Physical inactivity, sedentary habits and eating habits among Moroccan adolescents

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Abstract. In Morocco, noncommunicable diseases were responsible for 80% of all deaths in 2016. These risk factors are closely related to diet and physical activity. Therefore, this study aims to determine the prevalence of physical activity, sedentary behaviors and eating habits among a sample of Moroccan adolescents aged 14 to 19 years. This is a cross-sectional study involving a sample of 669 (285 boys and 384 girls) recruited during the year 2019 in the Province of Sidi Kacem-Morocco. Data on sedentary behaviors, physical activity and eating habits were collected using a validated questionnaire. Overall, 38% of Moroccan adolescents did not meet the recommended duration of one hour of moderate-intensity physical activity, boys are generally more active than girls ($p < 0.00$), and 36% of adolescents reported watching TV for more than 2 hours/day and 42% used a computer for a similar period. Girls are more sedentary than boys ($p = 0.005$). For eating habits, there were significantly more boys than girls who met the recommended scores for healthier foods, but there were significantly more girls than boys who exceeded the score of three days of intake per week for unhealthiest foods. The prevalence of sedentary behavior, physical inactivity and unhealthy eating habits appear to be moderately high, but physical and nutritional education programs are needed to promote an active living and a healthy eating.

Key words:

Physical inactivity; eating habits; sedentary behaviors; adolescents; Morocco.

Introduction

Globally, non-communicable diseases (NCDs) are the leading causes of death. In 2012, they accounted for 38 million (68%) of the 56 million deaths [1]. In Morocco, they were responsible for 80% of all deaths in 2016 [2].

According to the World Health Organization, 2002 (WHO) report, the greatest risks of NCDs included high blood pressure, high blood cholesterol levels, inadequate consumption of fruits and vegetables, overweight or obesity [3]. These risk factors are closely related to diet and physical activity [4].

Physical inactivity is an important risk factor for NCDs such as stroke, diabetes and cancer. At present, the practice of physical activity is increasingly declining in Morocco. Globally, 23% of adults and 81% of adolescents in school are not physically active enough [5].

Participation in healthy physical activity is a key determinant of youth energy expenditure and leads to better cardiovascular and metabolic health and good bone status [6, 7]. In contrast, persistent physical inactivity affects health and well-being [8]. For example, physical activity plays an important role in preventing overweight and obesity in childhood and adolescence and reduces the risk of obesity in adulthood [9].

During years of growth, optimal nutrition combined with regular physical activity increases the likelihood of a healthy model of physical maturation consistent with the genetic potential of children [10, 11]. Physical activity and diet are the cornerstones of obesity prevention and management [12]. In addition, obesity is further complicated by the complex interaction between diet, physical activity, and metabolic and genetic factors [13] in an environment that encourages the consumption of

energy-rich foods and discourages energy expenditure [14].

Poor lifestyles, including excessive intake of high-fat foods and low levels of physical activity, have contributed to an increase in the prevalence of overweight and obesity among adolescents [15]. The burden of disease in low- and middle-income countries has been largely attributed to the ongoing nutritional transition and lifestyle changes characterized by changes in food supply and intake and reduced leisure time and of occupational physical activity [16].

Physical inactivity or sedentary behaviors and unhealthy diets are considered the main causes of non-communicable diseases, thus contributing significantly to the global burden of morbidity, death and disability [17].

In this context, a few studies have examined some aspects of eating habits and lifestyle among Moroccan adolescents. Therefore, the objective of this study was to assess the prevalence of physical activity, sedentary behaviours and eating habits among Moroccan adolescents aged 14 to 20 years, using representative samples from three cities under the direction of Sidi Kacem Province.

Materials and methods

I- Study Population

The total sample consisted of 730 male and female adolescents enrolled in Moroccan secondary schools (college and high school) in three major cities in the province of Sidi Kacem: Sidi Kacem, Mechra Bel Ksiri and Jorf El Melha during the 2019/2020 school year.

Classes were selected at each school level using a simple random sampling design. Indeed, six secondary schools (three colleges and three high schools) were randomly selected: one college and one high school per

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city. Subsequently, a class was randomly selected in each of the three years of each cycle: one class per level (classes 1, 2 and 3). All classes were mixed (boys and girls) and all participants were apparently healthy without physical disabilities. Data were collected in the three cities from October to December 2019, avoiding any data collection on the months of hot, wet or very cold weather, as these environmental conditions can have a negative effect on the level of physical activity.

