year at King Abdul Aziz University. An invitation email was forwarded to each student explaining the study's purpose and its benefit to his health. Students were authorized as eligible for participating in the survey, with the exclusion criteria for students with a known disability and those with any chronic medical conditions e.g., cancer or kidney disease.

Sample proportion within ± 0.05 (95% confidence interval (CI) for population proportion) was specified to have a minimum sample size for each gender. After the final recruitment, the total sample size consisted of 747 students (347 male and 400 female), out of a total of 1718 enrolled students in the first year (43.4% of the eligible cohort). The age respectively of males and females was 19.1 ± 1.0 years and 19.5 ±1.00 years.

A cross-sectional survey design was utilized for this study. Ethical approval for this study was approved by the King Abdul Aziz University Hospital (KAUH) research ethics committee (Reference No 618-19). Study period started from March 2022 to December 2022. Furthermore, each participant signed an informed consent form before the start of clinical screening.

Protocol and survey design

A timetable was prepared and announced to define specific appointments for each group of students to expedite and improve participation. Qualified technicians performed all the examinations and measurements. Lifestyle habits were assessed using the

Arab Teen Lifestyle Study (ATLS) questionnaire. This self-reported questionnaire is a validated survey to collect information regarding lifestyle, diet patterns and physical activity among young people. The ATLS questionnaire is shown as reliable for the assessment of lifestyle and physical activities in youth aged 14-25 years, and provides detailed information for the assessment of lifestyle variables. This survey gathered all information regarding physical activity (duration, frequency and intensity (light/moderate/vigorous) of a normal 7-day week. A variety of physical activities covering sports activities, general fitness and household activities were included in the questionnaire. The metabolic equivalent (MET) value (METs-min/week) was assigned for each activity depending upon compendium for physical activity as well as to differentiate the activity levels.

The METs-min/week was divided into active and inactive and the physical activity categories were sub-divided classification as: a): Low Active = Total METs- min/week is less than 600 or less than 480 for vigorous activity; b): Medium Active = Total METs-min/week > 600 or > 480 for vigorous activity; and c): High Active = Total METs- min/week > 3000 or > 1500 for vigorous activity.

Sedentary behaviours (screen time) were also recorded. The participants estimated their sleep duration per day. The ATLS questionnaire is based on the assessment of time (hours per day) utilized in sedentary activities, e.g., using computer/ internet /television for enjoyment and video games. Furthermore, participants provided information for total screen viewing time and sleep duration time on weekends and weekdays.

Weekly dietary pattern was also recorded, including how many times per week participants eat dairy products, vegetables, fruits, cake, candy, chocolates, potato chips, French fries, fast food and breakfast. Healthy and unhealthy dietary habits (≥ 5 days per week, 3 to 4 days per week and less than three days per week) were subdivided into categorical variables ranging from never or zero to every day per week.

Anthropometric and health/biochemical measurements

The measurements of stature and waist circumference (WC) were recorded for each participant and all assessments were conducted between 9 am to 2 pm by experienced researchers. Stature was measured employing a portable measuring rod to the nearest 1 cm in a fully erect standing position. A non-stretchable tape at the umbilical plane was placed to measure WC (nearest to 0.1 cm) after the expiration phase. According to standard values, waist circumference > 94 cm was considered high for male subjects and > 80 cm high for female subjects. The cut-off points in adults established by WHO for 18 years of age and over were utilized.

Different parameters of body composition, e.g., extracellular water (ECW), intracellular water (ICW), body mass to nearest 0.1 kg, BMI, waist-hip ratio (WHR)), body fat mass (BFM)), % body fat (PBF), skeletal muscle mass (SMM) and fitness score all were measured directly by bioelectrical impedance analyzer (In Body Co., Ltd. Eonju-ro, Gangnam-gu, Seoul, 06106 Korea). These measurements were performed for the participants without shoes and with minimal clothing under the supervision of trained researchers. For the assessment of ≥18 years old adults, cut-off points for overweight adults as 25 - 29.9 kg/m^2 and obese adults as ≥30 kg/m^2 were used.

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were taken. Fasting blood samples from veins were also collected for the measurement of glucose and cholesterol. A qualified phlebotomist collected all the samples. Fasting blood glucose (FBG) levels were considered normal (less than 100 mg/dL), prediabetes (100 to 125.99 mg/dL) and diabetes (> 126 mg/dL), while blood total cholesterol (TC) was considered normal (< 200 mg/dL) and high levels (> 200 mg/dL).

