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CLINICAL & BASIC RESEARCH

Lifestyle Habits

Diet, physical activity and sleep duration among Omani adolescents

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عادات نمط الحياة

الغذاء و النشاط البدني ومدة النوم بين المراهقين العمانيين

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الملخص: **الهدف**: هدفت هذه الدراسة إلى التحقيق في عادات نمط الحياة والنشاط البدني (PA) وعادات الغذاء (EH) ، ومدة النوم (SD) بين المراهقين العمانيين، ودراسة الفروق بين الجنسين في هذه المتغيرات. **الطريقة**: تم استقطاب 802 من المراهقين العمانيين بشكل عشوائي (442 إناث و 360 ذكور)،تتراوح أعمارهم ما بين 15–18 سنة. وجرى تقييم مؤشرات قياس الجسم البشري، ومستوى النشاط البدني، وعادات الغذاء EH ومدة النوم SD بواسطة الاستبيان المعد لنمط الحياة في سن المراهقة العربية(ATLS)، كما طبقت أيضاً استبانة التكرارات شبه الكمية لتقييم الغذاء. **النتائج**: أظهرت النتائج أنه على الرغم من أن الخاضعين للدراسة كان نمط الحياة لديهم خاملاً (عدم وجود النشاط البدني، ومتوسط ساعات النوم 6.7، واستهلاك الأطعمة العالية السعرات الحرارية)، إلا أن مؤشر كتلتهم الجسمية كان طبيعياً (أقل من 25 Kg/m^2). ولقد تبين أن الذكور أكثر من الضعف نشاطاً من الإناث. فيما يتعلق بعادات الغذاء، كانت هناك بعض الاختلافات بين الجنسين، إلا في تناول منتجات الألبان واللحوم حيث تناول 62.5% و 55.5% من الذكور أكثر من 3 حصص على التوالي مقارنة ب 18.78% و 35.2% من الإناث على التوالي. بالإضافة إلى ذلك، كانت مشروبات الطاقة، واستهلاك البطاطس، وتناول الحلويات، والأنشطة البدنية القوية والإفطار ونسبة الخصر/الطول، والطول، والأسباب التي تحدد النشاط متنبئات مستقلة ذات دلالة إحصائية لمؤشر كتلة الجسم ($P < 0.05$) بالنسبة للذكور والإناث. **الخلاصة**: كشفت هذه الدراسة عن ارتفاع معدل انتشار السلوكيات الخاملة وانخفاض مستوى النشاط البدني بين عينة البحث، وخاصة بين الإناث. كما تم العثور على نطاق واسع من العادات الغذائية غير الصحية بين كلا الجنسين. هناك حاجة ماسة لمزيد من البحوث وكذلك سياسة وطنية لتعزيز نمط الحياة الصحي والنشاط البدني و العادات الغذائية وتثبيط السلوكيات الخاملة بين المراهقين العمانيين.

مفتاح الكلمات: المراهقون؛ عمان؛ نمط الحياة؛ النشاط البدني؛ العادات الغذائية؛ مؤشر كتلة الجسم؛ مدة النوم.

abstract: ***Objectives:*** This study aimed to investigate the lifestyle habits—physical activity (PA), eating habits (EH), and sleep duration (SD)—of Omani adolescents, and to examine gender differences in such variables. ***Methods:*** 802 Omani adolescents (442 females and 360 males), aged 15–18 years were randomly recruited. Anthropometric indices, PA level, and EH and SD were evaluated by the Arab Teenage Lifestyle questionnaire. A semi-quantitative food frequency questionnaire for dietary assessment was also administered. ***Results***: The results showed that although the study subjects had a sedentary lifestyle (lack of PA, average of 6.7 hours sleep, and consumption of high calorie foods), they maintained a normal body mass (less than 25 Kg/m^2). Males were more than twice as active as females. With respect to EH, there were few gender differences, except in dairy and meat consumption where 62.5% and 55.5% of males consumed more than 3 servings, respectively, compared to 18.78 % and 35.2% of females, respectively. In addition, waist/height ratio, height, reasons for being active, energy drinks, potato consumption, eating sweets, vigorous PA and breakfast EHs were statistically significant independent predictors for BMI, $P < 0.05$ for both males and females. ***Conclusion***: This study revealed a high prevalence of sedentary behaviors and a low level of physical activity, especially among females. Unhealthy dietary habits were also widely found among both genders. There is an urgent need for more research as well as a national policy promoting active living and healthy eating and discouraging sedentary behaviour among Omani adolescents.