A total of 18 classes were selected, with an average of 40 students per class. The required authorization and ethical approval from the National Ministry of Education has been obtained.

II- Assessment of the lifestyle of the population studied

II-1. Assessment of physical activity and inactivity

A self-reported questionnaire was used to assess the level of physical activity. The research questionnaire (Study of the lifestyle of Moroccan students) used in our study was also used in a study as part of the regional project ATLS (Arab Teens Lifestyle Study). It consists of 41 items for the assessment of physical activity, sedentary lifestyle and eating habits. The physical activity questionnaire is a modified questionnaire based on an original questionnaire that had previously shown high reliability (CCI = 0.85; 95% CL = 0.70- 0.93) and acceptable validity ($r = 0.30$; $p < 0.05$) compared to the pedometer measurements using a practical sample of young boys aged 15 to 25. [18,19]. In another validity study, involving both girls and boys aged 14 to 19, the current ATLS physical activity questionnaire was also validated against the electronic measurements of the pedometer and was found to have an acceptable validity coefficient ($r = 0.37$, $p < 0.001$) [20]. The questionnaire was designed to collect comprehensive information on the frequency, duration and intensity of a variety of mild, moderate and vigorous physical activities during a typical week. It covers areas such as transport activities, domestic activities etc... The questionnaires were completed by the class participants.

Instructions were given to participants to avoid any collection of data on hot, wet or very cold months, and on national and regional exam days as these conditions may have a negative effect on the level of physical activity.

Moderate intensity physical activities were assigned MET values based on the Physical Activity Compendium tables [21, 22]. Recreational sports of moderate leisure intensity have been assigned an average MET value equivalent to 4 METs. Intense sports have been assigned an average MET value equivalent to 8 METs.

The participants studied were classified into two groups (active or inactive) based on the total physical activity scores of 1680 METs-minutes per week (60 minutes per day 7 days per week x 4 METs) 1 hour of moderate physical activity per day [23]. One hour of at least one moderate-intensity physical activity per day is the minimum recommended duration of physical activity for children and youth [7].

II-2. Sedentary Behaviours

The sedentary behaviour questions followed the physical activity questions and were designed to assess the typical amount of time spent each day watching TV, using the computer and the Internet, and the number of hours of sleep per day (Night and day). Participants were asked to indicate their typical time (hours) spent on these activities without distinguishing between weekdays and weekends. The maximum time devoted to sedentary living (watching television, using the computer) was taken to classify the population studied into two categories (2 and >2 hours/day). We used the recommendations of the American Academy of Pediatrics of a maximum of 2 hours per day [24].

II-3- Assessment of eating habits

In addition to the physical activity questionnaire, the ATLS questionnaire included 10 specific questions in a separate section to determine the frequency of certain dietary habits in the study population during a typical week.

Eating habits were classified into two categories:

- Healthy eating habits such as eating breakfast, eating vegetables, fruits, milk and dairy products;
- Poor eating habits such as eating sugary drinks, doughnuts, cakes, cookies, sweets, chocolate, energy drinks and fast foods.

For dietary thresholds, we calculated the proportions of adolescents who took daily breakfast, fruits, vegetables and milk and those who exceeded 3 days a week of unhealthy food.

Statistical Analysis

The statistical analysis was carried out using the statistical software SPSS (Statistical Package for the Social Sciences; version 21). The normality of the variables was tested by the Kolmogorov-Smirnov (KS) test to a sample. Normally distributed quantitative variables were presented in average standard deviation while those following an abnormal distribution were expressed in median [interquartiles]. Qualitative variables were expressed in percentages and compared using the Chi-2 test. The $p < 0.05$ value shows the degree of statistical significance.

Results

A total of 669 students participated in this study with 42.6% boys and 57.4% girls. The average age of adolescents was 16.31 $\pm$ 1.66 years with a statistically significant difference by gender ($p = 0.000$) (Table 1).

Overall, boys are generally more active than girls in a typical week with a statistically significant difference ($p < 0.05$). The total MET-min score per week was significantly higher among boys than girls ($p < 0.000$).

