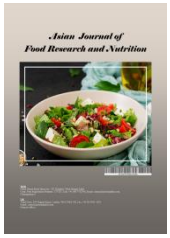

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Assessing Eating Habits, Physical Activity, and Nutritional Knowledge among Female Adolescents in Saudi Arabia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Studies on the health and nutrition of the Saudi population, especially those of children and adolescents, are limited. Assessing Saudi adolescents in relation to essential nutrition concepts is needed. This study examined nutrition related variables and evaluated factors influencing the eating habits of Saudi adolescent girls. It compared nutrition and lifestyle between two distinct locations in Saudi Arabia. A validated dietary questionnaire was given to 291 adolescent females students (aged 14-18 years) attending intermediate and high schools. The mean age for the sample was 14.6 ± 3.5 years. The majority of females were considered within normal weight (60%). Eating habits were significantly healthier among Al-Khobar females compared to Riyadh females (P = 0.028). Similarly, females from Al-Khobar reported being more physically active (P = 0.002) with higher self-efficacy (P = 0.049) compared with females from Riyadh. No significant differences were found among BMI categories. Bivariate correlation analyses found that eating habits were correlated with self-efficacy (P < 0.001) and knowledge of healthy dietary habits (P = 0.001) but were not associated with nutrition knowledge (P = 0.09). A linear regression model demonstrated

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that predictors—location (P = 0.028), self-efficacy (P < 0.001), and knowledge of healthy dietary habits (P = 0.008)—explained 12.8% of the variance. Location, self-efficacy, and knowledge of healthy dietary habits were significant predictors relating to eating habits. Educational strategies to improve nutrition and physical activity are needed to help female adolescents achieve lifelong healthy eating and active lifestyle behaviors.

Keywords: Eating habits; physical activity; adolescents; nutrition knowledge; self-efficacy; Saudi Arabia.

1. INTRODUCTION

Overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year because of being overweight or obese [1]. Worldwide, at least 10% of school-aged students are considered overweight or obese with the majority in the Americas (32%) followed by Europe (20%) and the Middle East (16%) [2].

In Saudi Arabia, evidence from serial cross-sectional assessments of body mass index (BMI), or percent body fat, on Saudi children and adolescents have confirmed a rising trend in obesity over the last two decades [3]. It has been estimated that among adolescents aged 13–18 years 26.6% are overweight and 10.6% are obese [4]. Moreover, adolescent girls have higher combined overweight and obesity prevalence rates compared with adolescent boys in Saudi Arabia [5].

Adolescence is a transitional period where young people are determining and taking control of their own eating habits and health behaviors [6]. Unfortunately, there is an increased trend toward unhealthy eating habits among adolescents, such as skipping breakfast and consuming a great deal of soft beverages [7,8]. A recent study investigating the relationship of adolescents' behaviors to physical and psychological health found that the majority of students (47.2%) reported low physical activity, low fruit and vegetable intake, and a high intake of sweets, chips, and fries. Approximately 26.5% reported high physical activity, high fruit and vegetable intake, and a low intake of sweets and soft drinks [9].

Similar trends of consuming more animal products and refined foods at the expense of vegetables and fruits have been reported for adolescents in Saudi Arabia [10,11]. The majority of Saudi adolescents (ranging from 66.8% to 80.4%) did not consume the daily Dietary Guidelines Recommendations (DGR) for milk, fruit, and vegetables. Adolescents did not consume breakfast on a regular basis. Unhealthy food types such as French fries, potato chips, cakes, donuts, candy, and chocolate were most often consumed with a higher prevalence of candy and chocolate consumption among females (52% for females as opposed to 37% for males) [12].

Even though the reasons for the recent and dramatic nationwide increases in overweight and obesity in children and adolescents are unclear, this trend can be attributed to the production and frequent consumption of convenience foods that are high in fat and calories (e.g., candy, chips, and sugary drinks) and diminished physical activity compared to the past [13-15].

Within the past decades, the Kingdom of Saudi Arabia, as well as other Arabian Gulf countries, has undergone tremendous lifestyle changes that include physical activity patterns and eating habits. Such dramatic lifestyle changes are thought to have contributed immensely to the increase in obesity prevalence among Saudi children and youth [16]. The intake of animal products and refined sugar has increased while the intake of fruit and vegetables and complex carbohydrates has decreased [17]. Furthermore, sedentary lifestyles are becoming particularly commonplace among Saudi children and youth [18].

Certain dietary patterns are noticeably related to adolescent obesity [19]. Skipping breakfast is a major dietary habit in Saudi Arabia and is positively correlated with obesity [20]. Approximately 74% of Saudi schoolgirls aged 12-16 years skipped or irregularly consumed breakfast [21]. According to Al-Hazza et al. [12], the number of Saudi adolescents skipping breakfast ranged from 15% to 49%.