Keywords: Adolescent; Oman; Lifestyle; Physical Activity; Dietary Habits; Index, Body Mass; Sleep; Habits.

Advances in Knowledge

- *The results of this research supply comprehensive and recent data on physical activity (PA)/inactivity patterns, eating habits and sleep duration in Omani adolescents, and their relationships to risk factors measures.*
- *These data represent baseline lifestyle characteristics to be used for potential intervention programmes in Oman.*
- *Information on the lack of PA, low amounts of sleep, the consumption of high calorie foods and a normal body mass index could be used for further research, including on the heritability of the Omani phenotype.*

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Application to Patient Care

- *The information in this study will stimulate society and healthcare providers to encourage increased PA, reduced electronic screen exposure, healthy dietary choices and sufficient amounts of sleep.*
- *Awareness of sleep deprivation may reduce automobile accidents, a significant percentage of which occur due to lack of sleep.*
- *This study provides information on characteristic lifestyle patterns for the consideration of Oman's Ministry of Education, physical education curriculum supervisors, public health authorities, policy makers and healthcare providers.*

Worldwide, a lifestyle that incorporates a healthy diet and physical activity (PA) is well-documented as being preventative of non-communicable diseases (NCDs) including type 2 diabetes (T2DM) and heart diseases. Lifestyle and well-being patterns are rooted in the habits of late adolescence and early adulthood and affect health in the long term. In 2005, the World Health Organization (WHO) estimated that 61% of deaths (35 million) and 49% of the global burden of diseases were attributable to NCDs, with 80% of such deaths occurring in low- and middle-income developing countries where health resources are limited.[1]

Oman, located in the southeastern corner of the Arabian Peninsula, is one of the developing countries in the Arabian Gulf. Oman's population numbers 3,090,150 of which 51% are under 24 years old.[2] In terms of its health profile, Oman has moved in less than half a century from a country dominated by infectious diseases to a country burdened by NCDs, including cardiovascular diseases, T2DM, obesity, hyperlipidaemia, and metabolic syndrome disorders.[3] Overweight and obesity are linked to the aetiology of NCDs, including T2DM, and are two conditions for which Omanis are considered a high-risk group.[3,4] The westernisation of lifestyle is associated with a high incidence of obesity and NCDs in the Gulf countries, including Oman.[5]

The risk of NCDs among the Arab population is reported to start at adolescence and is indicated by a high body mass index (BMI).[6,7] Physical inactivity and lack of knowledge about healthy and energy-dense foods might be considered risk factors for overweight and obesity among Omani adolescents, yet there are little data on the lifestyle habits of Omani adolescents.[8,9] It is important to monitor the lifestyle habits of young adolescents, as recent research has indicated an association between young people's lack of exercise, unhealthy dietary behaviour, self-imposed sleep reduction and an increased risk of developing NCDs.[1,10]

In addition, recent research on adolescents in Saudi Arabia has observed a high prevalence of sleep deprivation which was significantly associated with an increased risk of overweight and obesity.[11,12] Epidemiological studies suggest that self-reported sleep complaints are associated with an increased relative risk of cardiovascular morbidity and mortality.[13]

According to the National Commission on Sleep Disorders Research and reports from the National Highway Safety Administration, high-profile accidents can partly be attributed to people suffering from a severe lack of sleep.[14] This is a matter of alarm as those subjecting themselves to self-imposed sleep curtailment are at an increased risk for such accidents as well as likely to develop a sedentary lifestyle and obesity.

