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Social-ecological influences on unhealthy dietary behaviours among Moroccan adolescents: a mixed-methods study

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Abstract

Objective: To identify the prevalence of unhealthy dietary behaviours and their social-ecological influences in adolescents.

Design: This study used a sequential explanatory mixed-methods design, which begins with the collection of quantitative data, followed by the collection of the qualitative data to explain and enrich the quantitative findings. Quantitative data were collected via a global school-based student health survey and were analysed using quantitative approaches. Qualitative data were obtained via focus group discussions and were analysed thematically.

Setting: Middle and high secondary schools in Taza city, Morocco.

Participants: Our quantitative analyses included 764 students (14–19 years). For the qualitative part, 17 focus group discussions were conducted with 100 participants (56 adolescents, 26 parents and 18 teachers).

Results: Of total student participants, 46.1 % skipped breakfast, 60.6 % had inadequate intake of fruits and vegetables (FVs), 39.4 % consumed soft drinks and 28.0 % consumed fast foods. All of these dietary behaviours could coexist in the same person except for inadequate intake of FVs.

Gender, academic performance, age, perceived family income and education level of mother were associated with unhealthy dietary behaviours. Qualitative findings identified seven themes regarding social-ecological influences on adolescent dietary behaviours: cognitive, affective/

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AE carried out the literature searches, drafted and finalized the paper. All authors contributed equally in designing the study. AE, HE and SB were responsible for data collection, transcription, coding and analysis. YE and SE helped in data coding and analysis, supervised the study and coordinated the research team. All authors have read, revised and approved the final draft of the manuscript.

Conflict of interest:

None.

Ethical standards disclosure:

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Faculty of Medicine and Pharmacy of the Casablanca Research Ethics Committee and by the National Control Commission for the Protection of Personal Data (A-RS-193–2015). Written informed consent was obtained from all parents and teachers, and adolescent consent forms were signed by their parents.

biologic, lifestyle, outcome expectation, social network, accessibility/availability and macro-level influences.

Conclusions: The prevalence of unhealthy dietary behaviours in our study group is a concern. Dietary behaviours are the result of inseparable interactions among social-ecological influences. Modifiable factors identified may be useful when designing a future intervention aimed at improving breakfast and FV consumption and reducing fast/snack food consumption among adolescents.

Keywords

adolescents; dietary behaviours; mixed-methods design; social-ecological influences; Morocco

Introduction

The period of adolescence is characterized by many biological, psychosocial and cognitive changes that can influence nutritional needs and dietary behaviours⁽¹⁾. Diet patterns of adolescents today are characterized by skipping meals, snacking and eating out, which is compounded by a diet poor in healthy foods (e.g. fruits, vegetables and whole grains) and rich in unhealthy foods and beverages (e.g. processed foods; foods high in saturated fats, salt, or added sugar; increased portion sizes; and sugar-sweetened beverages)^(2–4). Unhealthy dietary behaviours have been associated with many nutrition-related health problems, the most important of which are obesity and chronic diseases^(5, 6). In 2010, unhealthy diets accounted for about 10 million deaths globally⁽⁶⁾.

Despite the many negative health outcomes with unhealthy diets, more adolescents are engaging in these behaviours. In the most recent Health Behaviour in School-aged Children survey, which was conducted in 42 European and North American mostly developed countries, 36 % of adolescents skipped breakfast, nearly one in five adolescent consumed soft drinks daily and only 37% ate two or more servings of fruits every day⁽⁷⁾. In developing countries, the situation is even more alarming according to data from the Global School-based Student Health Survey (GSHS)⁽⁸⁾. Results of the GSHS revealed that more than half (54.3 %) of adolescents consumed carbonated soft drinks and over 70 % did not consume enough fruits and vegetables (FVs)^(9, 10). The transition in these developing countries to poor nutritional habits, confirmed by the GSHS, has led to rising rates of adolescent obesity^(6, 11).

Given the above results on unhealthy diets and the fact that dietary behaviours adopted during adolescence can track to adulthood⁽¹²⁾, strategies to promote adolescent healthy dietary behaviours are needed. To develop a tailored strategy, it is first necessary to better understand the various factors that influence adolescent dietary behaviours, especially those that are modifiable^(13, 14). To characterize these influences, a social-ecological framework is particularly useful^(15, 16). This framework is a comprehensive approach that emphasizes connections between people and their environment. Dietary behaviours are thus seen as a function of multiple personal and environmental influences⁽¹⁵⁾.

Individual-level factors related to dietary behaviours include biology (e.g. age, gender, genes), demography (e.g. race/ethnicity, income), cognition (e.g. attitudes, knowledge, taste and preferences), lifestyle, outcome expectations, self-efficacy, motivations and behaviour control^(16–22). In an overview of determinants of dietary behaviours among youth, Sleddens and colleagues concluded that social-cognitive determinants have been mostly addressed toward the end of the 20th century, whereas environmental determinants have only been studied within the past 10 years⁽²¹⁾. Environmental-level influences can be separated into social, physical and macro-level environments. Influences within the social environment correspond to role modelling, social support and social norms from family, friends, peers and others^(14, 16, 17, 20, 21, 23). Influences within the physical environment include accessibility and availability of food products in the different settings where adolescents eat or get food^(14, 16, 17, 20, 21). Influences within the macro-level environment are mostly distal levels of influence and include social norms, agriculture and economic policies, food production and distribution structures, food marketing and prices^(14, 16, 17, 20, 21, 24, 25).