Less healthy snacking can be another factor linked to obesity. Many studies reported that carbonated beverages, cheese, non-carbonated canned drinks, candy, chocolate, and potato chips were foods commonly consumed as snacks among adolescents [12,21].

Ordering meals, eating out, or consuming ready-to-eat foods are behaviors that have become prevalent in Saudi Arabia. Musaiger [21] reported that high intake of fast foods and decreased consumption of homemade meals are associated with obesity among children and adolescents in Saudi Arabia and other Gulf countries. Moreover, he concluded that the incidence of obesity is expected to reach 52% or more among Saudi children who eat outside the home five times or more per week.

Physical inactivity and sedentary lifestyles are becoming more prevalent among Saudi children and adolescents. A study conducted in Al-Khobar, Jeddah, and Riyadh concluded that about 50% of males and 75% of the females did not meet daily physical activity guidelines. Females were more sedentary and less physically active. Almost 84% of males and 91.2% of female Saudi adolescents spent more than two hours daily onscreen (e.g., watching television) [12]. Another study revealed that normal weight adolescents were more active than obese ones, and participants with higher BMI reported lower levels of physical activity and higher amounts of sedentary time [22]. In addition, higher levels of physical activity were found among males when compared to females; however, physical activity levels appeared to decline with age for both groups.

Self-efficacy is another factor that has to be assessed as a critical determinant of behavior change in relation to health promotion and disease prevention. According to Bandura [23], self-efficacy is the internal belief about the ability to organize and execute courses of action necessary to achieve a goal. Therefore, individuals with strong self-efficacy beliefs are more confident in their capacity to execute a behavior. Most of the widely known health behavior theories include self-efficacy or similar concepts [24-26]. Preventive nutrition, dieting, weight control, and physical exercise can be guided by nutrition and physical exercise self-efficacy beliefs [27]. A study examined adolescent girls aged 18-21 years in Jeddah (western region of Saudi Arabia) in relation to knowledge, attitude, and behavior regarding fruit and vegetable consumption using a Transtheoretical Model (TTM). It was found that self-efficacy and pros were the most significant positive predictors of adopting healthy dietary habits such as fruit and vegetable consumption [28].

Nutrition knowledge is one of the factors influencing dietary practices. Inappropriate nutrition education and poor nutrition knowledge increase the possibility of developing poor dietary practices [29]. A study conducted to determine the correlation between nutrition knowledge and dietary behaviors found that knowledge was significantly associated with healthy eating: respondents with higher levels of nutrition knowledge are about 25 times more likely to meet current recommendations for fruit, vegetable, and fat intake than those with lower levels of knowledge [30]. According to Al-Almaie [31], knowledge about healthy diets was not adequate among Saudi school adolescents. This cross-sectional study included 1,240 males and 1,331 females from secondary schools in Al-Khobar, a mid-size city located in the eastern province of Saudi Arabia. About 51% of the male and 65% of the female students recognized unsaturated fats as healthy foods. However, students' knowledge on the benefits of fiber-containing foods and the risks of unhealthy foods was disappointing. Preliminary observations to assess nutrition awareness among 311 Saudi adolescent and adult subjects in Riyadh, the largest city in Saudi Arabia and located in the central region, concluded that an acceptable number of them consumed a variety of foods from the four food groups every day, which reflected a good trend in food and nutrition awareness [32].

The Saudi Arabian population has experienced major transitions in eating patterns and life-styles due to economic changes and rapid urbanization. Findings among adolescents show higher percentages of negative eating practices and reduced physical movement. In relation to nutrition knowledge, limited references concluded that the levels of knowledge among adolescents in Saudi Arabia were not adequate to promote positive eating patterns. Self-efficacy is confirmed to be associated positively with healthy diet patterns and physical activity.

The objectives of this study were to [1] examine eating habits, physical activity, self-efficacy, awareness of healthy dietary habits, and nutrition knowledge among adolescent girls aged 14-18 years, [2] compare these variables between Riyadh and Al-Khobar, and [3] determine the factors affecting dietary habits.

In general, studies of the Saudi population including children and adolescents are limited. For this reason, assessing Saudi adolescents in

relation to some essential health concepts appears to be needed. Locally, this study determined the quality of dietary consumption associated with the levels of nutritional knowledge among Saudi female adolescents. This information can be used as a reference to plan nutrition awareness programs, to improve nutrition consciousness and to promote the adoption of healthy lifestyles. Internationally, this study can aid in generating an introductory background about Arab and Middle Eastern populations. Further comprehensive studies that compare Saudi Arabia with other countries can be established.