Participants were instructed to be comfortable and sit quietly for 5 min. A calibrated mercurial sphygmomanometer (Yamasu Model 600, Ichihara, Japan) was used to measure the arterial blood pressure of the right arm. Three readings were taken with a 5 min interval between each reading and the average was employed in the analysis.

Statistical analysis

Descriptive data, mean values and standard deviations (SD) or proportions are presented unless otherwise stated. A T-test for independent samples analysed the variations in lifestyle habits for overweight/ or obese vs non-overweight/non-obese participants. T-tests also assessed variations for physically active vs inactive participants. Given the absence of any significant variation in lifestyle factors for overweight adults and obese adults, both groups were combined as those adults having BMI less than or more than 25 kg/m^2. The SPSS version 23 was employed. Statistical significance relied on: $P<0.05$.

3. RESULTS

All 747 participants responded with timely and complete data (100% response rate). Figure 1 represents the significant differences in participants (males vs. females) for (SBP: 130 ± 15 vs. 118 ± 13 mmHg) and (DBP: 73± 12.8 vs. 69± 9.0 mmHg) ($P<0.0001$).

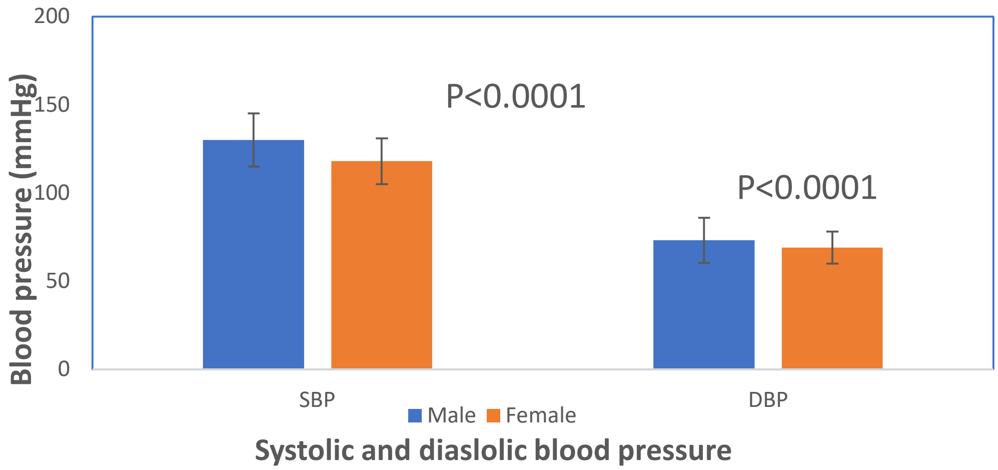

Figure 1 Systolic and diastolic blood pressures of the participants
(SBP: Systolic blood pressure; DBP: Diastolic blood pressure)

Male vs female for age (19.1 ± 1.0 vs. 19.5 ± 1.0 years), height (171 ± 6.8 vs. 156 ± 6.1 cm), body mass (73.4 ± 19.1 vs. 55.3 ± 13.4 kg), WC (84.5 ± 14.6 vs. 72.9 ± 11.6 cm) and BMI (25.03 ± 6.1 vs. 22.9 ± 5.4 kg/m^2) were all found to be having highly significant variations (P<0.0001). The percentage values for underweight, normal, overweight and obese were respectively as 12.7 vs 21.7, 43.6 vs. 48.9, 26 vs. 18 and 17.6 vs. 11.5. Significant difference in TC (mg/dl): 237 ± 53.3 vs. 226 ± 34.5; P< 0.0007) and FBG (mg/dl): 88.3±18 vs 96±26; P< 0.0001) were obtained (Figure 2). Both the ICW (24.12 ± 5.46 vs. 15.46 ± 2.94 L) and ECW (14.14 ± 2.59 vs. 9.65 ± 1.92) gave highly significant differences (P<0.0001; Figure 3).