It is helpful to understand the Omani risk factors and relate those to our results. Indeed, Omani lifestyle changes during the last 5 decades have influenced the culture, and it has become apparent that certain phenotypical factors seem to have influenced the Omani population's anthropometry. Few studies have tackled the problem of sedentary behaviours, limited PA, sleep duration (SD) or the eating habits (EH) of Arab adolescents. Therefore, the aim of this study was to investigate the lifestyle habits, including PA, EH and SD of Omani adolescents, and to examine the gender differences in such variables. We also sought to address the following specific questions: (1) What are the current lifestyle habits related to diet, PA/inactivity, and sleep deprivation among Omani adolescents? (2) Are there associations between lifestyle habits and BMI or overweight? (3) Are there differences between male and female lifestyles?

Methods

The participants were drawn from students attending secondary schools in the city of Muscat, the capital of Oman. The data were collected during

October and November 2010. Two questionnaires were simultaneously used for the study's cohort: the Arab Teens Lifestyle Study (ATLS) for the assessment of PA, anthropometrics and sleeping hours, and a semi-quantitative food frequency questionnaire (FFQ) for dietary intake assessment.[6] Anthropometric measurements (body weight, height and waist circumference [WC]) were also taken.

This research is part of the ATLS, an epidemiological, cross-sectional and multicentre project designed to study the lifestyle of adolescents living in major Arab cities.[6] The minimum sample size needed (± 0.05 of the population proportion with a 95% confidence level) was calculated as 770 adolescents, assuming the population proportion to be 0.50. The sample size was estimated using Epi Info 2008 (Centers for Disease Control and Prevention, Atlanta, Georgia, USA) and was based on a population of 40,000 students.

A multistage stratified-cluster random sampling technique was used to select the required sample. At the first stage, stratification was determined based on gender and geographical locations. Therefore, 6 schools were randomly selected from the three major geographical areas in Muscat, the northern, central and southern areas. To select the schools, a systematic random sampling procedure was used. Later on, classes were selected at each grade (level) using a simple random sampling design. Thus, we selected 18 classes (9 classes each at boys' and girls' schools).

The study subjects were recruited on a voluntary basis. The inclusion criteria required participants to be healthy, and free of endocrine disorders and chronic diseases. This inclusion criterion was important since we wanted to examine the lifestyle habits of healthy people. The exclusion criteria included physical deformities and chronic diseases. This information was obtained from the school students' medical records. The total sample size consisted of 802 adolescents (males = 360; females = 442).

The study protocol and procedures were approved by the Office of the Advisor for Academic Affairs at Sultan Qaboos University (SQU) as well as by the Ministry of Education's Directorate General of School Education in the Muscat Governorate. We also obtained school and parent consent for conducting the survey as well as the agreement of students to participate.

Anthropometric variables included body weight, height and WC. Measurements were taken in the morning by trained researchers using standardised procedures. All research assistants were volunteers from the Physical Education Department at the College of Education at SQU. Body weight was measured to the nearest 100 g with minimal clothing and without shoes, using a calibrated portable scale. Height was measured to the nearest cm with the subject in the full standing position without shoes and using a calibrated portable measuring rod. BMI is defined as the individual's body mass divided by the square of their height (Kg/m^2). The International Obesity Task Force's (IOTF) age- and sex-specific BMI reference values were used to define overweight and obesity in adolescents aged 14–17 years. For adolescents 18 years and older, we used the cut-off points for adults (normal, overweight and obese, based on 18–24.9, 25–29.9, and ≥30 Kg/m^2, respectively). WC was measured horizontally at navel level and at the end of gentle expiration to the nearest 0.1 cm using a non-stretchable measuring tape.[6]

The ATLS research instrument was used to record lifestyle information.[3,7] The questionnaires included items for the assessment of PA, sedentary behaviours, EHs and SD. To ensure accurate and consistent measurements throughout this study, the research assistants were trained and provided with a standardised written protocol.