2. METHODS

A cross-sectional survey was developed and administered to female intermediate and high school students randomly selected from two specific locations in Saudi Arabia (Riyadh and Al-Khobar) to assess their eating habits, physical activity, self-efficacy, and nutritional knowledge. The research protocol was approved by the Institutional Review Board at California State University Chico (CSUC) in May 2013 prior to implementation.

2.1 Participants

Participants for this study were 291 female students aged 14-18 years from intermediate and high schools in Riyadh and Al-Khobar. After a random selection of schools, the principals were contacted for approval to recruit students and distribute self-administered dietary questionnaires. Teachers received instructions regarding student consent. Under teacher supervision, surveys were distributed to students who were given 10-15 minutes to complete. Completed surveys were collected by teachers and given to the first author.

2.2 Study Locations

For this study, data were collected in two locations of Saudi Arabia: Riyadh and Al-Khobar. These locations were selected so more than one population area could be studied and to develop a more diverse representation of the Saudi population.

Riyadh: Riyadh is the largest city in Saudi Arabia with a population of 5.3 million people [33]. It is located in the center of the Arabian Peninsula with an area of 400 square miles. Riyadh is one of the richest urban cities in the Middle East and is the heart of economic and industrial development in Saudi Arabia. It is experiencing numerous and massive improvements in different areas of its society including educational, financial, agricultural, technical, and social programs. Eating patterns have changed dramatically with the population preferring processed and fast foods to home cooked meals, especially among children and adolescents. Moreover, Riyadh has a hot desert climate during summer with little rainfall. This hot, dry weather is the main impediment to Saudis engaging in outdoor activities (e.g., walking and jogging).

Al-Khobar: Al-Khobar is a mid-size city located in the eastern province of Saudi Arabia on the coast of the Arabian Gulf, about 250 miles northeast from Riyadh. The population is estimated to be 250,000 consisting of both Saudi citizens and international expatriates [34]. It is a vibrant business center that houses the world's largest oil company (Saudi Aramco). The weather tends to be very hot and humid during summer but dry and cool in winter. As an important region of Saudi Arabia, Al-Khobar has also experienced noticeable improvements within the past decades in several areas. Unlike Riyadh's residents, the citizens of Al-Khobar engage in many water sports and activities since they are on the east coast.

2.3 Surveys

A self-administered dietary questionnaire, originally developed for adolescent students in Italy [35], was used for this cross-sectional study. This questionnaire was previously constructed and tested for reliability [35,36]. Considering the major concepts identified in this cross-sectional study, the dietary questionnaire used by the Italian researchers had to be modified for this study.

The distributed questionnaire was translated into Arabic by the first author. Some questions were modified or removed to meet the religious and cultural requirements of the Saudi population. In particular, questions containing food items such as pork or alcoholic drinks were changed to other allowed food items. Also, specific Italian dishes (e.g., tiramisu) were replaced with food items better known to the Saudi population. There were six sections in the revised questionnaire.

Section 1. Personal Information: This section contained information on personal data: age, weight in kilograms, and height in centimeters.

Self-reported weight and height were used to calculate BMI. The English version of the children's BMI metric calculator was used [37]. Date of measurement, weight, and height were entered for each participant to obtain BMI and BMI-for-age percentile (%ile) values.

Section 2. Eating Habits: This section had 13 questions investigating the dietary habits of the adolescents. Questions asked about the number of meals per day, breakfast content, daily consumption of fruit and vegetables, and typical consumption of water and other beverages. Seven questions had the following response categories: always, often, sometimes, never. The other six had four structured response categories that correspond to each question. The scores ranged from 0 to 3 with the highest score assigned to the healthiest behavior and the lowest score to the least healthy behavior. The total score for this section was 39: low scores indicated "inadequate eating habits" and high scores indicated "satisfactory eating habits."

Section 3. Physical Activity. This section had five questions assessing the levels of physical activity. The responses were structured differently according to each question. The scores ranged from 0 to 3 with the maximum score assigned to the healthiest behavior and the minimum score to the least healthy behavior. The total score for this section was 15: low scores indicated "sedentary physical level" and high scores indicated "active physical level."

Section 4. Self-efficacy: This section had eight questions investigating the personal behaviors and attitudes linked to improving health status in relation to nutrition. These questions had three response categories: no = 0, I don't know = 1, yes = 2. The total score for this section was 16: low scores indicated "incapacity for using advice aimed at improving one's wellbeing" and high scores indicated "good capacity for using advice aimed at improving one's wellbeing."