The World Health Organization (WHO) emphasize that national-level data are necessary to inform national decision makers on the most relevant policies to promote adolescent health⁽²⁶⁾. Quantitative studies can be used to rank the importance of influences on behaviour, while qualitative studies can generate a more thorough understanding of the behaviour^(17, 20). The mixed-methods approach is a procedure for collecting, analysing and mixing both quantitative and qualitative data at some stage of the research process within a single study⁽²⁷⁾. Mixed-methods studies bring together the strengths of quantitative and qualitative studies and could therefore provide a clearer understanding of the occurrence of adolescent behaviours⁽²⁷⁾.

With regard to Moroccan adolescents, the 2016 GSHS found that 13.9 % of Moroccan adolescents were overweight, nearly one of two drank carbonated soft drinks, 15 % ate fast foods and more than half did not consume enough FVs⁽⁸⁾. Morocco, like many other developing countries, is also transitioning toward a Westernized diet, that is, one that is low in nutrients and high in energy-dense refined sugars and fats and that includes processed foods^(5, 28, 29). So far, few studies have investigated what influences the dietary behaviours of Moroccan adolescents^(28, 30, 31), and none of them used a qualitative or mixed approach. To help fill this gap, we conducted a sequential explanatory mixed-methods study to investigate the prevalence and social-ecological influences on adolescent dietary behaviours.

The objective of the quantitative phase was to determine the prevalence of four unhealthy dietary behaviours (skipping breakfast, inadequate FV intake, fast food consumption and soft drink consumption) in adolescents and to identify their socio-demographic-associated factors. The objective of the qualitative phase was to explore social-ecological influences on dietary behaviours examined in the quantitative phase, to allow a contextualized understanding of why these dietary behaviours occur.

Methods

Study design and target population

In this sequential explanatory mixed-methods design (which begins with the collection of quantitative data, followed by the collection of qualitative data to explain and enrich the quantitative findings⁽²⁷⁾), we connected quantitative and qualitative phases during the development of a guide for focus group (FG) discussions and through discussions of the outcomes of the entire study. The present study is part of larger underway research project⁽³²⁾, which has a major goal of developing and implementing an intervention that supports a healthy lifestyle among adolescents. Our study group included school age adolescents from Taza city, a medium-sized city (207 984 inhabitants) in north-central Morocco⁽³³⁾.

Quantitative study

Survey participants—We recruited 764 adolescents from February to March 2016. The sample size was estimated based on a population of 30 000 students⁽³⁴⁾, a confidence level of 95 % and a population proportion of 0.50. A multistage stratified cluster random sampling method was used, and a design effect coefficient of two was chosen, resulting in a final sample size of 760 (380×2). By using a stratified cluster random sampling, six middle and secondary schools were selected from 17 middle and secondary schools existing in Taza city. Thus, in the first step, two schools were randomly selected from each of three neighbourhoods defined by social-economic level (disadvantaged, average and advantaged). Next, four classes were randomly selected within each school. All students in these classes were invited to participate in the survey, resulting in a sample size of 764 adolescents.

Quantitative data collection—Students were asked to complete the Moroccan version of the GSHS. This questionnaire was developed by the WHO and the US Centers for Disease Control and Prevention (CDC) in collaboration with other institutions. Details on the GSHS, a useful tool to assess health behaviours among students aged 13 to 17 years, are available on the CDC website⁽⁸⁾.

We were interested in four dependent variables: breakfast, FVs, soft drink and fast food consumption. To assess breakfast consumption, the question ‘During the past 30 days, how often did you eat breakfast?’ allowed response options that ranged from one (never) to five (always). Skipping breakfast was defined as eating breakfast never, rarely or sometimes. To assess FV consumption, the question ‘During the past 30 days, how many times per day did you usually eat fruit (e.g. bananas, apples, oranges or any other fruit) or vegetables (e.g. potatoes or tomatoes)?’ allowed response options that ranged from one (I did not eat fruits or vegetables during the past 30 days) to seven (I ate fruits or vegetables five or more times per day). Inadequate FV consumption was defined as having less than five servings per day. To assess soft drink consumption, the question ‘During the past 30 days, how many times per day did you usually drink carbonated soft drinks, such as Coca Cola or Fanta?’ provided response options that ranged from one (I did not drink carbonated soft drinks during the past 30 days) to seven (I drank carbonated soft drinks five or more times per day). Participant responses were then coded as one (drinking carbonated soft drinks one or more times per

day) or zero (never). To assess fast food consumption, the question ‘During the past seven days, on how many days did you eat food from a fast food restaurant, such as McDonalds or Pizza Hut?’ allowed response options that ranged from one (zero days) to eight (seven days). Responses were coded as one (ate food from a fast food restaurant on three or more days) or zero (ate food from a fast food restaurant on less than three days).

Independent variables included sex, age, body mass index (BMI), academic performance, perceived family income, educational level of parents and mother’s employment status. The international age and sex-specific child BMI, calculated as weight/height² (kg/m²), cut-off points were used to define overweight and obesity⁽³⁵⁾.

Quantitative data analysis—Data were analysed using SPSS version 19 (SPSS, Inc., Chicago, IL, USA). Bivariate and multivariate analyses were performed to evaluate associations between dependent and independent variables. Statistical significance was defined as $P<0.05$. Odds ratios with 95 % confidence intervals were derived where appropriate. Independent variables were included in the multivariate analysis if they had a significant association ($P<0.20$) with a dependent variable in the bivariate analysis.