Different PAs were assigned metabolic-equivalent (MET) values based on a compendium of PAs and the compendium of PAs for youth.[6] Moderate-intensity PAs include normal paced walking, brisk walking, recreational swimming, household activities, and recreational sports such as volleyball, badminton and table tennis. Moderate-intensity recreational sports were assigned an average MET value equivalent to 4 METs. Household activities were given an average MET value of 3. Slow walking, normal paced walking and brisk walking were assigned values of 2.8, 3.5 and 4.5 METs respectively, based on the modified MET values in the compendium of PA for youth.[15] Vigorous-intensity PAs and sports include stair climbing, jogging, running, cycling, self-defense, weight training, soccer, basketball, handball, and singles tennis. Vigorous-intensity sports were assigned an average MET value of 8. To measure the

Table 1: General characteristics of the study subjects

Variable	Male (n = 360)	Female (n = 442)
Age in years	17.1 ± 1.2	16.7 ± 1.3
Weight in Kg	59.6 ± 13.1*	53.2 ± 11.1
Height in cm	168.9 ± 7.6*	158.3 ± 6.5
BMI in Kg/m²	20.9 ± 4.2	21.3 ± 4.4
WC in cm	69.8 ± .5	72.9 ± .5
Total screen time in hrs/day	2.86 ± 2.3	3.70 ± 2.9*

*Data are means ± standard deviation; *P <0.05.*
BMI = body mass index; WC = waist circumference.

participants' levels of PA, the total METs-mins per week and the METs-mins per week spent in each of the moderate- and vigorous-intensity PAs were used. For PA cut-off values, three categories (low, medium and high activity) based on tertiles of total METs-mins per week, METs-mins per week from vigorous-intensity PA, and METs-mins per week from moderate-intensity PA were used. Inactivity was defined as 1,680 METS (60 mins per day × 7 days per week × 4 METs).

The ATLS instrument also included questions on sedentary behaviours, assessing the typical amount of time spent per day on screen-related activities, including television viewing, electronic games, and computer and Internet use. Participants were asked to state their typical time (hrs) per week spent on these activities without differentiating between weekdays and the weekend. For total screen-viewing time cut-off values, we used the American Academy of Paediatrics (AAP) guidelines of a maximum of 2 hours per day.[6,7]

The retrospective dietary intake of the study participants was estimated using a semi-quantitative FFQ where all subjects were asked to report the frequency and portion size for each food item consumed over the past 6 months.[16] This period was chosen to take into account the seasonal variation in food consumption. Also, all study subjects were asked if they had changed their diets from their usual routines in the last 12 months. The FFQ was adapted according to portion sizes based on commonly used household serving units/utensils in Oman, and was tested for its validity, reliability and reproducibility before conducting the study.[17]

The different food groups included in the questionnaire were as follows: breads/cereals, vegetables, fruits, meat/meat substitutes, milk/dairy products, desserts, beverages, sandwiches, and traditional Omani dishes. The collected dietary data were categorised into two groups: (1) Food group analysis, or the number of daily servings of food groups based on the frequency of consumption. All participants were subsequently grouped according to the Food Guide Pyramid from USA Departments of Agriculture and Health and Human Services.[18] (2) Nutrient density, or the percentage of energy contribution from the daily macronutrients intake to the total energy intake. The Food Processor software, Version 10.2 (ESHA Research, Salem, Oregon, USA) was used to calculate the means of daily nutrient intake of macronutrients and total energy intake as estimated from the portion sizes and nutrient content for all foods reported by each participant.

All participants were asked about the number of typical sleeping hours per day (night and day) using a self-reported questionnaire included in the ATLS. No differentiaton between weekdays and weekends in sleeping hours was ascertained. In this study, insufficient sleep was defined as sleeping less than 7 hours per night according to the definition of the National Sleep Foundation for the adolescent population.[14]

Data were presented as means ± standard deviation (SD). Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS), Version 19 (IBM, Corp., Chicago, IL, USA). The Chi-square test was used to analyse categorical variables. The one-way analysis of variance (ANOVA) followed by Freeman-Tukey's test or the unpaired Student's t-test were used for analysing continuous variables. Multinomial logistic regression analysis was used where the dependent variable was BMI. A *P* value of <0.05 was considered statistically significant.