Section 5. Awareness of Healthy Dietary Habits: This section had eight questions investigating the levels of knowledge in relation to modifications or improvements in eating habits. Each question had two responses: Yes=0, No=1. The total score for this section was 8: low scores indicated "high levels of knowledge of modifying one's own eating habits with the aim of improving them" and high scores indicated "low levels of knowledge of modifying one's own eating habits with the aim of improving them."

Section 6. Nutritional Knowledge: This section had 11 questions investigating students' knowledge regarding particular food items and various nutritional definitions. Each question had four different response categories. The scoring was 1 for correct answers and 0 for wrong answers. The total score for this section was 11: low scores indicated "insufficient nutritional knowledge" and high scores indicated "good nutritional knowledge."

2.4 Statistical Analysis

Responses from these questionnaires were expressed as means, standard deviations, and distribution of scores. Independent t-tests were computed to investigate the differences in scores among study locations. One-way ANOVA was computed to compare score differences among three BMI groups (underweight, normal, and overweight/obese). Bivariate analyses were tested to determine the nature of the association between eating habits and other variables. Linear regression was performed to identify the significant factors affecting dietary habits. Microsoft Excel was used to code the variables. SPSS software version 19.0 (SPSS, Inc., Chicago, IL) was used to perform all statistical analyses. Participant recruitment and questionnaire distribution were held throughout May 2013. Data entry and analyses were conducted throughout the fall of 2013. $P \leq 0.05$ was considered statistically significant and all P values were two sided.

3. RESULTS

3.1 Characteristics

Anthropometric measurements for the sample are shown in Table 1. A total of 291 female students were recruited for this study: 160 participants (55%) participated from Riyadh and 131 (45%) from Al-Khobar. The majority of recruited female students were aged 14 years (34%) and 25% were aged 15 years. The mean age for the sample was 14.6 ± 3.5 years.

According to BMI-for-age percentiles, most females were considered within normal weight (60%) while 28% were found to be underweight. Only 10 participants were classified as obese and 24 were overweight. The mean weight for the study population was 52.2 ± 10.7 kg.

3.2 Eating Habits and Physical Activity

The mean score obtained for eating habits was 21.7 ± 5. Skipping breakfast was not prevalent in

the sample (6.5%). Additionally, 59.4% of the female adolescents indicated they did not consume milk or yogurt at breakfast, and 23.7% and 21% of the sample did not consume at least two portions of fruits and vegetables per day, respectively. About 27% of the sample indicated a high consumption of desserts and cakes, particularly during a meal (Table 2).

The mean score calculated for physical activity was 6.2 ± 2.9. In response to the question "do you usually practice a physical activity," 21.8% of the sample answered "always." Almost 14% of the females responded "never." In response to the question "what do you prefer to do during your free time," 73.6% of the sample answered "watching television," "using the computer," "listening to music," or "reading a book." Only 8.7% and 8% answered "walking" and "practicing a sport," respectively (Table 2). Mean scores and standard deviations for self-efficacy, awareness of healthy dietary habits, and nutrition knowledge are shown in Table 3.

3.3 Nutrition Related Variables and Location

Table 3 shows the mean values of female adolescents' scores in relation to location (Riyadh and Al-Khobar). Eating habits were found to be significantly healthier in Al-Khobar compared to Riyadh ($t(253) = -2.21$, $P = 0.03$). Females from Al-Khobar also reported being more physically active compared with females from Riyadh ($t(281) = -3.20$, $P = 0.002$). Self-efficacy was also higher among the Al-Khobar population ($t(266) = -0.43$, $P = 0.049$). No differences were found for knowledge of healthy dietary habits and nutrition knowledge. Additionally, no significant differences in BMI categories were found between these two locations.

3.4 Nutrition Related Variables and BMI Groups

Table 4 shows the mean values of female adolescents' scores in relation to BMI groups (underweight, normal weight, overweight/obese). Across all survey sections, no significant differences were found among BMI groups.

3.5 Factors Affecting Eating Habits

Bivariate correlation analyses (Pearson's) were tested among eating habits responses and certain factors. Nutrition knowledge was not associated with eating habits ($r(224) = 0.113$, $P = 0.09$), but awareness of healthy dietary habits was negatively correlated with eating habits ($r(236) = -0.221$, $P = 0.001$). Using Spearman's test, self-efficacy was significantly related to eating habits ($r(239) = 0.270$, $P < 0.001$).

Three variables were tested for correlations with eating habits: location, self-efficacy, and knowledge of healthy dietary habits (Table 5). These variables were added in one linear regression model. The results indicated that the three predictors explained 12.8% of the variance ($R = 0.36$, $F(3,226) = 11.08$, $P < 0.001$). Location ($\beta = 1.39$, $P = 0.028$), self-efficacy ($\beta = 0.45$, $P < 0.001$), and awareness of healthy dietary habits ($\beta = -0.53$, $P = 0.008$) were significant predictors of eating habits.

