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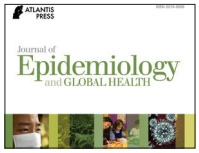

Original Article

Lifestyle Habits in Relation to Overweight and Obesity among Saudi Women Attending Health Science Colleges

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ABSTRACT

The study examined the associations between lifestyle habits and overweight/obesity among Saudi females attending health science colleges. A total of 454 female students were randomly recruited from five health science colleges at King Saud University, using a multistage stratified cluster sampling technique. Body weight and height were measured, and body mass index was calculated. All participants answered a validated questionnaire to assess physical activity (PA), sedentary behaviors (SB), sleep duration, and dietary habits. Results showed that the prevalence of overweight (21.4%) plus obesity (8.1%) among female participants was 29.5%. There was no significant difference between overweight/obese and nonoverweight/nonobese females in PA, screen time, sleep duration, or dietary habits. Overall, 50.4% of the participants were physically inactive (activity energy expenditure was <600 metabolic equivalent minutes per week). Active females showed significantly ($p < 0.01$) higher intakes of vegetables and fruits, lower chocolate/candy consumption ($p = 0.05$), and higher proportion of sufficient sleeping duration (>8 hours per night) ($p < 0.001$). It was concluded that half of the Saudi females in this study were physically inactive. Although PA positively impacted some of the lifestyle habits of college females, overweight/obesity was not associated with PA, SB, sleeping time, or dietary habits among the participants. Future research should attempt to elucidate the key factors involved in such relationship.

1. INTRODUCTION

The prevalence of obesity is increasing worldwide [1]. Such an increase in obesity prevalence represents a major public health concern [2]. In the Arabian Gulf States, the prevalence rates of overweight and obesity among adults were estimated to be at 25–50% and 13–50%, respectively [3]. Obesity in Saudi Arabia, in particular, is notably high. The reported national prevalence rates of overweight plus obesity [body mass index (BMI) ≥25 kg/m^2] among youths aged 15–24 years were 54.1% and 51.6% for males and females, respectively [4]. An earlier study showed that the rates of overweight and obesity among Saudi adolescents 13–18 years of age were 26.6% and 10.6%, respectively [5]. Also, there appear to be a rising trends in obesity prevalence among Saudi youths over the past few decades [6–8].

Obesity is considered a multifactorial condition influenced by many modifiable and nonmodifiable variables [9]. Physical inactivity, sedentary behaviors, and dietary habits are among the modifiable factors that are associated with obesity. The reported prevalence of insufficient physical activity in Saudi Arabia is notably high. Among Saudi youths 15–24 years old, inactivity was reported to be 41.8% in men and 75.6% in women [4]. In another study that used a validated comprehensive questionnaire, physical inactivity among adolescent males and females was estimated to be 45.5% and 78.1%, respectively [10]. Furthermore, high prevalence of sedentary behaviors and unhealthy dietary habits have been recently documented among Saudi adolescents [10,11].

Earlier studies conducted in different countries have shown that obesity among young people was associated with several lifestyle habits, including physical inactivity [12,13], sedentary behaviors [14,15], unhealthy dietary habits [16,17], and insufficient sleep duration [18,19]. In addition, recent local data indicated that obesity among Saudi adolescents was significantly associated with low level of vigorous physical activity, lower intakes of breakfast, fruits, and vegetables, and higher consumption of sugar-sweetened beverages [20].

Among Saudi college-age females, the prevalence of overweight plus obesity, on average, appears to be lower than that reported in the national estimates, ranging from 17.6% to 31.2% [21–23]. In addition, lifestyle habits among university students may not be optimal, due in part to school-related pressure. Furthermore, information on lifestyle factors associated with obesity in this age group in Saudi Arabia are currently limited [21–24], and many of these studies did not use a validated instrument when assessing physical activity and other lifestyle variables [22–24].

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In this paper, we present findings on the associations between obesity and lifestyle habits among a representative sample of Saudi females attending five medical science colleges at King Saud University, using a previously validated questionnaire [25]. A better understanding of the relationships between obesity on one hand, and physical activity, sedentary behaviors, sleep duration, and dietary habits on the other hand, may improve our efforts to plan and administer effective obesity prevention and management interventions targeting Saudi college-age females.

2. MATERIALS AND METHODS

2.1. Study Design and Participants

This is a cross-sectional study involving healthy students randomly selected from five health science colleges (medicine, dentistry, nursing, applied medical science, and pharmacy) at King Saud University, Riyadh, Saudi Arabia. The random selection of the sample was based on a multistage stratified cluster sampling technique. The minimum needed sample size was calculated so that the sample proportion would be within 0.05 of the population proportion (which was assumed to be 0.50) with a 95% confidence level. The study protocol and procedures were approved by the ethical committee (Institutional Review Board) in the College of Medicine at King Saud University. Signed consent forms were also obtained from all the participating females.