Results

The descriptive characteristics of the participants are shown in Table 1. All the Omani adolescents who participated in this study were similar in age (17.1 ± 1.2 years for males and 16.7 ± 1.3 years for females). The percentage of females in the sample slightly exceeded that of males (55.1% *versus* 44.9%). Although males and females had similar values for BMI and WC, the prevalence of overweight

Table 2: Frequency of selected variables among the enrolled study subjects

Variable	Male (n = 360) %	Female (n = 442) %
Energy drinks	65*	47
Sweets ≥ 3 times/week	65*	47.3
Potato fries/chips ≥ 3 times/ week	65*	47.3
Fast food consumption, based on < or > 4 times/week	50.2*	63.3
Skipping breakfast, based on < or > 4 times/week	36.9*	64.9
Activity levels, based on < 1, 680 METs (inactive)	33.3*	76.9
BMI (normal)	87.2	87.5
BMI (overweight)	6.3	12
BMI (obese)	5	9.2
Sleep < 7 hrs/day (mean 6.76)	41.5	43

**P <0.05.*

MET = metabolic-equivalent; BMI = body mass index.

Table 3: Frequency of consumption of different categories of food by study subjects

Food group and number of servings/ day	Males n = 360		Females n = 442		Test
	n	%	n	%	
Bread, cereal, rice and pasta					
<6	40	11.11	50	11.31	$\chi^2 = 0.001$ $P = 0.99$
6–11	285	79.17	348	78.74	
≥11	35	9.72	44	9.95	
Vegetables					
<3	35	9.72	43	9.73	
3–5	281	78.06	347	78.51	$\chi^2 = 0.038$ $P = 0.98$
≥5	44	12.22	52	11.76	
Fruit					
<2	60	16.67	71	16.07	
2–4	250	69.44	308	69.68	$\chi^2 = 0.067$ $P = 0.96$
>4	50	13.89	63	14.25	
Dairy (milk, yogurt and cheese products)					
<2	12	3.33	10	2.26	
2–3	123	34.17	416	94.12	$\chi^2 = 79.29$ $P = 0.001$*
≥3	225	62.5	16	3.62	
Meat (red meat, poultry, fish, dry beans, eggs and nuts)					
<2	33	9.17	40	9.05	$\chi^2 = 31.55$ $P = 0.001$*
2–3	127	35.28	319	72.17	
≥3	200	55.55	83	18.78	

**P<0.05.*

or obesity was higher in females than males, but only by a very small proportion. However, the total screen time was also higher in females than males (3.7 *versus* 2.8 hours/day, respectively).

Table 2 shows that the intake of energy drinks, sweets, French fries and potato chips based on ≥3 times/week consumption was higher in males than in females and significantly different (P <0.05). There was also a higher percentage (64.9%) of females who skipped breakfast regularly (based on a response of doing so >4 times/week), while a high percentage of both genders consumed fast food.

The assessment of PA levels was based on metabolic equivalent levels and the routine exercise practices of males *versus* females. The activity levels based on <1,680 METs (inactive) was higher in females than males and significantly different (76.9% *versus* 33.3%). Although the amount of weekly exercise time was limited for both genders, males engaged in PA and routine exercise more frequently than females (P <0.05) [Table 2].

Despite the fact that subjects were classified as normal, as indicated by BMI, the frequency of overweight and obese subjects was 11.5% for males and 18.1% for females. No significant percentages of underweight were found in the male or female respondents (0% and 2%, respectively).

In addition, the mean SD was 6.72 hrs per day with no significant difference between males and females. About 57.6% of the participants had less than 7 hours of sleep per day with no significant difference relative to gender, while approximately 77.1% got ≤8 hours of daily sleep. A total of 42.5% of subjects (in both males and females) slept less than the mean while only 23% slept longer than the mean.

Females spent more time than males (55.2% *versus* 44.8%, respectively) on total screen time. Females also had a higher percentage of screen time and sitting in comparison to males (24.8% *versus* 17.9%, respectively) [Figure 1]. Nevertheless, the males spent more time on the computer than watching TV as compared to females.