4. DISCUSSION

This study assessed eating habits, physical activity, self-efficacy, awareness of healthy dietary habits, and nutritional knowledge among Saudi female students aged 14-18 years from two major geographical locations in Saudi Arabia. Most of the female adolescents had normal body weight or were underweight; only 10% of the females were classified as overweight or obese.

In this study, skipping breakfast was not a prevalent dietary pattern in the sample. Almost 93% of female adolescents reported consuming breakfast daily or frequently. These findings are not consistent with conclusions from other studies on the Saudi population [12,21]. Abalkhail et al. [38] found that skipping breakfast was reported by 14.9% of students and this habit did not differ by age, sex, body mass index, or social class. Among students aged 16-25 years in Riyadh, breakfast was skipped by 20% of respondents [39]. Another study found that breakfast was a regular meal for 49% of secondary school students and milk was consumed daily by 51.5% of the sample [40].

In our study, a small proportion of females consumed fruit and vegetables daily. Economic improvements in Saudi Arabia have encouraged negative eating behaviors. The majority of children and youth from Arab Gulf countries consume insufficient amounts of fruits and vegetables, which in turn can lead to inadequate dietary fiber and essential nutrient intake [41]. Many previous studies reported low consumption

of fruits and vegetables by both genders. Al-Rethaiaa and colleagues [10] reported that Saudi students do not frequently consume vegetables and fruits, except for dates. Unhealthy dietary habits are common in youth. Results from the 2009 National Youth Risk Behavior Surveillance study indicated that during the seven days preceding the survey, 78% of high school students had not eaten fruits and/or vegetables five or more times per day [42].

Physical inactivity was prevalent among females of this study. About 17% of females reported engaging in a particular sport. Physical inactivity associated with unhealthy diets are among the leading causes of major non-communicable diseases, including cardiovascular disease, type-2 diabetes, and certain types of cancer, which contributes substantially to the global burden of disease, death, and disability in Arab countries [43]. Saudi Arabia has witnessed significant lifestyle changes in recent years. Rapid urbanization, predominance of the automobile for personal travel, introduction of labor-saving devices in the home and the workplace, availability of high-fat and caloric-dense foods, satellite TV, and increased reliance on computers and telecommunication technology contribute to negative eating habits and poor physical activity patterns [12].

Screen time was the most reported sedentary behavior linked to physical inactivity and unhealthy eating: watching television takes away time that could be spent engaging in physical activities. This sedentary behavior increases food intake, especially unhealthy snacks, and decreases the motivation to move and be active. The prevalence of physical inactivity was significantly ($P < 0.001$) higher among Saudi adolescents (64%) compared to British adolescents (25.5%). The proportion of adolescents exceeding two hours of daily screen time was high among Saudis (88.0%) and British (90.8%) [44]. Similar findings revealed that 91.2% of female Saudi adolescents spent more than two hours onscreen daily [12]. A longitudinal study indicated opposing conclusions: it was shown that changes in watching television did not necessarily indicate changes in leisure time as the two behaviors represent two separate constructs, not functional opposites [45].

Self-efficacy is an essential concept influencing nutrition practices and dietary patterns [46]. This study confirmed the correlation between self-efficacy and dietary behavior. Using self-efficacy as a functional predictor for health behavior change is recommended. By implementing self-efficacy as a mediator variable in designed interventions, it will positively improve eating patterns and physical activity [47,48]. Planning an integrated dietary approach that uses the determinants of the TTM model has been proven effective among adolescents [28]. In addition, applying Bandura's Social Cognitive Theory constructs to a particular nutrition intervention has the potential to improve self-efficacy and overall health in adolescent females [49].

Study results revealed that adolescents' nutrition knowledge did not predict eating behavior. The literature on eating habits and nutrition knowledge were contradictory. Some have shown a positive and strong correlation between nutrition knowledge and eating behavior [31,32,46]. Other studies concluded only a small correlation exists between these factors [50]. Knowledge of what to eat is important in making healthy food choices but only if the knowledge is put into practice [51]. However, awareness of healthy dietary habits was associated with eating behavior in this study.

Significant locational variations in eating habits, physical activity, and self-efficacy were found. Al-Khobar adolescent females had significantly healthier dietary patterns and more active lifestyle compared to Riyadh adolescent females. Even though both cities have experienced rapid urbanization, Riyadh cannot be compared to Al-Khobar in terms of size and population density. Riyadh is considered the center of the industrial and business movement in Saudi Arabia, thus it is undergoing a stronger transition in eating patterns and lifestyle. Furthermore, extreme climate conditions limit outdoor activities during summer and winter in both cities [33,34]. However, Al-Khobar's geographical location on the east coast can serve as a major incentive to engage in certain physical activities compared to Riyadh's desert climate. Because of cultural and social reasons, Saudi females have fewer opportunities to engage in leisure-time physical activity, both inside and outside of school, compared with males [44].