Qualitative study

Participants in Focus group discussions—Participants were recruited from two middle schools (disadvantaged and advantaged per socioeconomic level) that participated in the quantitative portion of the study. From each school, 14- to 16-year-old students were invited to participate in FG discussions. Adolescents, parents and teachers received an information letter that provided a comprehensive explanation of study objectives and processes, as well as an informed consent form to sign. After participant informed consent was received, researchers, participants and school officials selected an appropriate date and setting to conduct FG discussions. Sampling continued until data saturation was reached.

Qualitative data collection—We chose the FG method because it encourages interactive discussions between participants⁽³⁶⁾. Discussions with participants were conducted by a moderator with assistance of an observer who are trained to conduct FG discussions. These discussions followed a semi-structured guide underpinned by social-ecological framework as a theoretical framework⁽¹⁵⁾. This guide was pilot-tested with a convenient sample of each type of participant and refined before definitive use. Discussions were aimed at exploring social-ecological factors influencing the consumption of breakfast, FVs and fast/snack foods among adolescents. Snack foods were those that were energy-dense and nutrient poor (high in sodium, sugar and/or fat) that were prepared outside the home such as cookies, cakes, sugar-sweetened beverages, chips and some unhealthy street foods⁽³⁷⁾. Table 1 shows the main questions asked during FG discussions. The total number of FGs was determined by the saturation principle.

FGs were homogeneous with regard to sex to overcome possible bias and to provide an opportunity for possible sex-specific factors to appear. Discussions were conducted in a suitable room in the participating schools and were audio-recorded with permission from participants. Participants also gave permission to use their anonymous quotes in research publications.

Qualitative data analysis—Audio tapes from the discussions were fully transcribed and organized into separate datasets for adolescents, parents, and teachers. All datasets and notes from the observer were then analysed using thematic analysis of Braun and Clarke⁽³⁸⁾. Thematic analysis is an easy and flexible qualitative analytic method that can identify, analyse, and report themes within data⁽³⁸⁾. Themes are patterns which capture something interesting about the data in relation to the research question⁽³⁸⁾. During analysis, coders followed one-by-one the different steps outlined by Braun and Clarke which are: becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining themes, and producing the report⁽³⁸⁾. Coders started reading and re-reading transcripts to become familiar with the data, took notes, and jot down early impressions. Then, open coding was used; that means we did not have preset codes but developed and modified the codes as we worked through the coding process. In addition, the coding process included consideration of our research question. So, this was an inductive-deductive thematic analysis. The next step was to search for themes; once the initial codes were generated, we started to combine them to form overarching themes. Themes were predominately at the semantic level, i.e. they are identified within the explicit or surface meanings of the data. After developing the initial themes, they were continually reviewed, created and discarded using an iterative process. Thus, we constantly moved back and forth between the selected extracts from the data and the entire dataset to check if the themes make sense and account for all the coded extracts and the entire data set to assess the applicability of themes. Finally, each theme was defined, labelled and analysed. A thematic map was also established (Figure 2), in which themes were organized within individual and environmental levels of the social-ecological model.

Doubts or disagreements between coders were discussed under the supervision of another researcher skilled in qualitative analysis until consensus was reached. Some quotes illustrating themes and subthemes were translated into English (Table 5 and supplementary data). The analysis was conducted manually (i.e. no software was used in the data analysis).

Results

Quantitative results

The survey sample consisted of 764 adolescents aged 14 to 19 years (response rate of 95.5 %); 53.3 % were girls. Other sample characteristics are presented in Table 2. Overall, 46.1 % of surveyed adolescents skipped breakfast, 60.6 % had inadequate consumption of FV intake, 39.4 % consumed soft drinks and 28.0 % consumed fast foods (Figure 1).

In multivariate analysis (Table 3 and Table 4), skipping breakfast was most prevalent among girls, adolescents with low academic performance and those who consumed fast foods. Inadequate FV intake was negatively associated with soft drink and fast food consumption. Soft drink consumption was negatively and positively associated with inadequate FV and fast food consumption, respectively. Fast food consumption was most prevalent among breakfast skippers and those who consumed soft drinks. However, it was negatively associated with adolescents who were between 16 and 17 years old, those with a low perceived family income, those who had an illiterate mother and those with inadequate FV consumption.

Qualitative results—A total of 100 people participated in the 17 FG discussions. The estimated point of saturation was observed after 8 FGs of adolescents (n 56; 50 % boys), 5 FGs of parents (n 26; 81 % males) and four FGs of teachers (n 18). The average number of participants per FG was seven for adolescents, five to six for parents, and four to five for teachers. Each FG discussion lasted between 50 and 80 minutes.

After data analysis, we identified seven main themes regarding potential social-ecological influences on adolescent dietary behaviours studied in the quantitative phase. Four themes were at the individual level, which included cognitive (theme 1), affective and biologic (theme 2), lifestyle (theme 3) and outcome expectation (theme 4) influences. Three themes were at the environmental level, which included social network (theme 5), accessibility and availability (theme 6) and macro-level (theme 7) influences. Figure 2 presents a thematic map of main themes summarizing the social-ecological influences on adolescent dietary behaviours. Example quotes are shown in Table 5 to support themes and subthemes and Table 6 summarizes the number of codes and quotes for each theme.