Highly significant differences were observed

Table 4: The association of body mass index with different variables among males and females

	B (Standard error)	Standardised coefficients	*P* value
Independent predictors Males			
Waist/height	167.47 (9.11)	0.670	<0.001*
Height in m	90.933 (5.887)	0.554	<0.001*
Reasons for being active	- 0.945 (0.270)	- 0.125	<0.001*
Energy drinks	- 1.375 (0.334)	- 0.158	<0.001*
Potato snacks	1.127 (0.294)	0.165	<0.001*
Sweets	- 0.694 (0.286)	- 0.101	0.016*
Vigorous exercise mins/ week	- 0.007 (0.003)	- 0.084	0.023*
Breakfast intake	- 1.051 (0.509)	- 0.075	0.040*
Independent predictors Females			
Waist/height	4.609 (0.371)	0.543	0.000*
Height in m	- 0.879 (0.346)	- 0.110	0.012*
Reasons for being active	- 0.52 (0.018)	- 0.127	0.004*
Energy drinks	-1.287 (0.471)	- 0.105	0.007*
Potato snacks	- 0.469 (0.187)	- 0.097	0.013
Sweets	- 0.028 (0.010)	- 0.120	0.007*
Vigorous exercise mins/ week	0.0 (0.0)	- 0.169	0.006*
Breakfast intake	- 0.077 (0.027)	- 0.127	0.004*

**P <0.05.*

between males and females in the area of consumption of dairy and meat groups (P <0.05). Of the male subjects, 62.5% consumed more than 3 servings of dairy products per day as compared to 3.62% of female subjects [Table 3]. The same pattern was observed for meat consumption, where it was found that 55.55% of male subjects consumed more than 3 servings of meat products and substitutes/ day as compared to 18.78% for female subjects. On the other hand, no significant differences were observed in the daily intake of servings from the cereal and milk groups (P >0.05).

Figure 2 illustrates the nutrient density as presented by the percentage of energy derived from each macronutrient to the daily total energy intake. It was found that for male subjects, the nutrient density for carbohydrates, fat and protein was 55.46 ± 7.93, 30.43 ± 6.66, and 22.54 ± 4.48, respectively. The same pattern was observed for female subjects: 51.12 ± 8.42 for carbohydrates, 22.61 ± 5.93 for fat and 18.67.54 ± 3.34 for protein. The difference was significantly higher among male subjects *versus* female subjects based on one-way ANOVA analysis followed by the Freeman-Tukey's test (F = 38.33, R square = 0.9623, P = 0.007).

The association between BMI and other independent predictors for weight gain was determined using the multinomial logistic regression analysis stepwise method as presented in Table 4. The model presented in this table for males shows that participants' waist/height ratios and height; reasons for being active; consumption of breakfast, energy drinks, potato products, and sweets; frequency of vigorous PA and breakfast EH were the highest independent predictors for BMI levels (P <0.05). The same pattern was observed for females. Meanwhile, other study variables were not associated with BMI (P >0.05).

Discussion

Our results showed that although the study subjects had a sedentary lifestyle (lack of PA, low number of sleeping hours and consumption of high caloric foods), they maintained a normal BMI of <25 Kg/ m^2. If this lifestyle pattern were to prevail in the long term, the genetic predisposition might synergise with environmentally-driven factors like PA and diet in the aetiology of obesity and overweight among Omani adolescents; thus, this may be considered a multifactorial health problem in Oman.

In addition, the results of this study revealed that raised BMI levels are found less frequently than in other similar studies in the Middle East; furthermore, Trudeau *et al*. found that adolescents appear to experience a marked decline in PA as they get older.[19] Changes occurring during adolescence, including the adoption of positive and negative health habits, are acquired before adulthood.[19] In subsequent studies, numerous researchers have shown that the rate of children and adolescents

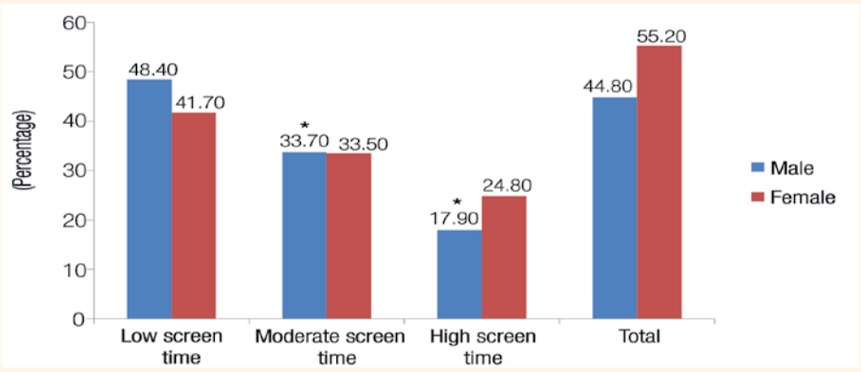

Figure 1: Low, moderate and high screen time for male and female subjects.
**Significantly different = P <0.05.*