Overweight and obesity were not common in our sample. These data are lower than reported by Mahfouz et al. [52], which showed that the rate of obesity and overweight amounted to 23.2% among boys and 29.4% among girls. Another cross-sectional study found that 61% of adolescent girls were normal weight, 28% were overweight or obese, and 11% were

underweight. Similar to our study, the findings show that adolescent girls in Saudi Arabia face two contrasting nutrition situations [53].

The rates of obesity are increasing among Saudi children and adolescents due to marked nutritional changes and rapid urbanization [5]. However, these trends tend to be the lowest among girls aged 14-16 years, which was seen in our study [4]. Al-Dossary et al. revealed that more than 50% of adolescents between 14 and 18 years had weight above the 85th percentile. However, only 19.2% of the female adolescents were considered overweight or obese [54].

Surprisingly, overweight and obesity were not related to scores obtained in the dietary questionnaire, even for eating habits and physical activity. In an international comparative study involving youth from 34 countries, a significant negative relationship was found between BMI categories and candy consumption in 91% of countries, while no association between the consumption of non-diet soft drinks and being overweight was found [55]. Recent studies about Saudi eating patterns and obesity revealed significant associations between unhealthy eating patterns and obesity [10,11,56]. Obese females were significantly less active (especially in terms of vigorous activity), had less favorable dietary habits (e.g., lower intake of breakfast, fruits, and milk), but had lower intake of sugar-sweetened drinks and sweets/ chocolates [56]. Al-Rethaiaa et al. [10] found a rising trend towards consuming more animal products and refined foods in the diet at the expense of vegetables and fruits. These eating patterns are correlated with an increased tendency of obesity and elevated body fat in children, adolescents, and adults in the past few decades.

In our model, eating habits were predicted by location, self-efficacy, and awareness of healthy dietary habits. Conceptual models and theories explain the dynamics of eating behavior and the surrounding external influences. Formulating a common theme based on these theories will help clarify the function of eating behavior according to personal and socio-environmental factors that interact to influence behavioral patterns [57]. In particular, Social Cognitive Theory (SCT) provides a useful framework for understanding the influential interactions related to eating behaviors in adolescents [57]. This theory examines a certain behavior in terms of interactions between personal factors, environmental aspects, and behavior.

Self-efficacy and knowledge are certain individual characteristics related to eating behavior. These intrapersonal factors have the ability to effectively modify the eating behavior [57]. Self-efficacy has frequently been a good predictor of health behavior, sometimes explaining 50% or more of variability [58]. Self-efficacy has found to be an associated variable in relation to predicting eating behavior among adolescents. Among adolescent girls, self-efficacy was identified as an important predictor for energy consumption, as it was inversely correlated with total intake at a meal ($P < .01$) [59]. Knowledge of healthy eating is essential, but knowledge by itself does not act towards adopting healthy eating behaviors in adolescents. A study based on twenty-three focus groups found that regardless of adolescents' knowledge, it is difficult to follow healthy eating recommendations and to limit consuming foods that perceived to be unhealthy [60-62].

Table 1. Anthropometric characteristics of the survey participants (n=291)

			Mean ± SD
Age	14	99 (34) [1]	
	15	73 (25) [1]	
	16	38 (13) [1]	14.6 ± 3.5
	17	43 (15) [1]	
	18	24 (8) [1]	
Weight			52.2 ± 10.7
Height			158.4 ± 6.6
BMI %ile[2]	Underweight	82 (28) [1]	
	Normal	175 (60) [1]	39.8 ± 33.5
	Overweight	24 (8) [1]	
	Obese	10 (3) [1]	

[1] *Values expressed as n (%)*

[2] *Body Mass Index (BMI)-for-age percentile, for children / adolescents 2 years and older*

Table 2. Distribution of female adolescents' responses for eating habits and physical activity