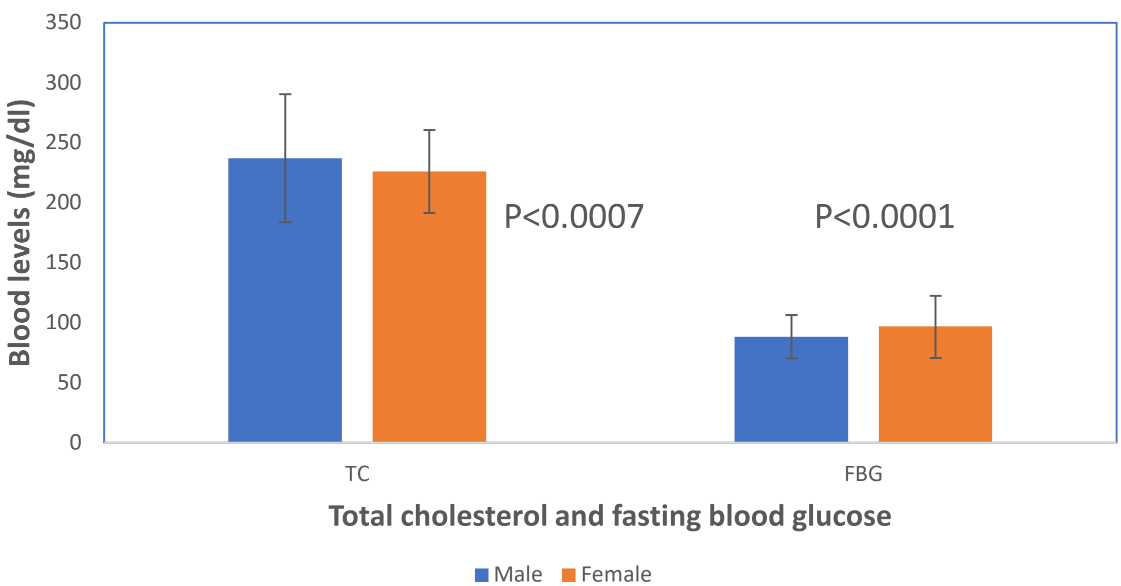

Figure 2 Total cholesterol and fasting blood glucose of the participants
(TC: Total cholesterol; FBG: Fasting blood glucose)

The SMM: 29.38 ± 6.16 vs. 18.17 ± 3.84, PBF: 26.08 ± 11.41 vs. 36.58 ± 9.17 and WHR: 0.88 ± 0.06 vs. 0.81 ± 0.06 showed highly significant differences (P<0.0001) (Fig. 4). In contrast, fitness scores (65.77 ± 11.56 vs. 64.97 ± 7.43; P: 0.255) and BFM: 20.64 ± 14.00 vs. 21.11 ± 9.85; P: 0.592 did not show any gender significant differences (Figure 4).

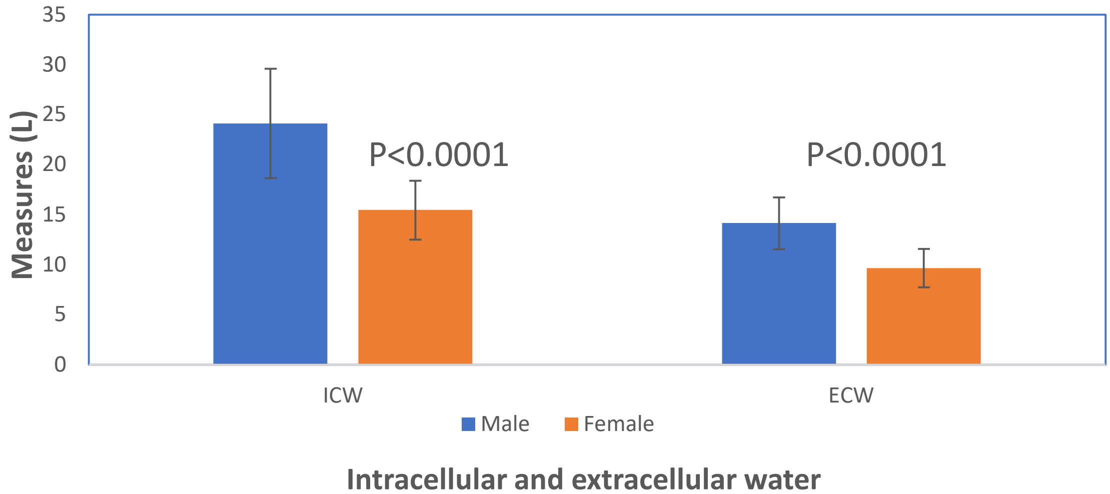

Figure 3 Intracellular and extracellular water in male and female participants
(ICW: Intracellular water; ECW: Extracellular water)