Theme 1: Cognitive influences (individual level)—Two subthemes emerged from this theme: (1) perceived healthy and unhealthy dietary patterns and (2) knowledge, awareness and attitudes.

With regard to the first subtheme, adolescent and parent participants categorized dietary behaviours among adolescents into healthy and unhealthy patterns. Healthy patterns included balanced diet, diversified diet and diet based on natural products, as well as more frequent family meals eaten at home. Traditional eating patterns were considered better than less traditional patterns. Unhealthy dietary patterns were perceived as eating food away from home (that is, ‘eating out,’ which could include fast foods, snacks, soft drinks, cookies, sweets, chips), skipping meals, fewer family meals and inadequate consumption of FVs and cereals. Teachers, for their part, confirmed these views and they mentioned that today’s adolescents are largely oriented towards adopting unhealthy dietary patterns.

According to all participant groups, knowledge, the second subtheme, can influence adolescent dietary choices and behaviours. Adolescents make good dietary choices if they have sufficient nutritional knowledge, including nutritional recommendations and information on benefits and risks related to foods or dietary behaviours. Concurrently, participants reported that adolescents may lack appropriate nutritional awareness to make good eating choices. Adolescents perceived that FV intake is beneficial to health but they ignored the daily recommended amount. Parents and teachers recognized their role in shaping dietary culture among adolescents, while each of them minimizes their responsibility. Finally, some adolescents stated that they consume some foods despite awareness that these foods can harm their health.

Theme 2: Affective and biologic influences, including appetite, taste and preferences, and hunger (individual level)—Adolescent girls and parents indicated that poor appetite in the morning was an important cause for breakfast skipping, especially among girls.

Adolescent participants indicated a preference for tasty foods, with fruits favoured over vegetables and some vegetables even hated. There also was a preference for snacks, soft drinks and cookies consumed away from home versus prepared at home, with the former perceived as tastier. This view was shared by parents and teachers. In addition, adolescents also stated that hunger was another reason for eating fast food.

Theme 3: Lifestyle-related influences (individual level)—Two subthemes emerged from this theme: (1) time and convenience and (2) behaviours.

All participant groups considered lack of time, the first subtheme, as a real barrier to healthy eating in adolescents. Indeed, adolescents, especially boys, who woke up late in the morning reported not having enough time to eat breakfast. Adolescents and parents reported that academic achievement pressures and spending time away from home seemed to push adolescents to eat fast foods. According to all groups of participants, some unhealthy foods (e.g. cookies, fast foods) were found to be more convenient than healthy foods (e.g. dairy products, FVs) or those prepared at home.

With regard to the second subtheme, all participants stated that many adolescent eating behaviours (healthy or unhealthy) are rooted in those established when much younger; therefore, eating behaviours can be tracked from childhood to adolescence. Some participants, especially teachers, reported that adolescent lifestyle can influence eating behaviours. Thus, an organized lifestyle (that is, with good time management) seemed to positively affect adolescent eating habits.

Theme 4: Health and social outcome expectation influences (individual level)

—Some health expectations were reasons for adolescents to adopt good eating behaviours. Adolescents expressed a desire to preserve their current and future health from certain diseases (e.g. overweight, diabetes and hypertension). Most of these adolescents had parents or relatives who had these diseases. Some adolescents reported that they consume breakfast to better concentrate in class, whereas others, especially girls, stated adopting certain eating habits to maintain a desirable weight or physical appearance. From a social perspective, some adolescents, parents and teachers thought that adolescents consumed fast foods in order to show off in front of their friends or to not feel isolated from the group.

Theme 5: Social network (environmental level)—This theme includes two sources of influences: family members and peers. Regarding family influences, all participant groups mentioned that parents play a primary role in building dietary behaviours and background knowledge among adolescents. They reported that parents play an important role through different mechanisms, including having frequent family meals, preparing tasty and healthy meals and advising and/or controlling the dietary habits of their children. In the same vein, adolescents and teachers found that parents do not play this role properly. One student stated, *'I do not take my breakfast because my mother does not prepare it for me'* (Table 5). Parents, in turn, stated that providing a nutritional education to children is a real challenge, acknowledging an inability to overcome the pressures (e.g. availability and affordability of competitive unhealthy foods, food advertising and peer pressure) to which their children are

exposed. According to all groups of participants, other barriers related to the family environment included working parents and low family income.

Influences of peers were seen as barriers to good dietary behaviours among adolescents by all participant groups. Regarding obtaining food outside of home, FG discussions among adolescents included '*Everybody buys, I buy them too*' and '*I eat them with my friends*' (Table 5).

Theme 6: Availability and affordability of foods (environmental level)—The quotes shown in Table 5 with regard to theme 6 suggest that an adolescent's dietary intake is positively influenced by availability and variety of healthy food options such as FVs in the home. Adolescent found unhealthy competitive foods to be readily available, affordable, tasty and varied compared with foods prepared at home and stated a preference for them. This was re-iterated by parents and teachers. Furthermore, students said that they buy unhealthy foods during recess from the school environment which is not controlled by the relevant authorities.

According to all participant groups, prices of FVs, dairy products and others healthy foods were perceived as high, limiting their affordability for socio-economically disadvantaged families. Some parents mentioned that living in a poor neighbourhood could limit adolescent's access to healthy foods.

Theme 7: Distal influences (environmental level)—Although all groups of participants considered that media could improve nutritional awareness among adolescents, most of them found media played a negative role, including encouraging adolescents to adopt unhealthy eating habits through advertisements.