Eating Habits				
Q1: Do you eat breakfast? (n = 291)	Always 81 (27.8) [1]	Often 79 (27.1)	Sometimes 112 (38.5)	Never 19 (6.5)
Q2: Which beverage do you consume at breakfast? (n = 283)	Milk/milk and coffee /cappuccino/yogurt 115 (40.6)	Fruit juice 76 (26.9)	Tea/coffee 70 (24.7)	Chocolate 22 (7.8)
Q3: At breakfast you eat: (n = 280)	Biscuits/cakes/crackers/ breakfast cereals/bread 106 (37.9)	Fruit 17 (6.1)	Eggs and cheese 56 (20)	Dough/pizza/toast 101 (36.1)
Q4: Do you eat at least 2 portions (200g) of fruit every day? (n = 291)	Always 25 (8.6)	Often 68 (23.4)	Sometimes 129 (44.3)	Never 69 (23.7)
Q5: Do you eat at least 2 portions (200g) of vegetables every day? (n = 291)	Always 47 (16.2)	Often 77 (26.5)	Sometimes 106 (36.4)	Never 61 (21)
Q6: Do you usually eat a cake or a dessert at meals? (n = 291)	Always 79 (27.1)	Often 122 (41.9)	Sometimes 55 (18.9)	Never 35 (12)
Q7: Do you usually eat breakfast, lunch and dinner every day? (n = 290)	Always 63 (21.7)	Often 102 (35.2)	Sometimes 91 (31.4)	Never 34 (11.7)
Q8: Your diet: (n = 290)	Is different every day 157 (54.1)	Is different only sometimes during a week 88 (30.3)	Is different only during the weekend days 36 (12.4)	Is very monotonous 9 (3.1)
Q9: Your diet is based mainly on: (n = 286)	High protein content foods 35 (12.2)	High fat content foods 21 (7.3)	High carbohydrate content foods 61 (21.3)	Different foods every day 169 (59.1)
Q10: Your snacks are based mainly on: (n = 283)	Fruit/fruit juice/fruit and milk shakes/yogurt 56 (19.8)	Biscuits/crackers/bread/ stick bread 42 (14.8)	Fried potatoes/doughnuts /peanuts/soft drinks 86 (30.4)	Sweets/chocolate/ ice-cream/cakes 99 (35)
Q11: Which beverages do you usually drink between meals? (n = 287)	Water 164 (57.1)	Soft drinks 70 (24.4)	Fruit/fruit juice/fruit and milk shakes 42 (14.6)	Energy drinks 11 (3.8)
Q12: Do you drink at least 1 glass of milk or do you eat at least 1 cup of yogurt every day? (n = 289)	Always 46 (15.9)	Often 67 (23.2)	Sometimes 97 (33.6)	Never 79 (27.3)
Q13: Do you drink at least 1–1.5 L of water every day (≈4-6 cups)? (n = 289)	Always 79 (27.3)	Often 84 (29.1)	Sometimes 98 (33.9)	Never 28 (9.7)
Physical Activity and Lifestyle				
Q1: Do you usually practice a physical activity? (n = 289)	Always during the entire year 63 (21.8)	Only in some seasons 61 (21.1)	Sometimes 125 (43.3)	Never 40 (13.8)
Q2: How many hours do you practice it? (n = 288)	None 108 (37.5)	1h–2h in a week 122 (42.4)	3h–4h /week 32 (11.1)	More than 4h / week 26 (9)

Physical Activity and Lifestyle				
Q3: What do you prefer to do during free time? (n = 288)	Walking 25 (8.7)	Watching TV/listening to music /using the computer /reading a book 212 (73.6)	Practicing a sport 23 (8)	Shopping 28 (9.7)
Q4: How many hours do you spend on the computer or watching TV? (n = 288)	1h–2h a day 74 (25.7)	3h–4h a day 94 (32.6)	5h–6h a day 40 (13.9)	More than 6h a day 80 (27.8)
Q5: Your lifestyle is: (n = 289)	Very sedentary 16 (5.5)	Sedentary 91 (31.5)	Moderately active 144 (49.8)	Very active 38 (13.1)

[1] *Values expressed as n (%)*

Table 3. Differences in nutrition related variables among study locations in Saudi Arabia (Riyadh and Al-Khobar)

Variable (n)	Scores	Riyadh, n = 160	Al-Khobar, n = 131	P-Value
Eating habits [1] (n= 255)	21.7 ± 5.0 [a]	21.1 ± 4.9, n = 139 [b]	22.5 ± 5.1, n = 116	0.028 *
Physical activity and lifestyle [2] (n = 283)	6.2 ± 2.9	5.7 ±2.9, n = 154	6.8 ± 2.9, n = 129	0.002 *
Self-efficacy [3] (n = 269)	13 ±2.7	12.8 ± 2.8, n = 148	13.4 ± 2.7, n = 121	0.049 *
Awareness of healthy dietary habits [4] (n = 268)	2.6 ±1.6	2.6 ± 1.6, n = 152	2.6 ± 1.6, n = 116	0.668
Nutritional knowledge [5] (n = 252)	4.9 ± 1.9	4.7 ± 1.8, n = 143	5.1 ± 2.0, n = 109	0.190

Independent T-test.
** Significant findings.*
a Mean score ±standard deviation.
b Values are expressed as mean ± standard deviation,n.
1 Total score for eating habits section = 39.
2 Total score for physical activity and lifestyle section = 15.
3 Total score for self-efficacy section = 16. Non-parametric variable, Mann-Whitney U test was used.
4 Total score for awareness of healthy dietary habits section = 8. Higher score indicates lower knowledge in modifying dietary habits
5 Total score for nutritional knowledge section = 11.