Table1: Physical activity profiles and sedentary behavior among Moroccan adolescents aged 14-19

Variable	Boys N=285	Girls N=384		Total N=669	p-value
Gendre (%)	42.6	57.4		100	-
Age (Years)	16.61±1.71	16.08±1.59		16.31±1.66	0.000
Education level (n (%))	College students	131(46)	193(28.8)	324(48.4)	0.003
	High school students	154(54)	191(28.5)	345(51.5)	
Physical activity measurements Energy expenditure (MET-min / week)					
Moderate physical activity	1127.45±1046.42	1427.76±1581.08		1299.82±1385.97	0.005
Vigorous physical activity	3181.36±2439.67	1029.21 ±1411.76		1946.04±2192.60	0.000
Total MET-min week	4308.81 ±3056.87	2456.97±2455.96		3245.87±2875.92	0.000
(<1680 MET-min/week) (%)	23.5	48.6		38	0.000
Sedentary activity measurements					
Watching television> 2 h / d (%)	26	43.4		36.0	0.005
Computer and smartphone use> 2 h / d (%)	36.1	46.4		42.0	0.005
Sleep <7 h / d (%)	27	29.4		28.4	0.005

Girls have significantly higher moderate physical activity than boys ($p<0,005$). On the other hand, they spend significantly more time in vigorous physical activity ($p<0.000$). Compared to recommendations for daily physical activity; in total, more than one third (38%) of Moroccan adolescents did not meet the recommended duration of one hour of moderate intensity physical activity with a statistically significant difference by sex ($p<0.00$). Indeed, almost half of girls (48.6%) and 23.5% of boys did not reach the recommended moderate level of physical activity (≥ 1680 MET-min/week), while 65.5% of boys and almost half of girls (51.4%) met daily physical activity recommendations.

For sedentary activities; in total, 36% of adolescents reported watching TV for more than 2 hours a day and 42% used a computer for a similar period. Overall, girls are more sedentary than boys with a statistically significant difference ($p=0.005$). A higher proportion (43.4%) of girls and more than a quarter of boys (26%) watched television for more than 2 hours a day and almost half of girls (46.4%) and one third of boys (36.1%) used the computer and smartphone during the same period ($p=0.005$).

Table 2 presents the pattern of dietary patterns. According to the recommendations for healthy daily food intake, there were significantly more boys than girls who met the recommended scores for most healthy foods, namely fruit consumption, vegetables, milk and dairy products and also taking breakfast at home. However, the consumption of milk and its derivatives is more pronounced in girls than in boys. Indeed, more than two thirds of boys (69.1%) and a large proportion of girls (63.5%) reported having breakfast at least 5 days a week at home, but only 41.7% of boys and more than one third of girls (33.5%) reported daily fruit consumption. Thus, a third of boys

(33.3%) and less than a quarter of girls (24.4%) consumed vegetables. In addition, a small proportion of boys (20.3%) and 22.6% of girls consumed milk or its derivatives on a daily basis (Table 2).

For unhealthy eating habits, there were significantly more girls (35%) than boys who exceeded the score of three days of intake per week for most unhealthy foods, including, fries, donuts, cakes, sweets and chocolate. Moreover, there is no statistical deference between the two sexes for the consumption of fast foods. In contrast, for the remaining unhealthy eating habits, boys consumed more sugary drinks and energy drinks ($p=0.002$). Indeed, more than a third (35%) of girls and a quarter of boys (25%) consumed donuts, cakes, sweets and chocolate more than three days a week and almost a quarter of girls (23%) and more than 14% of boys exceeded this score for the consumption of fries. Nevertheless, 21.4% of boys and more than 12% of girls exceeded three days a week for the consumption of sugary drinks and less than 9% of boys and almost 3% of girls consumed energy drinks of the same frequency.

Discussion

Despite major lifestyle changes in Moroccan society over the past ten years, namely population growth, technological revolution, development of social networks, and the great competition between telecommunications companies in Morocco, the prevalence of television channels and the creation of local playgrounds, limited research has been carried out on physical activity, sedentary behaviors and eating habits of Moroccan adolescents. The purpose of this study is to describe the way of life of Moroccan students aged 14 to 19 in Sidi Kacem province. Overall, the results of this study show a high prevalence of physical