Regarding the role of schools in dietary decisions, teacher participants confessed that this role was insufficient. '*The school currently has a very limited role,*' said one teacher (Table 5). Parents and adolescents had the same point of view as teachers. When asked to explain this, teachers reported that, on the one hand, current school programs did not provide adequate nutritional education. On the other hand, this lack of health education is countered by the abundance of unhealthy foods, influences of media and advertising and peer pressures.

Parents and teachers have affirmed that the Moroccan society is becoming increasingly involved in modern and Western food patterns, with some foods considered as symbols of fashion and cultivation.

Discussion

Overall, the extent of unhealthy dietary behaviours among adolescents was concerning. Many skipped breakfast (46.1 %), had inadequate intake of FVs (60.6 %), consumed soft drinks (39.4 %) and ate fast foods (28.0 %). Quantitative and qualitative findings showed that the dietary behaviours of adolescents were the result of inseparable interactions among individual and environmental factors.

Breakfast intake

Although many adolescents skip breakfast, the regular consumption of breakfast has been shown to be of benefit to their general health^(39, 40). Quantitatively, we found that breakfast skippers were more often girls than boys, ate more fast food and had lower academic performance.

In the literature, skipping breakfast is typically more prevalent among girls^(41, 42). This gender difference is not fully understood, and it was often explained by the higher weight-related concerns among girls compared with boys^(43, 44). The girls in our survey reported that lack of hunger and appetite in the morning was the main reason to skip breakfast. Like previous studies^(3, 41, 42), our findings showed that adolescents who skipped breakfast ate more fast foods. The mechanism linking breakfast skipping and fast food intake was clarified during the FG discussions, with breakfast skippers reporting that they purchased fast/snack foods at school when they felt hungry. Because fast/snack foods are energy dense, skipping breakfast could lead to weight gain in adolescents^(3, 39). Moreover, breakfast-skipping behaviour has been associated with other health risk behaviours such as physical inactivity, which explains the high frequency of this behaviour among obese adolescents⁽⁴¹⁾. Therefore, habitual breakfast consumption could contribute to prevention of childhood obesity⁽⁴⁵⁾.

In addition, our survey showed a positive association between breakfast skipping and low academic performance. During FGs, some breakfast eaters conveyed that they have breakfast to not feel hungry and to better concentrate in class. In assessments of the effects of breakfast consumption on cognitive and academic outcomes^(41, 46), adolescents may be more vulnerable to the nutritional effects of breakfast on brain activity and associated cognitive and academic outcomes than adults⁽⁴⁶⁾. Although evidence is not consistent, habitual breakfast consumption could improve many aspects of cognitive and academic outcomes (e.g. memory, attention and concentration, school attendance) by hunger alleviation^(41, 46), with type of breakfast and time of administration also having possible effects⁽⁴⁶⁾.

We found that skipping breakfast in adolescents was influenced by several individual and environmental factors. Individual factors included sex (girl), lack of time (because of waking up late), lack of hungry and appetite in the morning. Environmental factors were mainly at the family and home level and included insufficient parental support (e.g. not preparing breakfast for children, not having breakfast together) and lack of availability of varied foods.

Given the importance of breakfast consumption for adolescent health, interventions aimed at improving this dietary behaviour are needed. Some of the modifiable influences that we have identified could be used to design a future intervention programme; these could include improving adolescent knowledge and skills regarding the importance of breakfast consumption and improving time management skills. Parents need to be involved in such interventions to provide family support (e.g. preparing breakfast, providing various items, acting as a role model, controlling pocket money).

Intake of fruits and vegetables

Many adolescents (60.6 %) in our study did not reach the threshold of eating five FVs per day, which is close to the national prevalence (54.5 %) and compares with findings of other low- and middle-income countries^(8, 10). Although epidemiologic evidence has suggested that a FV-rich diet could promote health and prevent chronic diseases^(2, 6, 47), diets low in FVs were responsible for more than six million deaths in 2010⁽⁶⁾.

It is well known that FV intake is strongly influenced by socio-economic status⁽¹⁷⁾. Our survey results showed that adolescents with uneducated mothers consumed fewer FVs. These results are congruent with previous studies because parents' education level can be used to assess family socio-economic level⁽⁴⁸⁾. Individuals at low socio-economic levels had decreased FV availability, which in turn decreased their intake, as confirmed by participants during FG discussions.

We also found that various individual and environmental factors contributed to inadequate FV intake. Individual factors included attitude, knowledge, taste, perceived time constraints, convenience and outcome expectations. Environmental factors included availability and affordability of FV in home and social factors.

Although most of our participants perceived that FV intake is beneficial to health, adolescents were unable to list these benefits, and they were unaware of the daily recommended amount of FVs. Because poor knowledge about the recommended intake levels might lead to an overestimation of own FV intake⁽⁴⁹⁾, we suggest improving adolescent awareness regarding recommendations through interventions.

Another barrier to FV intake in our participants was perceived bad taste, especially of vegetables. It has been documented that children value taste over health and that FVs are not among their favourite foods⁽¹⁷⁾. Given that taste is influenced by some features such as familiarity and methods of preparation, parents are encouraged to expose their children to a variety of FVs from a young age and should pay more attention to methods of preparation.