Anthropometric variables included body weight and height. Measurements were performed in the morning by a trained researcher. Body weight was measured with minimal clothing and without shoes and to the nearest 100 g using calibrated portable scales. Height was measured to the nearest centimeter using a calibrated measuring rod while the participant was in a full standing position without shoes. BMI was calculated as the ratio of weight in kilograms by the height squared in meters.

2.2. Assessments of Lifestyle Factors

2.2.1. Physical activity

The Arab Teen Lifestyle Study (ATLS) questionnaire was used to collect lifestyle variables [10,25]. The questionnaire was previously shown to be a reliable and valid instrument for assessing physical activity and other lifestyle habits in a group of youths from 14 to 25 years of age [26,27]. Briefly, the physical activity section of the questionnaire was intended to collect information on the frequency, duration, and intensity of light-, moderate-, and vigorous-intensity physical activities during a typical (usual) week. The physical activity questionnaire covers transport, household, fitness, and sporting activities. Each activity was assigned a metabolic equivalent (MET) value based on the compendium of physical activity [28]. To determine the participants' levels of physical activity, we used the total activity energy expenditure in METs-minutes per week (METs-min/wk) and the METs-min/wk spent in each of the moderate- and vigorous-intensity physical activity. Physical activity was also categorized into two levels of activities based on total activity energy expenditures in METs-min/wk as inactive (<600 METs-min/wk) or active (600+ METs-min/wk).

2.2.2. Sedentary behaviors and sleep duration

The ATLS questionnaire includes questions designed to assess typical time in hours spent per day on sedentary activities, including television (TV) viewing, video games, and recreational use of computer and internet during weekdays and weekends. Participants were also asked to state their typical sleep duration in hours spent on weekdays and weekends. For total screen viewing time cutoff values, we used above or below 3 hours per day, and for sleep duration we calculated sufficient and insufficient sleep duration as above or below 8 hours per night.

2.2.3. Dietary habits

The ATLS questionnaire also included 10 specific questions related to intake frequency of certain dietary habits during a typical (usual) week. The questions asked the participants to state how many times per week they consume breakfast, vegetables (cooked and uncooked), fruits, milk and dairy products, sugar-sweetened drinks (including soft drinks), fast foods, donuts/cakes, sweets and chocolate, and energy drinks. The questions covered both healthy and unhealthy dietary habits. The student was given a choice of answers, ranging from zero intake (never) to a maximum intake of 7 days per week (every day).

2.3. Data and Statistical Analysis

The data entered into a coded SPSS data entry sheet, checked, cleaned, and analyzed using IBM SPSS software, version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated and presented as means and standard deviations (SD) or proportions. Prevalence of physical activity/inactivity and overweight and obesity were calculated using cross tabulation. In addition, *t*-tests for independent samples were used to test differences in lifestyle habits between overweight/obese versus nonoverweight/nonobese participants as well as between physically active versus inactive groups. As there was no significant difference in lifestyle factors between overweight and obese participants, we combined the two categories when testing the differences in lifestyle factors between those with BMI values below or above 25 kg/m^2. Furthermore, the proportion of Saudi college females with high versus low screen time and sufficient versus insufficient sleep duration were tested against physical activity category using cross tabulation with a chi-square test. Finally, we used multiple linear regression analysis, with stepwise procedures, to predict the level of BMI from lifestyle variables, while using the stepwise method. The level of significance was set at $p < 0.05$.

3. RESULTS

Table 1 presents the anthropometric characteristics of the participants relative to overweight plus obesity status. There was no significant difference in age between the overweight/obese versus the nonoverweight/nonobese females. The prevalence of overweight plus obesity among the college-female participants was 29.5%.

The proportion (%) of Saudi college female's physical activity levels relative to obesity is shown in Table 2. The activity levels were classified according to total activity energy expenditure in total METs-min/wk into inactive and active participants based on a cutoff value of 600 METs-min/wk (an equivalent of 150 min of moderate intensity physical activity). Nearly half of the females in the health science college were physically active, with no significant difference in inactivity levels between overweight/obese and nonoverweight/nonobese participants.