Table 4. Differences in nutrition related variables among three BMI groups (underweight, normal, and overweight vs. obese)

Variable	Underweight	Normal weight	Overweight vs. obese	P-Value
Eating habits	21.6 ± 5.2, n = 67 [1]	21.5 ± 5.1, n = 158	23.2 ±5.0, n = 30	0.245
Physical activity and lifestyle	6.1 ± 3.0, n= 82	6.3 ± 3.0, n = 170	6.0 ± 2.7, n = 31	0.753
Self-efficacy [2]	13.1 ± 2.6, n = 68	13.1 ± 2.7, n = 169	12.8 ± 3.4, n = 32	0.994
Awareness of healthy dietary habits [3]	2.7 ± 1.7, n = 72	2.6 ± 1.6, n = 165	2.3 ± 1.5, n = 31	0.427
Nutritional knowledge	4.5 ± 2.0, n = 67	4.9 ± 1.9, n = 153	5.4 ± 1.7, n= 32	0.117

One-way ANOVA, post-hoc tests (Tukey's test).

[1] Values are expressed as mean ± SD, n.

[2] Non-parametric variable, Kruskal-Wallis test was used.

[3] Higher scores indicate lower knowledge in modifying dietary habits

Table 5. Variables tested for association with eating habits

Variable	Beta[1]	P-Value
Location	1.385	0.028 *
Self-efficacy	0.450	< 0.001 *
Awareness of healthy dietary habits [2]	- 0.529	0.008 *

Linear regression model
** Significant findings.*
[1] B unstandardized coefficients
[2] Higher scores indicate lower knowledge in modifying dietary habits.

Developing nutrition intervention programs must be initiated by identifying the most predictive variables of adolescent eating behaviors. The process of identifying predictive factors will assist in creating an effective framework for planning interventions. These interventions should be directed to improve predictive factors in order to improve the eating behavior. Programs that focus on the benefits of healthful foods by emphasizing the good quality and taste may be successful. Providing some convenient ways to include healthy meals and snacks has the potential to improve self-efficacy and change the eating behavior.

5. CONCLUSION

Unhealthy dietary patterns and sedentary lifestyles among Saudi adolescents are a major public concern. Particularly, female adolescents are at greater risk for physical inactivity and sedentary behaviors. Findings from this study confirm unhealthy lifestyle behaviors among female adolescents living in urbanized areas. There is an urgent need to develop nutrition awareness programs for children and adolescents to promote better dietary patterns and improve overall health. Appropriate physical activity programs should be added to female class curriculum to increase fitness among females. Additionally, health education classes and campaigns regarding nutrition and healthy food choices should be included to encourage healthier lifestyles. Future research should address these factors with a larger sample size. Assessing socioeconomic status and income for adolescent females could possibly uncover further associations between dietary consumption and weight. Initiating interventional programs to modify unhealthy dietary and lifestyle patterns among children and adolescents is highly suggested. Globally, nutrition and health professionals should focus on adolescent eating habits and tailor suitable educational strategies to improve adolescent nutrition. Providing nutrition knowledge in schools nationwide has the opportunity to develop a healthier generation.

6. STRENGTHS AND LIMITATIONS

Studies on Saudi population nutrition and dietary habits are limited. Several nutrition and lifestyle factors were tested in this study, so results can add additional insight to eating habits and lifestyle patterns of the Saudi population. This study can be used as a reference, especially for self-efficacy and nutrition knowledge among Saudi females. Selecting subjects from two different locations in Saudi Arabia has the advantage of generating a better representation of the female Saudi population. Major significant locational differences can be used as a background for future research.

One of the limitations of this study was that the information gathered was from self-reporting, including weight and height, which could limit the reliability of the results. Low rates of overweight and obese participants could be due to sample self-selection, as overweight/obese students were less likely to respond. The cross-sectional design can be considered as another limitation. Additionally, the small sample size may not be representative of the population, and some associations or significant variations might not be discovered because of that. Furthermore, dietary information provided by the female adolescents lacked quantity estimation as the focus was on the frequency of consumption rather than the amount or portion size. This could influence the results related to dietary patterns and correlations with other factors. Moreover, respondents' biases might have occurred due to survey translation.

CONSENT

As per international standard or university standard, Parental written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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