Convenience was another factor that influenced FV consumption in adolescents. Compared with competitive unhealthy choices such as fast/snack foods, participants perceived that FVs are less convenient as they are not easy to prepare, transport and eat outside the home. This inconvenience has been shown to be a key barrier limiting FV intake, with greater influence than other factors⁽¹⁷⁾. In addition, children do not eat inconvenient FVs, even those that they perceive as tasty⁽¹⁷⁾.

Our findings showed that FV intake in adolescents was driven by their health outcome expectations, which have been previously classified as short- and long-term outcomes⁽¹⁷⁾. In accordance with previous studies^(17, 50), our adolescent participants tended to be more concerned by short-term outcomes (e.g. energy, healthy weight, physical appearance, school performance) than long-term outcomes such as chronic diseases. For future intervention, messages to youth related to diet should focus on short-term or immediate benefits, as they would have more appeal⁽⁵⁰⁾.

Participants in our study stated that availability of FVs at home was a key factor affecting adolescents' FV consumption. This importance is asserted by other studies, which stated that FV intake increased despite not liking the taste when FVs are available at home^(16, 17, 21). Because prices of FVs were perceived as high, their affordability was limited, especially for socio-economically disadvantaged families. Not surprisingly, FV intake in adolescents is influenced by their home accessibility^(16, 17). Although FV availability at home is difficult to ameliorate because it depends on socio-economic level, parents need to be aware of the importance of FVs to increase accessibility to their children.

Our qualitative findings also showed that the social environment was both a facilitator and barrier for FV intake in adolescents; consequently, the social environment can be both supportive and unsupportive. Mechanisms in an adolescent's social environment (e.g. support and pressure from family, friends and peers) that can influence FV intake include role models, social support and social norms^(16, 21, 50, 51). We therefore suggest that intervention programmes should involve parents because of their key roles in an adolescent's social environment.

Fast and snack foods eaten outside home

Many foods prepared and consumed outside of home, such as fast foods and soft drinks, have low nutrient levels and are energy dense^(3, 4, 37). Among our Moroccan adolescents, 39.4 % and 28.0 % consumed soft drinks and fast foods, respectively. Consumption of soft drinks and fast foods was prevalent among adolescents who skipped breakfast and adolescents with working mothers. Those adolescents who skipped breakfast reported being hungry later in the day, resulting in more fast food consumption, compared with those who ate breakfast. Busy work schedules of parents and lack of time prompted adolescents to eat outside the home. In addition, parental work schedules contributed to decreased supervision of adolescents' dietary habits, thereby allowing adolescents to eat unhealthy foods⁽⁵²⁾.

We found that adolescents with educated mothers or low family income consumed fewer fast foods and soft drinks. This issue was not evoked during FG discussions. Educated mothers may be more aware of the negative health consequences of food choices and consequently thus supervise the eating habits of their children. Furthermore, mothers from low income households in Morocco are generally housewives, which could decrease fast food and soft drink intake by increasing the frequency of family meals.

Qualitative analysis through FG discussions allowed us to thoroughly understand the individual and environmental factors facilitating food consumption outside of home (e.g. snack and fast foods, street foods, soft drinks). Individual factors were mainly greater preference, time constraint, educational plans, pocket money, low awareness and social expectations (e.g. social integration). Environmental factors were availability and affordability of fast/snack foods, low parental support, peer pressure, media advertising and insufficient health education at school. The availability of snack and fast foods and beverages in the school environment was considered a real problem. Reducing the availability of unhealthy foods and increasing the availability of healthy ones in the school environment has had promising results⁽⁵³⁾. Other intervention strategies have been effective in reducing the consumption of fast/snack foods⁽⁴⁾, including plain packaging, warning

labels, and taxes on sugary beverages⁽⁵⁴⁾. In accordance, because of the many causes of unhealthy dietary behaviours, multifaceted programmes are required^(4, 47).

Contrast in the participants' perspectives

Altogether, the perspectives from the different groups of participants were usually convergent and complementary. As has been shown in Table 6, all themes were emanated from all groups of participants even though some themes were unequally supported.

Differences between participants' perspectives concerned responsibilities of parents and school to improve adolescents' dietary patterns (e.g. background of knowledge and behaviours). These findings were consistent with the concept of attribution error (i.e. the tendency of blaming situational factors when justifying one's behavior) which has been reported by previous studies^(22, 55). Indeed, adolescents and teachers perceived that parents do not play their role properly, while parents blamed other factors such as availability and affordability of competitive unhealthy foods, food advertising and peer pressure. Moreover, previous research has suggested that because of low perceived control, parents absolve themselves of personal responsibility for the behaviours of their children. In this way, they can pose a barrier to the success of intervention companies⁽⁵⁶⁾. Whilst teachers recognized the role of school in shaping adolescents' dietary behaviour, they minimized their responsibility. When asked to explain this, teachers mentioned various factors like school programs which did not provide adequate nutritional education, the abundance of unhealthy foods, influences of media and advertising and peer pressures.

Limitations

Because of the cross-sectional and qualitative nature of this research, we could not infer causality or define which factor was the most significant in influencing adolescent dietary behaviour. During the qualitative phase of the study, we explored all potential social-ecological influences on adolescent dietary behaviours, whereas, in the quantitative phase, we investigated only the socio-demographic factors as independent variables.

Conclusions

The prevalence of unhealthy dietary behaviours in our study group of Moroccan adolescents is a concern. Unhealthy dietary behaviours are the result of inseparable interactions between individual and environmental factors. Modifiable factors should be targeted in the design of future interventions aimed at improving breakfast and FV consumption and reducing fast/snack foods consumption among adolescents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Prevalence of four unhealthy dietary behaviours among adolescents by sex.