Table 3 exhibits selected lifestyle-related variables relative to overweight/obesity levels among Saudi college-age females. There was no significant difference between the two groups in terms of total physical activity energy expenditure, sum of moderate-intensity physical activity, or sum of vigorous physical activity in METs-min/wk. In addition, there was no significant difference between the two groups in average screen time, sleep duration, or any of the dietary habits. Table 4 shows selected dietary habits classified according to activity levels among the Saudi college females. Active females exhibited significantly higher vegetable and fruit intakes and lower consumption of chocolate/candy than inactive females. The rest of the dietary variables were not significantly different between the active and inactive groups.

The proportions (%) of Saudi college females with screen time and sleep duration cutoff values relative to physical activity levels are displayed in Table 5. There was no significant difference between active and inactive females in the time spent above or below 3 hours of screen time per day. However, the proportion of active college females who had 8 hours or more of sleep per day is significantly ($p < 0.001$) higher than the inactive females. Indeed, more than 95% of inactive female had <8 hours of sleep per day. Finally, the results of multiple linear regression analysis showed that of all independent predictors (lifestyle variables), only intake of French fries/potato chips remained in the equation and was significant in predicting BMI [$R^2 = 0.012$; with $B = 0.358$ (95% CI = 0.057–0.659) and $p = 0.020$].

Table 1 | Anthropometric characteristics of participating females (means ± standard deviations or percentage)

Variables	All ($n = 454$)	Nonoverweight/nonobese ($n = 320$)	Overweight/obese ($n = 134$)
Age (y)	20.3 ± 1.5	20.3 ± 1.5	20.2 ± 1.5
Weight (kg)	59.9 ± 13.5	53.6 ± 7.0*	74.7 ± 13.8
Height (cm)	159.9 ± 5.8	160.0 ± 5.9	159.6 ± 5.3
BMI (kg/m^2)	23.4 ± 4.9	20.9 ± 2.3*	29.2 ± 4.7
Overweight (%)	21.4	–	–
Obesity (%)	8.1	–	–

*$p < 0.001$ for the difference between the two groups (t-test for independent samples); BMI, body mass index.

Table 2 | The proportion (%) of physical activity levels of Saudi college females relative to obesity (activity levels were classified according to total activity energy expenditure in MET-min/wk)

Activity category*	Nonoverweight/nonobese	Overweight/obese	All
Inactive (<600 METs-min/wk)	51.6	47.8	50.4
Active (600+ METs-min/wk)	48.4	52.2	49.6

*No significant ($p = 0.266$) differences based on chi-square test for the activity category by obesity level.

Table 3 | Selected lifestyle-related variables relative to obesity levels among Saudi college females

Variables	Nonoverweight/nonobese	Overweight/obese	p-Value[a]
Total activity energy expenditure (METs-min/wk)	964.1 ± 70.9	1320.5 ± 324.8	0.286
Sum of moderate-intensity activity (METs-min/wk)	573.6 ± 54.1	875.6 ± 271.6	0.277
Sum of vigorous-intensity activity (METs-min/wk)	390.5 ± 38.0	444.8 ± 73.7	0.514
Average screen time (h/d)	5.6 ± 2.5	5.4 ± 2.5	0.558
Average sleep duration (h/d)	5.5 ± 1.5	5.5 ± 1.5	0.917
Breakfast intake (d/wk)	3.6 ± 2.6	3.7 ± 2.9	0.704
Vegetable intake (d/wk)	3.9 ± 2.3	3.8 ± 2.3	0.564
Fruit intake (d/wk)	2.8 ± 2.5	2.5 ± 2.1	0.336
Milk/milk products intake (d/wk)	4.8 ± 2.3	4.4 ± 2.5	0.106
Sweetened drinks intake (d/wk)	2.4 ± 2.2	2.5 ± 2.3	0.614
Fast foods intake (d/wk)	1.9 ± 1.5	1.9 ± 1.6	0.818
French fries/potato chips intake (d/wk)	1.6 ± 1.4	1.6 ± 1.7	0.952
Cake/donuts intake (d/wk)	2.4 ± 2.0	2.3 ± 2.1	0.764
Chocolate/candy intake (d/wk)	3.4 ± 2.2	3.1 ± 2.2	0.125

[a]t-test for independent samples; Data are means and standard deviations except activity energy expenditure, which are means and standard errors; METs-min/wk, metabolic equivalent minutes per week.