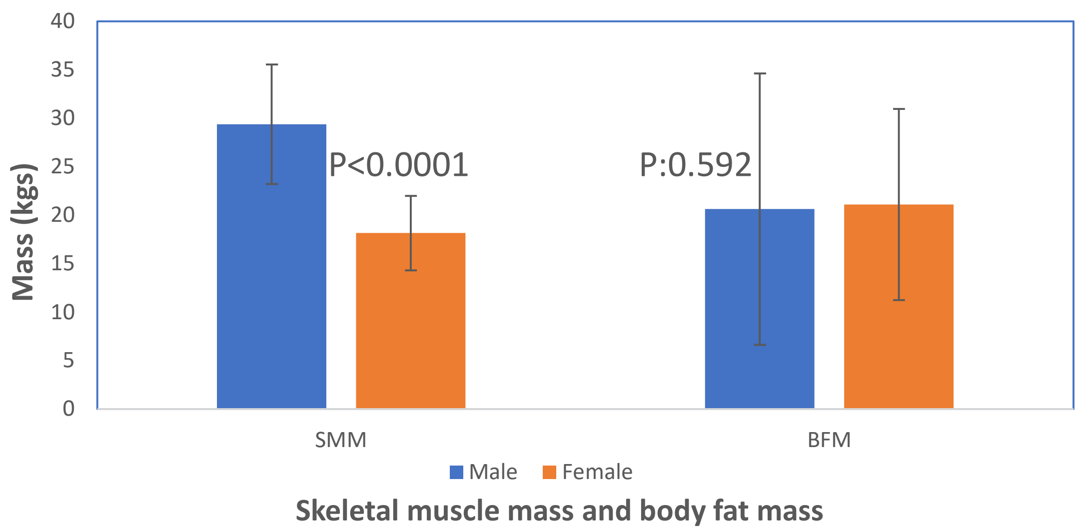

Figure 4 Skeletal muscle mass and body fat mass in male and female participants
(SMM: Skeletal muscle mass; BFM: Body fat mass)

Other variables found to be significantly different for male vs female participants were: Sum of moderate-intensity activity (METs-min/week) (1990 ± 2089 vs. 817 ± 1071; P:0.0001), sum of vigorous-intensity activity (METs-min/week) (822 ± 869 vs. 1698 ± 1523; P: 0.0001), total screen time (hour/day) (3.08 ± 4.18 vs. 4.15 ± 4.27; P: 0.001), sleep duration (hour/day) (7.86 ± 1.47 vs. 8.18 ± 1.70; P: 0.006), fruit intake (day/week) (2.68 ± 2.20 vs. 2.33 ± 2.10; P: 0.027), French fries/potato chips intake (day/week) (2.53 ± 2.07 vs. 3.09 ± 2.22; P:0.0001), cake, donut or biscuits intake (day/week) (2.48 ± 2.14 vs. 3.16 ± 2.31; P: 0.0001) and sweets or chocolates intake (day/week) (2.81 ± 2.20 vs. 3.87 ± 2.35; P: 0.0001).

Other variables not found to be significantly different were: total activity energy expenditure (METs-min/week) (2813 ± 2507 vs. 2514 ± 2073), breakfast intake (day/week) (3.00 ± 2.64 vs. 3.22 ± 2.78), sugar-sweetened drink (day/week) (3.76 ± 2.74 vs. 3.58 ± 2.60), vegetable intake (day/week) (3.17 ± 2.34 vs. 3.15 ± 2.35), milk/dairy products intake (day/week) (3.96 ± 2.50 vs. 3.92 ± 2.63) and fast foods intake (day/week) (3.48 ± 2.05 vs. 3.47 ± 2.09).

4. DISCUSSION

Aim of the present study was to determine the associations among dietary habits, physical activity, other lifestyle behaviours/factors and biochemical measures in young Saudi university students. Similar data has shown an interaction among lifestyle, where information was gathered regarding the epidemiology and related determinants among university students in Saudi Arabia (Al-Qahtani, 2016).