engaging in PA has decreased over recent years due to the increasing influence of sedentary activities such as television viewing, Internet surfing and video games.[20] In support of this trend, Gordon-Larsen *et al.* found that adolescents spend less time in physical education sessions than younger children.[21]

Although some health benefits can occur through an average of 30 minutes of PA per day, PA guidelines for children and adolescents recommend that they should participate in at least 60 mins of moderate to vigorous PA on a daily basis.[22] In the present study, the cut-off score of 1,680 METs-mins per week was used to correspond to one hr of daily moderate-intensity PA, and 2,520 METs-mins per week was used as a cut-off score corresponding to one hr of daily moderate- to vigorous-intensity PA.[11] Based on these cut-off scores, we found a considerably higher prevalence of physical inactivity, especially among Omani females. About 40% of the males and less than 30% of the females met the current recommendations of one hr daily of moderate-intensity PA. Such high rates of low PA levels represent an area of great concern because of the association of inactivity with increased cardiovascular and metabolic risk factors in children and adolescents.[23]

Major factors that contribute to youth inactivity in Oman include a reliance on cars rather than walking for short-distance travel, including trips to and from school, and the limited quality of physical education programmes in schools, especially for girls. The rate of private car ownership is as high as 69% among Omanis.[24] Females in the present study were found to be not only significantly more sedentary than males, but they were also much less physically active, especially in terms of vigorous PA. Insufficient vigorous PA was shown to be a risk factor for higher BMI for adolescent boys and girls. Thus, our findings suggest that Omani

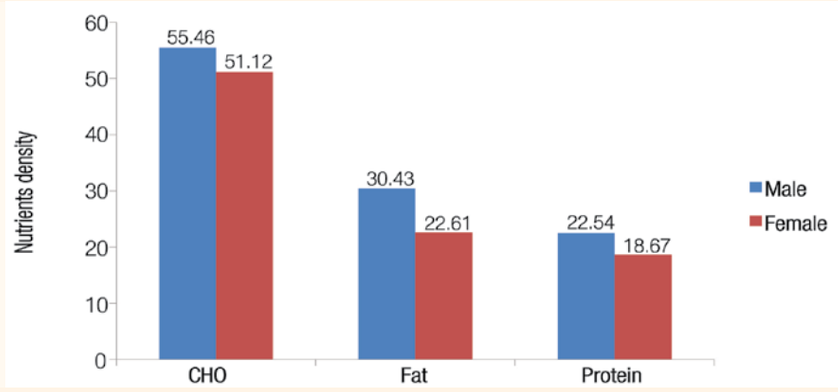

Figure 2: Nutrient density, the percentage of energy contribution from different macronutrients consumed by study subjects in comparison to their total energy intake.
CHO = carbohydrates.

females may be a good target for PA interventions. It is noteworthy that the PA levels of Arab females, irrespective of the region, have generally been reported to be much lower than those of males.[25] Families may not encourage females to take part in PA for cultural reasons.[26] Another study showed that males were found more likely than females to participate in sports and PA.[8]

The prevalence of sedentary behaviours found in the present study among Omani adolescents was remarkably high. The AAP has expressed concern about the amount of time that children and adolescents spend viewing TV and has issued guidelines recommending that screen time should not exceed 2 hours per day.[27] It seems that males spend more time sitting at computers than females, but the opposite is true of TV-viewing habits. Females spend more time sitting and watching TV than males [Figure 1].