Table 4 | Selected dietary habits relative to activity levels among Saudi college females

Variables	Active (600+ METs-min/wk)	Inactive (<600 METs-min/wk)	p-Value*
Breakfast intake (d/wk)	3.6 ± 2.6	3.6 ± 2.7	0.984
Vegetable intake (d/wk)	4.2 ± 2.4	3.6 ± 2.2	0.006
Fruit intake (d/wk)	3.1 ± 2.2	2.3 ± 2.0	<0.001
Milk/milk products intake (d/wk)	4.9 ± 2.4	4.5 ± 2.4	0.078
Sweetened drinks intake (d/wk)	2.3 ± 2.3	2.5 ± 2.1	0.389
Fast foods intake (d/wk)	1.9 ± 1.5	1.9 ± 1.6	0.750
French fries/potato chips intake (d/wk)	1.5 ± 1.6	1.7 ± 1.4	0.248
Cake/donuts intake (d/wk)	2.3 ± 2.0	2.4 ± 2.0	0.477
Chocolate/candy intake (d/wk)	3.1 ± 2.2	3.5 ± 2.1	0.050

*t-test for independent samples.

4. DISCUSSION

In this cross-sectional study, we investigated the associations of lifestyle habits with obesity and physical activity status among a representative sample of female students attending five health science colleges from a large public university in Saudi Arabia. The present study is among a few local studies that assessed the physical activity levels of college students using a validated and comprehensive physical activity questionnaire. The ATLS physical activity questionnaire that was used in the current investigation is now widely used in studies that assessed lifestyle habits among various Arab youths [10,29–32].

Table 5 | The proportions (%) of Saudi college females with screen time and sleep duration cutoff values relative to physical activity levels (activity levels were classified according to total activity energy expenditure in MET-min/wk)

Activity category	Cutoff value	Active (600+ METs-min/wk)	Inactive (<600 METs-min/wk)	Chi-square test (*p*)
Screen time (h/d)	≤3 h	12.9	16.5	0.168
	>3 h	87.1	83.5	
Sleep duration (h/d)	<8 h	54.1	95.3	<0.001
	8+ h	45.9	4.7	

METs-min/wk, metabolic equivalent minutes per week.

The overweight plus obesity prevalence among this sample of college females reached nearly 30%. Such figure is much lower than the recent average national prevalence (38%) reported for overweight plus obese Saudi young adults [4], and similar to those reported for university females in the city of Jeddah [23], but higher than those reported for college females in other cities of the country [21,22]. Such lower obesity rate compared to the national prevalence might reflect the specific nature of the participants, who may be more health-conscious than the other segments of the population. Needless to say, overweight and obesity prevalence among Saudi adults has been on the rise over the past decades and is projected to increase in the future, especially among females [33]. In comparison with a random sample of female college students from 22 universities in 22 countries, the reported prevalence rates of overweight and obesity were 14.1% and 5.2%, respectively [34]. These rates are much lower those found in the present study.

Based on weekly total activity energy expenditure, the current study indicated that more than half of the Saudi college females from the five medical sciences colleges were physically inactive (spent <600 METs-min/wk). Physical inactivity represents a public health burden in Saudi Arabia, especially for females, as recent studies have shown that nearly 78% of Saudi adult women [35] and 78.1% of Saudi adolescent females were inactive [10]. However, it must be noted that the recommended minimum activity guidelines for adolescents, in absolute terms, are twice those of adults. A review of studies conducted on the physical activity behaviors of college age students concluded that approximately 40–50% of students are considered physically inactive [36]. Active females in our study exhibited significantly higher intakes of vegetables and fruits, lower chocolate/candy consumption, and higher proportion of adequate sleep duration (≥8 hours per night). An earlier local study that was conducted on secondary school students, using the same lifestyle questionnaires, revealed that physical activity was associated with several good dietary habits, such as higher intakes of breakfast, vegetables, fruits, and milk/milk products [11].

The present study showed that there was no significant difference between overweight/obese and nonoverweight/nonobese females in physical activity levels, screen time, sleep duration, or dietary habits. One explanation for these results might reflect the fact that many overweight/obese females are frequently engaged in weight loss programs through physical activity and low calorie diets. Indeed, our findings showed that almost 60% of the overweight/obese females in the present study indicated that losing weight is the main reason why they were engaging in physical activity as opposed to only 15% in the case of nonoverweight/nonobese females. Overweight and obese females who are on weight-loss programs may also adopt healthy lifestyle habits in order to reduce their excess weight.