A study from Jeddah, Saudi Arabia, reported that obesity in university students was more than half (58%) of the total number of students who were either overweight (29%) or obese (29%) (Khabaz et al., 2017). Similar findings in Jazan, Saudi Arabia, were documented (Syed et al., 2020) that the prevalence of overweight (20.4%) and obesity (14.9%) were similar to another report (Al-Rethaiaa et al., 2010), as the status of overweight as 21.8% and obesity as 15.7%. Consequently, the prevention of obesity and its many other causal health-related issues, e.g., diabetes and cardiac problems are now a priority in public health in Saudi Arabia (Al-Qahtani, 2016).

In this study, the percentage of university adults being overweight: 26% male and 18% female and obese: 17.6% male and 11.5% female was higher than in several other countries, like Sweden: 12.4% categorized as overweight and 2.4% as obese (Winkvist et al., 2016) and Sudan 14.7% were classified as overweight and 1.7% as obese (Musaiger et al., 2016), whilst Lebanon showed higher at one-third or 32.2% overall prevalence for overweight/obesity in adolescents (El-Kassas and Ziade, 2017). Adolescents in Iraq have reported a prevalence of overweight plus obese (25.3%) (Musaiger et al., 2014), amongst Kuwait adolescents, the prevalence of overweight and obesity was 50.5% and 46.5% respectively in male and female subjects (Allafi et al., 2013) and among Jordan University students, the prevalence rates of overweight and obesity among students were respectively as (28.5%) and (10.2%) (Suleiman et al., 2009).

Previous data on gender interactions with concurrent obesity and selected lifestyle habits are sparse. In this study, estimated energy expenditure activity, screening time, sleep duration and selected dietary habits in Saudi male and female participants between the ages of 18 and 25, focusing on gender interaction effects with obesity were estimated. The values of obesity were significantly higher in males than in females. Other obesity indicators in our study were higher in males (WC 84.5 ± 14.6 cm and WHR 0.88±0.06) as compared to females (WC 72.9 ± 11.6 cm and WHR 0.81±0.06). In addition, obesity has been linked with different determinants (biological, behavioural and environmental). This present study shows that low physical activity, high screen time and short sleep duration are non-significant behavioural correlates of obesity that indicates the relationship between obesity and the time spent using screens and short sleep duration is compounded by other confounders.

The BMI was not significantly correlated with daily screen time. It may however contribute to a constellation of obesity pathways since it can decrease physical activity, increase calorie intake and decrease resting metabolism (O'Brien et al., 2018). The results revealed that females' mean screen time was significantly more than male students. The investigations in the current study are different from a study examining the relationship between physical activity, screen time and weight status among adolescents who found that girls reported significantly fewer minutes of daily video game use than boys (O'Brien et al., 2018). Similar results were found earlier in university adults (Al-Hazzaa et al., 2012; Silva et al., 2019). The present results showed a correlation between sedentary behaviour (screen time) and body fat percentage. In females, the percentage of body fat is significantly higher as compared to males. It is known that men have less percentage of body fat than women. The men and women respectively have 10-15% and 20-25% normal healthy range of body fat and obesity is indicated as the body fat percentage of over 20% and 30% for men and women respectively (Alzamil et al., 2019).

The proportion of physically moderate-intensity active males was found to be higher as compared to that of females and the proportion of physically vigorous intensity was significantly higher in females. Most university students in our study reported low physical activity when compared with previous studies (Al-Hazzaa et al., 2018). There are some environmental barriers to physical activities such as climate, place, time and noise. Some of these barriers can easily be changed, but climate proves to be a severe barrier in Saudi Arabia. Exercise capacity and physiological responses in hot climates are impaired compared to moderate conditions, suggesting that environmental temperature conditions have a significant influence on physical performance (Al-Hazzaa et al., 2018). Other barriers to physical activity are a lack of sports facilities in universities, an inability to walk or exercise outdoors because of extreme weather and a lack of time due to busy schedules (Al-Hazzaa et al., 2018). Although time limit, lack of facilities and resources, low self-efficacy and absence of social support represent major barriers to be physically active, it is still required for Saudi population to have a better idea about the barriers whether the social, environmental or personal, specifically about the various domains of transport, occupation, leisure time and others (Alkhateeb et al., 2019).

Breakfast is seen to be an important part of the day. Several studies have shown that breakfast skipping is popular among young adults in colleges and universities (Ünal et al., 2017). Gökçe and colleagues investigated the effect of breakfast habits among university students on anthropometric measurements, found that there was no significant relationship between BMI and having breakfast and observed amongst those who had regular breakfast, 10.4% of them were underweight, 81.7% of them was normal and 7.9% of them was overweight (BMI: 25 kg/m2) according to BMI (Ünal et al., 2017).