Both the males and females in our study exceeded the AAP recommendations for daily screen time. The implication of this finding is that there is a need to reduce the time spent by adolescents on TV viewing and computer use. Excessive TV viewing in adolescence appears to be related to an unfavourable cardiovascular risk factor profile.[28] In addition, it is now recognised that sedentary behaviours are associated with other harmful health outcomes than those that are attributable to the lack of PA.[8]

The females in the present study spent on average more of their leisure hours on screen time than the males indicating that females are less active than males and prone to a sedentary lifestyle. Similarly in the United Arab Emirates (UAE) watching TV was found to be the predominant leisure time pursuit among 14 to 16-year-old adolescents in the United Arab Emirates, with an average of 2.5 hrs viewed per day.[29]

The male subjects in this study indicated they had a diet with a high frequency consumption of red meat and saturated fat, and a moderate consumption of fruits and vegetables as compared to the female subjects. The WHO Global Strategy for Diet and Physical Activity recommendations call for achieving an energy balance, limiting the energy intake from fats, reducing the intake of free sugars and increasing fruit and vegetable consumption.[30] In the present study, the prevalence of daily fruit and vegetable consumption by both genders was noticeably good [Table 3] and was higher than that previously reported for adolescents in Jeddah, Saudi Arabia, which amounted to 27.6% and 26.4% for fruits and vegetables, respectively.[31] In the UAE fruit and vegetable consumption was reported to range from 49–69% for both males and females.[32]

Skipping breakfast is another unhealthy EH that was found to be very common in the present study. Skipping breakfast was reported at 32% among Omani adolescents from Muscat. Skipping breakfast was also shown to be prevalent in the USA and Europe, ranging from 10–30% depending on the age-group, population and definition.[33] The consumption of fast food more than three times per week was 50.2% and 63.3% for male and female adolescents in Oman, respectively; therefore, interestingly, female students were more likely to consume fast food than males. These percentages are higher than the rate of fast food intake reported recently for other Arab countries.[34]

The main findings of this study indicate that 42.5–57.6% of Omani adolescents do not obtain enough sleep. The average SD (6.721 hrs/day) found among Omani adolescents in the current study appears lower than that reported by Saudi Arabian or Australian adolescents (ranging from 6.4–7.2 and 8.40–9.10 hrs/day for 14–19 and 15.5–17.5 year olds, respectively).[35] The findings of the present study showed that about half of the Omani adolescents did not sleep 7 hrs nightly, while about 70% of the participants slept less than 8 hrs a night. In comparison with our findings, McKnight-Eily *et al.* have reported that 68.9% of USA high school students get insufficient sleep (<8 hrs/day) on an average school day.[36] In Japan, the proportions of adolescent boys and girls who reported less than 6 hrs of daily sleep were 28.7% and 32.6%, respectively.[37] Among Taiwanese adolescents, 54% reported that they slept less than the suggested 6–8 hrs per day.[38]

The reduced SD observed among Omani adolescents in the current study may be attributed to several factors. Adolescence is a critical period in which a growing sense of autonomy and increased socialisation may dominate life. Our modern lifestyle, with round-the-clock satellite television programming and high-speed Internet availability, along with the increased demands for more studying and homework, may distract adolescents from going to bed early.

In our study we could not assess the relationship

between short sleep and obesity and/or overweight due to the normal scores in our participants' BMIs and the low incidence of overweight.

Conclusion

The present study reported on the prevalence of the several lifestyle factors among adolescents aged 15–18 years from public schools in Muscat, Oman. The findings of this study provide evidence of the high prevalence of sedentary behaviours and low levels of PA, especially among females. Unhealthy EH were also widely found among both genders. Furthermore, correlation analyses revealed that unhealthy behaviours, such as increased electronic screen time and unhealthy EHs, appear to aggregate in this group of Omani adolescents. Future investigations in other regions of Oman, to test the effects of urban *versus* rural lifestyles, are needed before any national intervention plan could be drawn up. Nonetheless, the promotion of a healthy lifestyle should be a national public health priority. In addition, there is an urgent need for national policy promoting active living and healthy eating while reducing sedentary behaviours among Omani children and adolescents. Future research needs to address the determinants of sedentary behaviours, PA and inactivity, and unhealthy EHs. Future interventions should investigate whether the adoption of a healthy lifestyle by Omani adolescents with sleep deprivation would improve the sleeping habits of 15–18-year-olds residing in rural areas *versus* the habits of those living in urban areas using Muscat as an urban model.

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