Figure 2.
 Thematic map of main themes regarding social-ecological factors influencing adolescent dietary behaviours.

Table 1**Focus group discussion steps****Step 1:** Introduction of discussion

After the moderator and observer introduced themselves, the moderator stated the aims of the study and clarified anonymity and some consents to conduct discussion. Permission to record the interview was also obtained.

Step 2 *: Exploring eating behaviours of adolescents

Adolescents	Parents	Teachers
Please, describe your eating behaviour during a typical day.	Please, can you describe the eating habits of your children during a typical day?	Please, what can you tell us about adolescent dietary behaviours today?
How do you judge this behaviour?	How do you judge these behaviours?	

Step 3 *: By using open-ended questions, we explored the potential social-ecological influences of the following dietary behaviours: consumption of breakfast, fruits/vegetables and fast/snack foods.

Adolescents:

When a student admitted adopting a healthy or unhealthy eating behaviour in the previous step, we asked him/her to mention any reason behind the adoption of such behaviour.

Parents and Teachers:

Please, tell us any potential factors that are likely to influence adolescent dietary behaviours?

* Questions in step 2 and 3 served to map discussions; however, there were other direct questions that emanated from participants to clarify their statements.

Table 2

Socio-demographic characteristics of participants in the quantitative phase of the study.

Characteristics	<i>n</i> (%)
Age in years	
14–15	220 (28.8)
16–17	347 (45.4)
18–19	197 (25.8)
Gender	
Girls	407 (53.3)
Boys	357 (46.7)
Grade level	
Middle school	289 (37.8)
High school	475 (62.6)
Body Mass Index	
Underweight or normal	698 (91.4)
Overweight or obese	66 (8.6)
Perceived family income	
Low (%)	76 (9.9)
Average (%)	580 (75.9)
High (%)	108 (14.1)
Education level of parents	
Fathers (% illiterate)	102 (13.4)
Mothers (% illiterate)	286 (37.4)

Table 3

Associations between dependent variables (skipping breakfast and inadequate intake of fruits and vegetables) and sociodemographic variables in adolescents

Independent Variable	Skipping Breakfast		Inadequate Intake of Fruits and Vegetables	
	UOR (95% CI)	AOR (95% CI)	UOR (95% CI)	AOR (95% CI)
Sex	<i>P</i><0.001	<i>P</i><0.001	<i>P</i> =0.199	
Girls	1	1	1	
Boys	0.41 (0.31–0.55)	0.39 (0.28–0.53)	1.21 (0.90–1.62)	
Age in years	<i>P</i> =0.76		<i>P</i> =0.40	
14–15	1		1	
16–17	1.01 (0.69–1.49)		0.84 (0.57–1.25)	
18–19	1.12 (0.79–1.60)		0.78 (0.54–1.12)	
Body mass index	<i>P</i> =0.53		<i>P</i> =0.60	
Underweight or normal	1		1	
Overweight or obese	0.85 (0.51–1.42)		1.15 (0.68–1.94)	
Academic performance	<i>P</i> =0.13	<i>P</i>=0.003	<i>P</i> =0.43	
Average or good	1	1	1	
Lower	1.38 (0.91–2.10)	2.00 (1.27–3.15)	1.19 (0.77–1.84)	
Perceived family income	<i>P</i> =0.47		<i>P</i> =0.33	
Average or good	1		1	
Lower	0.84 (0.52–1.35)		1.28 (0.79–2.11)	
Education level of father	<i>P</i> =0.20		<i>P</i> =0.18	
Educated	1		1	
Not educated	0.76 (0.50–1.16)		1.35 (0.87–2.10)	
Education level of mother	<i>P</i> =0.056		<i>P</i>=0.007	
Educated	1		1	
Not educated	0.75 (0.56–1.01)		1.52 (1.12–2.07)	
Mother's job	<i>P</i> =0.12		<i>P</i> =0.72	
Housewife	1		1	
Working mother	1.44 (0.91–2.26)		0.92 (0.58–1.46)	
Breakfast consumption			<i>P</i> =0.093	
Eating			1	
Skipping			0.78 (0.58–1.04)	
Fruit and vegetable consumption	<i>P</i> =0.09			
Adequate	1			
Inadequate	0.78 (0.58–1.04)			
Soft drink consumption	<i>P</i>=0.048		<i>P</i><0.001	<i>P</i><0.001
No	1		1	1
Yes	1.34 (1.00–1.80)		0.41 (0.31–0.56)	0.45 (0.33–0.61)
Fast food consumption	<i>P</i>=0.008	<i>P</i>=0.026	<i>P</i><0.001	<i>P</i>=0.019
No	1	1	1	1
Yes	1.53 (1.12–2.11)	1.48 (1.05–2.09)	0.56 (0.41–0.77)	0.67 (0.48–0.94)

AOR, adjusted odds ratio; CI, confidence interval; UOR, unadjusted odds ratio. Significant *P* values are indicated in bold font.