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	Boys N=285	Girls N=384	Total (n=669)	p-value
Healthy eating habits				
Breakfast at home (≥ 5times / week) (%)	69.1	63.5	65.9	0.077
Fruits (≥ 7 times / week) (%)	41.7	33.5	37.1	0.019
Vegetables (≥ 7 times / week) (%)	33.3	24.4	38.6	0.010
Milk or dairy products (≥ 7 times / week) (%)	20.3	22.6	21.7	0.268
Unhealthy eating habits				
Fast foods (> 3 times / week)	11.9	11.9	12.0	0.542
French fries (> 3 times / week)	14.7	23.4	19.7	0.003
Donuts / cakes (> 3 times / week)	25.2	36.4	31.7	0.001
Candy / chocolate (> 3 times / week)	24.9	35.6	31.1	0.002
Sweet drinks (> 3 times / week)	21.4	12.7	16.4	0.002
Energy drinks (> 3 times / week)	8.4	2.8	5.2	0.001

Table 2: Dietary profiles among Moroccan adolescents aged 14-19 years

inactivity, sedentary behaviors and unhealthy eating habits among Moroccan adolescents.

1. Physical Activity

Children and adolescents who achieve high levels of physical activity are less likely to be at risk for cardiovascular disease [25]. Physical activity guidelines for children and youth recommend that they participate daily at least 60 minutes of moderate to vigorous physical activity [6,7].

In this study, the prevalence of physical inactivity (38%) was higher than the results of the study conducted in the city of Kenitra (21%) [26], but lower than that conducted in Taza (58%) [27] and by Baddou et al [28]. Our estimate was lower compared to other Arab adolescents [34,35].

A large proportion (48.6%) of girls and almost a quarter (23.5%) of boys did not participate in moderate physical activity for at least one hour per day. These results are higher than those found in Kenitra adolescents, with 9% of boys and 32% of girls not meeting physical activity recommendations [26], in contrast, in Taza, 50% of boys and 66.6% of girls did not comply with these recommendations [27]. This remarkable difference may be due to differences in geographical locations of cities, socio-economic and traditional factors. The main factors contributing to the inactivity of adolescents in Morocco include short distances to and from schools, short periods reserved for physical education and sports in schools, reduced recreational facilities, etc. As a result, families cannot encourage girls to be physically active. Elsewhere, boys were more likely than girls to be physically active [29, 30].

Levels of physical activity among adolescents have been widely reported in different countries, but most do not reach the recommended levels [31]. It should be noted that physical activity levels among Arab girls in all regions were lower than those of boys [32, 33].

The prevalence of physical inactivity among Moroccan adolescents is lower than that reported among Saudi Arabian and Kuwaiti Arab adolescents, aged 15 to 19 years [34,35]. In 2010, WHO reported that only 16% of adolescent girls are physically active worldwide [36]. According to (GSHS) in 34 countries, only 24% of boys and more than 15% of girls meet current global physical activity guidelines [37] and (YRBSS) results in the United States, reported that 18,4% of adolescents met these recommendations [38].

Worldwide, physical inactivity is responsible for nearly two million deaths [3].

2. Sedentary behaviours

The guidelines of the American Academy of Pediatrics (AAP) for adolescents not exceeding 2 hours per day [23]. Children who watch television for one hour a day or less have a lower prevalence of obesity [39]. Unfortunately, our results showed that more than one-third (36%) of teenagers spend more than two hours a day watching TV and 42% using the computer during the same period. These results are very close to those found in Kenitra and Taza. Indeed, in the latter, 30.3% of adolescents spend more than 2h/d watching television and 43% using the computer [27]. In Kenitra, 45% of adolescents spend more than 2 hours/day watching TV and 38% use the computer [26].

The factors contributing to the increase of sedentary activities in Morocco are the increase of the means of telecommunications namely computers, tablets and smartphones and the large number of television channels. It should be noted that over the years, the use of telecommunication means increases compared to the monitoring of television because of the prevalence of channels on YouTube addressed to the teenager, social networks (Facebook, Twitter, Instagram WhatsApp, video games), the great ease of access to the Internet due to the great competition between telecommunications companies.

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These adolescents may be at greater risk of developing obesity and related diseases especially if physical activity levels are also low [26].

However, in other Arab countries, Saudi Arabia [34] and Kuwait [35], more than 95% of adolescents can exceed two hours in front of a screen per day.

For example, girls in our study population were more sedentary than boys. In this context, several studies have shown that inactivity among girls is very important. Indeed, more than half of Iranian teenage girls (55.2%) spent more than 2 hours a day just in front of television [40] and another study of American high school students reported that 42.8% of girls exceeded 2 hours a day watching television [41].