Research assessing the prevalence and factors associated with simultaneous health-risk behaviors in college students in Brazil has found that inadequate diet and physical inactivity were among the most frequent behaviors [37]. The World Health Organization (WHO) listed inadequate intake of fruits and vegetables, being overweight or obese, and physical inactivity as part of the most important risk factors of noncommunicable diseases [38]. Elsewhere, the relationship between weight and diet in a group of college students was investigated and showed that participants of healthy weight or underweight consumed more green leafy vegetables, whereas overweight and obese students prefer all meat diet [39]. In the present study, however, the consumption of meats and poultry was not assessed, although fast-food consumption was not different between overweight/obese and nonoverweight/nonobese Saudi college females. However, among health science university students in north Lebanon, a healthy diet score was found to be associated with decreased risk of obesity [40].

The WHO's Global Strategy for Diet and Physical Activity recommends limiting energy intake from fats, reducing the intake of free sugars, and increasing fruit and vegetable consumption [41]. Moreover, a recent systematic review on the role of fruit and vegetable intake and obesity concluded that increased fruit and vegetable intake contributed to reduced adiposity among overweight or obese adults [42]. Interestingly, in our study, there was no significant difference in females' vegetable and fruit consumption relative to overweight/obesity status. However, active Saudi college females showed significantly higher consumption of fruit and vegetables and lower chocolate intake than inactive females.

In Saudi Arabia, the food consumption pattern has changed enormously over the past three to four decades. During this period, the consumption of fatty animal products and refined sugar has increased, whereas the intake of fruit and vegetables and the traditional foods that are high in complex carbohydrates decreased [43]. Furthermore, Western calorie-dense fast foods became increasingly available, with escalated consumption by the young generation in this region. In the present study, only intake of French fries/potato chips was significant in predicting BMI level among college females. However, there was no significant association between the frequency of fast-food intake and obesity. However, it should be noted that portion size of fast foods was not accounted for in the present study and may have confounded the association between the frequency of fast-food consumption and obesity. During the transition from adolescence to adulthood, it was shown that fast-food consumption and breakfast skipping were markedly increased and that both of these dietary behaviors were associated with weight gain during the same period [44]. However, in the current study, there were no significant differences in fast-food intake or

breakfast skipping between overweight/obese and nonoverweight/obese females.

The average daily time (in hours) spent in recreational screen use reported in the present study was high among both overweight/obese (5.4 ± 2.5) and nonoverweight/nonobese (5.6 ± 2.5) Saudi college females. In fact, more than 80% of our study group exceeded 3 hours per day spent in sedentary behaviors. This is in line with similar research reported earlier for Saudi adolescents showing a very high level of sedentary behaviors [10]. Sedentary behaviors were shown to be related to obesity and metabolic risk [45] and are believed to be associated with adverse health outcomes independently from those attributed to physical inactivity [46].

Interestingly, we found a strong association between physical activity level and duration of sleep, which showed that 95.3% of the inactive group reported <8 hours of sleep daily, whereas only 54% of the active students had <8 hours of sleep daily. Exercise is shown to positively influence sleep, as findings from a systematic review of previous meta-analyses have supported the effect of exercise on improving selected sleep outcomes in adults [47]. In addition, the National Sleep Foundation listed physical activity as one of the practices that has a positive impact on the duration and quality of sleep [48].

The present study has its strengths and limitations. One of its strengths is having a representative sample of females from five medical science colleges in a large public university. Also, the instruments used in the current study have been previously validated and include a comprehensive physical activity questionnaire, using metabolic equivalents for calculating energy expenditure from physical activity. However, we must also acknowledge several limitations of the present study. First, the cross-sectional nature of this study does not allow us to assume causal relationships between independent and dependent variables. Second, the findings were based on questionnaires and we cannot rule out the potential for recall bias in the frequency of physical activity, sedentary behaviors, and dietary habits. Third, the study findings may not be generalized to all college females, as the sample in the present study came from health science colleges. Fourth, the food frequency questionnaire did not account for portion size, which may have influenced the associations between dietary habits and overweight/obesity indicator.

5. CONCLUSION

The present study examined the associations of several lifestyle factors with overweight/obesity among Saudi college-age females attending five medical science colleges at King Saud University. More than half of the Saudi college females from medical science colleges were physically inactive. Although physical activity positively impacted some of the lifestyle habits of Saudi college females, overweight/obesity was not associated with activity levels, sedentary behaviors, sleeping time, or dietary habits among the participants. Future research should try to elucidate the key factors involved in such complex relationships. Primary prevention of overweight and obesity by promoting a healthy diet and active lifestyles should still be a major public health target. Such efforts should include, among other things, education, research, and intervention while involving the students, their family, healthcare providers, and policy makers.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

Study concept: MAA, HMA, and HAA; data collection: WA, SNA and NAA; statistical analyses: HMA; drafting the paper: HMA, MAA, HAA. All authors critically read and approved the final version of the manuscript.

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