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Table 4

Associations between dependent variables (soft drink and fast food consumption) and sociodemographic variables in adolescents

Independent Variable	Soft Drink Consumption		Fast Food Consumption	
	UOR (95% CI)	AOR (95% CI)	UOR (95% CI)	AOR (95% CI)
Sex	<i>P</i> =0.69		<i>P</i> =1.000	
Girls	1		1	
Boys	0.94 (0.71–1.26)		1.00 (0.73–1.37)	<i>P</i>=0.013
Age in years	<i>P</i> =0.39		<i>P</i> =0.097	
14–15	1		1	1
16–17	1.19 (0.80–1.77)		0.63 (0.41–0.97)	0.51 (0.33–0.81)
18–19	1.29 (0.90–1.85)		0.75 (0.51–1.09)	0.67 (0.45–0.996); <i>P</i> =0.048
Body mass index	<i>P</i> =0.29		<i>P</i> =0.197	
Underweight or normal	1		1	
Overweight or obese	0.75 (0.44–1.28)		1.42 (0.83–2.42)	
Academic performance	<i>P</i> =0.10	<i>P</i>=0.047	<i>P</i> =0.53	
Average or good	1	1	1	
Lower	1.42 (0.93–2.17)	1.56 (1.005–2.43)	0.86 (0.53–1.38)	
Perceived family income	<i>P</i> =0.99		<i>P</i>=0.002	<i>P</i>=0.01
Average or good	1		1	1
Lower	1.00 (0.62–1.63)		0.32 (0.16–0.65)	0.39 (0.19–0.81)
Education level of father	<i>P</i> =0.49		<i>P</i> =0.12	
Educated	1		1	
Not educated	0.86 (0.56–1.32)		0.67 (0.41–1.11)	
Education level of mother	<i>P</i>=0.037		<i>P</i><0.001	<i>P</i>=0.002
Educated	1		1	1
Not educated	0.72 (0.53–0.98)		0.45 (0.32–0.64)	0.53 (0.36–0.79)
Mother's job	<i>P</i> =0.72		<i>P</i>=0.037	
Housewife	1		1	
Working mother	0.92 (0.58–1.47)		1.65 (1.03–2.64)	
Breakfast consumption	<i>P</i>=0.048		<i>P</i>=0.008	<i>P</i>=0.038
Eating	1		1	1
Skipping	1.34 (1.00–1.80)		1.53 (1.12–2.11)	1.42 (1.02–1.98)
Fruit and vegetable consumption	<i>P</i><0.001	<i>P</i><0.001	<i>P</i>=0.001	<i>P</i> = 0.018
Adequate	1	1	1	1
Inadequate	0.41 (0.31–0.56)	0.43 (0.31–0.58)	0.56 (0.41–0.77)	0.67 (0.47–0.93)
Soft drink consumption			<i>P</i><0.001	<i>P</i><0.001
No			1	1
Yes			2.04 (1.48–2.81)	1.88 (1.34–2.64)
Fast food consumption	<i>P</i><0.001	<i>P</i>=0.002		
No	1	1		
Yes	2.04 (1.48–2.81)	1.72 (1.22–2.42)		

AOR, adjusted odds ratio; CI, confidence interval; UOR, unadjusted odds ratio. Significant *P* values are indicated in bold font.

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Table 5

Quote examples from each of the themes and subthemes

Theme/Subtheme	Level	Example of quote
1. Cognitive influences <ul style="list-style-type: none"> • Perceived healthy and unhealthy dietary patterns • Knowledge and attitudes 	Individual	'Nowadays, unhealthy eating behaviours are widespread among youth. I can quote for example: frequently eating outside the home, the consumption of canned foods, fast foods, etc' (Teacher 16) 'Even if I know that these foods [fast foods, cookies and other unhealthy foods] are not good for health, I buy them.' (Student 4) 'Me, in my opinion, the problem is that the school does not play its role properly in this regard...., school curricula are failing.' (Mother 2)
2. Affective and biologic influences, including appetite, taste and preferences, and hunger (Individual level)	Individual	'Me...., even if everything is available on the table, I cannot eat my breakfast, I have no appetite in the morning.' (Student 3) 'I take street food because I feel hungry.' (Student 17)
3. Lifestyle-related influences (individual level) <ul style="list-style-type: none"> • Time and convenience • Behaviours 	Individual	'I don't have enough time in the morning to eat my breakfast because ... I wake up late.' (Student 11) 'I took the habit of taking breakfast since childhood, ... it became a habit for me.' (Student 44)
4. Health and social outcome expectation influences (Individual level)	Individual	'He does not take this kind of food [unhealthy foods] to preserve his health, especially if there is someone in the family suffering from a chronic disease.' (Parent 5)
5. Social network (Environmental level)	Environmental	'I do not take my breakfast because my Parent does not prepare it for me.' (Student 15) 'Everybody buys, I buy them too.' (Student 23) 'I eat them with my friends' (Student 26) 'Parents and family do not control foods their children consume.' (Teacher 1)
6. Availability and affordability of foods (Environmental level)	Environmental	'I eat fruits and vegetables when I find them at home.' (Student 44) 'I don't take my breakfast because I do not find what I like.' (Student 24)
7. Distal influences (Environmental level)	Environmental	'I buy what I see in advertising.' (Student 23) 'The school currently has a very limited role.' (Teacher 1)

Table 6

Number of codes and quotes for each theme according to the category of participants

		Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Theme 7
<i>n</i> of codes	Students	18	9	4	2	13	10	13
	Parents	4	4	8	2	8	11	6
	Teachers	2	2	3	1	11	5	8
<i>n</i> of quotes	Students	86	69	18	11	50	54	30
	Parents	34	12	25	3	30	26	14
	Teachers	22	2	5	3	24	15	32