In summary, today's youth spend more time than previous generations doing sedentary activities, such as watching television and using computers [42]. This difference may be due to religious differences and the lack of suitable walks for Iranian girls, who they prefer to stay at home. It is recognized that the biological, social and environmental pathways to sedentary behaviour in relation to physical activity may be different.

Sedentary behaviours among youth can be reduced by increasing opportunities for more physical activity in schools and the community.

3. Eating Habits

A combination of optimal nutrition and regular physical activity during a child's formative years increases the likelihood of a healthy model of physical maturation consistent with genetic potential [10, 43].

The most important meal of the day is breakfast. Indeed, its regular consumption has been associated with better food quality [44, 45], better cognitive functioning and better school performance [46]. However, our results showed that only 53.4% of Moroccan teenagers regularly eat breakfast. These results are higher than those found in Kenitra (39%) [26] and lower than those found in Taza (60%) [27]. In terms of the number of times breakfast was taken per week, our study showed that only 69.1% of teens and 63.5% of teens took at least five times a week their breakfast at home. The jump of breakfast in Morocco is linked to various factors, including the change of the legal time of the country by adding 60 minutes, the reduction of sleep hours because of the high prevalence of sedentary activities, ignorance of the importance of breakfast for adolescents and their families.

Compared to other Arab adolescents, skipping breakfast among Saudi adolescents ranged from 15% to 49% [47,48] and it is about 10% among boys in the United Arab Emirates and almost 19% for girls in the same country [49]. In addition, in Western countries, breakfast consumption is around 60% to 70% [50, 46]. For example, 60% of rural and urban South African adolescents regularly had breakfast [51] and 77.9% of students in Turkey had breakfast every day [52].

In addition, breakfast is associated with a reduced risk of overweight or obesity [53].

Concerning the consumption of fruits and vegetables, several research studies have shown that these food

categories have important effective sources of antioxidants and they also have a major role in the prevention of non-communicable diseases [54]. In addition, dairy products (milk, yogurt and cheese) play an important role in preventing obesity, hypertension, cardiovascular disease and improving the health of bones and teeth. Recommendations from WHO's Global Food and Physical Activity Strategy call for achieving energy balance, increasing fruit and vegetable consumption, and reducing energy intake from simple sugars and fats [4]. In this context, our study found that the prevalence of daily consumption of fruits and vegetables was 37.1% and 38.6% noted that the recommendation to take fruits and vegetables at least five times a day has a protective factor against obesity, diabetes, cardiovascular diseases and cancers [55]. Thus, 21.7% of adolescents consumed dairy products knowing that it is recommended that adolescents consume at least 3 servings of these products per day. By comparison, our population has shown a higher consumption of fruit compared to those found in the study of Kenitra (28%) and also in the study of Taza (20%). For the consumption of vegetables, our results are similar to those found in the two cities respectively (49%) and (38%) but the prevalence of consumption of dairy products was so much lower than those reported by the Kenitra study (38%) and that of Taza (78%). A study in the United States showed that the prevalence of college students who do not consume fruits and vegetables on a daily basis is 28.5% and 33.2% respectively [56] and in Nepal, 51% of adolescents never eat fruit [57].

In terms of unhealthy eating habits, they affected a small proportion of our study population. These habits include fast food, eating French fries/donuts/cakes and sweets/chocolate/sweet drinks and energy drinks. In the study of Taza [27] and other ATLS reports [34, 35, 26], poor eating habits are more common among Arab adolescents. In addition, studies have shown that the prevalence of dairy consumption has decreased in recent years, while the consumption of soft drinks and juices has increased among adolescent girls [58]. Poor eating habits increase the risk of developing non-communicable diseases [17].

Conclusion

Results of this study show the high prevalence of physical inactivity, sedentary behaviours and unhealthy eating behaviours among Moroccan schooled adolescents. It is necessary to introduce food culture and its impact on individual and public health and to add more physical and sports education sessions in schools and ensure sports spaces for healthy active eating.

Study limitations

Our study has some limitations, the inability to sample in the private education sector and the assessment of dietary habits was based on the frequency of intakes without any information on the number of servings per day and the quality of nutrients and less detail on sedentary activities as well, the types of applications on the phone, tablet and computer and the kind of programs followed on television channels.

Abbreviations

NCD : NonCommunicable Diseases
 AAP: American Academy of Pediatrics
 ATLS: Arab Teens Lifestyle Study
 MET: Metabolic Equivalent
 TV : Television
 WHO : World Health Organization

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