Saudi dietary habits usually comprise packaged entrees, fast foods, canned foods, packaged soup and other processed foods, eggs, milk, laban, yogurt, cheese, nuts and beverages with sugar sweeteners (SSB). A previous study demonstrated that use of red meat; fruits, eggs, SSB, yogurt, cheese and processed foods were statistically higher in the Saudi population as compared to Gulf Countries (Moradi-Lakeh et al., 2017). Consumption differences were found significant in the present study for potato chips/ French fries and sweets, cake, chocolates and donuts in female participants compared to males. Furthermore, the results in the present study showed that the increased intake of sweets, fries, cake and fast food was negatively and non-significantly associated with the overweight participants. Moreover, the results show the intake of drinks containing sugar sweeteners was not significantly higher among male participants. Regular consumption of Sugar-sweetened drink may increase blood pressure and consequently evokes problems such as hypertension, tachycardia and nervousness, all of which can lead to cardiovascular disorders. A study in Jeddah reported that 37% of the participants ate fruits and vegetables once a day, in contrast, 26.5% of participants were consuming 3 to 4 fast food meals weekly, half of these participants were using soft drinks or Sugar-sweetened drinks more than once per day and the prevalence of overweight and obesity was commonly observed amongst these students (Alasqah et al., 2021).

Evidence from various studies has confirmed that obesity is related to decreased sleep duration in adults and it may cause sleep discomforts resulting from disordered breathing with sleep disorders leading to weight gain in view of metabolic/endocrine dysfunctions (Spaeth et al., 2013). However, this link is equivocal, since in one study comprising college students, no significant association between sleep duration and weight status was found, though sleep disturbance associated significantly with increased level of BMI (Chang and Chen, 2015). Weight gain started in students after starting college life (Cluskey and Grobe, 2009) but proper management of uncontrolled gain in weight in college students seems beneficial to minimize any sleep disorders. In another study investigating the sleep and obesity in US and South Korean college students, those obese college students had sleep problems versus their normal-weight counter parts (Sa et al., 2020), our findings have shown that whilst sleep duration was significantly higher for females than for males ($P < 0.001$), there were no significant differences between the overweight/obesity participants.

Amongst participants in the current study, cardiovascular risk factors such as glucose and cholesterol levels were significantly different in male vs. female participants. Cholesterol levels of more than 170 mg/dL are high-risk factors for many diseases (Yahia et al., 2017). This is not surprising; as based on the questionnaire, the students' diet appears to be unhealthy and includes most fast food. In female students, blood pressure however was normal, in contrast to the males' mean SBP of 130 mmHg with an increased level of blood cholesterol, which is considered stage one hypertension following '2017 American College of Cardiology/American Heart Association guideline' (Whelton et al., 2018).

As with all studies, several limitations need to be acknowledged. One limitation is that it is not known what the weight status of those students who did not provide consent and this could bias the sample. The bias might result in an under estimation of the problem outlined in this study, especially if those chose not to participate because they were concerned about being overweight and obese. Secondly, the food frequency questionnaire did not include estimations of portion sizes, so implications are difficult to draw beyond the frequency of food choices. Thirdly, whilst screen time was self-reported, it has been shown moderately reliable (Oeckel et al., 2020). Strength of the study includes large sample size and the use of a validated and comprehensive questionnaire. The large number of students participate the present study provides good ecological validity for this student population.

5. CONCLUSION

The present study revealed significant differences between an unhealthy diet (sweets and fries) and obesity and low levels of physical activity, high screen time with less sleep duration among university students. It is crucial to encourage students to modify their unhealthy eating practices and increase physical activity by decreasing sedentary activity, thus reducing possible health risks posed by obesity and obesity-associated risk factors. These findings have implications for several health policies that should be embarked upon by University and Government departments including, but not limited to, healthy eating (availability of healthy diet in cafeterias), the promotion of physical activity (at home and the university) and health screening to alert students with known risk factors.

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Author Contributions

As a single author, planned, collected, analysed and interpreted the data and wrote the manuscript.

Ethical approval

Ethical approval was granted by the Unit of Biomedical Ethics Research Committee in Medical Department, King-Abdulaziz University, KSA.

Informed consent

All subjects/ patients voluntarily signed a document record of informed consent. Written & oral consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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