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Karima Azekour,[1] Zahra Outaleb,[1] Mohamed Eddouks,[1] Farid Khallouki[1] and Bachir El Bouhali [1]

[1]Department of Biology, Faculty of Sciences and Techniques, Moulay Ismail University, Errachidia, Morocco (Correspondence to: B. El Bouhali: bachirbouhali@hotmail.com)

Abstract

Background: Dietary patterns, eating behaviour and lifestyle are changing in Morocco. It would be interesting to identify and evaluate this transition in its Mediterranean context.

Aims: To assess adherence to the Mediterranean diet (MedDiet) and analyse associated factors in school-age children living in oasis environments.

Methods: A cross-sectional survey was conducted among 3684 school-age children between May 2015 and November 2017 in Tafilalet Oasis. The mean age was 9.81 (2.13), 51.3% were girls, and 62.7% were from urban areas. Participants were recruited from public primary schools. Adherence to the MedDiet was evaluated by Mediterranean Diet Quality (KIDMED) index. Socioeconomic characteristics and anthropometric measurements were obtained.

Results: Only 2.12% had a poor KIDMED index, 57.9% had an average index and 39.98% had a high index. Maternal ethnicity was associated with degree of adherence to the MedDiet. Poor adherence was seen in 2.17% of urban participants compared with 2.04% of rural participants. Participants with high income were more likely to have good adherence to the MedDiet. Low levels of parental education were more likely to result in higher levels of poor adherence. There was no significant correlation between body weight and KIDMED index.

Conclusions: Most of the study population had medium to good adherence to MedDiet, but low KIDMED index was observed. Interventions and strategies should be devised for preserving

and promoting healthy eating habits in this target population.

Keywords: Mediterranean diet, school-age children, oasis, Draa-Tafilalet, Morocco.

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Introduction

The Mediterranean diet (MedDiet) is widely studied and is considered to be the healthiest dietary model in the world. It incorporates the traditional healthy living habits of populations from the Mediterranean Region. In 2013, it was included on the United Nations Educational, Scientific and Cultural Organization Intangible Cultural Heritage list (1). The MedDiet varies among countries bordering the Mediterranean Sea, but in general, it is known by abundant consumption of vegetables, fresh or dried fruits, cereals, olive oil as the main source of fats; moderate intake of fish, meat and dairy products; and low intake of eggs and sweets (2). It is recognized as having several beneficial effects on health. Numerous studies have concluded that the MedDiet is a protective factor against many chronic illnesses, such as diabetes, cancer and cardiovascular diseases (3,4). In a particular sample of 3042 participants, adherence to the MedDiet was associated with 15% lower incidence of cardiovascular disease (5). Nonetheless, data about children's MedDiet adherence, especially in Morocco, are lacking.

Therefore, the aim of the present study was to investigate the level of adherence to the MedDiet among school-age children living in Tafilalet Oasis, which is located far from major cities and considered to be the largest oasis in the world. It has several specific features that differ considerably from those in other Moroccan regions, such as low level of urbanization, high

poverty and specific culinary habits based on high consumption of vegetables, in particular, dates, okra, collards and alfalfa. The study was carried out to investigate socioeconomic and anthropometric factors associated with adherence to the MedDiet. School-age children were selected because they developed in a poor and precarious context, and the impact of these conditions was more important in children than adults. Furthermore, childhood is a period of cognitive and physical development accompanied by increasing nutritional needs.

Methods

Description of the study site

The Drâa-Tafilalet Region is located in the Southeast of Morocco and consists of an area of 88 836 km2. According to the general census of the population and the habitat of 2014, the region had 1 635 008 inhabitants (4.83% of the national population); of whom, 34.30% were urban dwellers, which was significantly lower than the national rate of 60.36%. The region is dominated by oasis that occupies 88% of the surface area (46% of the Moroccan oases). At the administrative level, the Region is divided into 5 provinces (Figure 1) (6).

Study design

This cross-sectional study was conducted between May 2015 and November 2017 in Tafilalet Oasis. The random sample was produced to represent at least 1% of the target population. We randomly selected 39 public primary schools from a total of 284 from urban and rural areas of the Oasis. Moreover, one class by level was chosen in each elementary school (1, 2, 3, 4, 5 and 6 levels). The number of students per classroom varied from 28 to 50, and 30–50% of the students per class were sampled. The study sample was taken from mixed-sex classes. Face-to-face interviews were conducted using an assisted questionnaire, and anthropometric measurements noted. Authorization was obtained from the regional and local education authorities, and oral consents of parents or tutors was required.

Study population

The study group included 3684 school-age children. There were 1890 (51.3%) girls and 1794 (48.7%) boys, with an average age of 9.81 (2.13) years. Over the study period, only children with parents who had agreed to participate were included. Children whose parents/tutors did not consent to answer the questionnaire were excluded. All children included in the sampling were apparently healthy with no physical diseases or disabilities.

Questionnaire

The questionnaire was divided into 2 sections: the first comprised questions for assessing socioeconomic status, and the second measured the degree of dietary adherence. Dates of birth of all children were noted from the list given by the teachers. Education of parents was

classified into 4 categories: university, secondary, primary and illiterate. Other questions were: ethnicity of mother's children (people who spoke Arabic were considered Arab and those who spoke Amazigh were considered Amazigh); urban or rural residence; occupation, employed or not; school time (morning, afternoon or both); type of family (nuclear or joint); family size (3 or 4, 5 or 6, or ≥ 7 persons); and monthly family income: > 5000 Moroccan Dirham (MAD) was considered to be high, 2001–4999 MAD medium, and

The degree of adherence to the MedDiet was evaluated by the Mediterranean Diet Quality Index (KIDMED). It is one of the most recent methods, which is widely used to evaluate adherence to the MedDiet, and has proven reliability (7). The KIDMED questionnaire was translated into Arabic and Amazigh languages (reliability test was performed to ensure translations). It contains 16 items, and evaluates frequency of intake of 8 food groups: vegetables, beans, fruits, nuts, cereal, fish, dairy products and olive oil. Consumption of fast food, baked goods and sweets, and skipping breakfast are scored as 1 and remaining questions as +1. According to the KIDMED classification, a score of 0–3 reflects low adherence to the MedDiet, 4–7 average adherence that needs improvement, and 8–12 strong adherence that reflects optimal quality diet (higher scores indicating greater adherence) (8).

Pilot sample

Before the survey, the questionnaire was administered to a pilot sample of 43 children from the same survey population with the same conditions as those for the total survey, and they were not included in the study population.

Anthropometric measurements

Measurements of weight and height were taken carefully, as described previously (9). Children were weighed without shoes, wearing a few clothes, using a weight scale (seca 804). Height was measured standing upright, feet together using a height measuring board. The body mass index (BMI) for age was calculated for all children and z scores were determined using World Health Organization (WHO) AnthroPlus software. Rates of obesity and overweight were assessed among children based on the new WHO standards of growth. Overweight was indicated by a z score > +1 standard deviation (SD), obesity by > +2 SD, underweight by **Data analysis**

Data were entered, coded, checked, and analysed using appropriate statistical software. A descriptive analysis of all variables was performed. Categorical variables were expressed as numbers and percentages. Associations and correlations between studied variables were assessed using the $\chi 2$ test. P **Results**

The total study population was included in the analysis (Table 1). Children who refused to participate or were absent were not included in the survey. The total sample included 3684

scholars (response rate, 94%) and 62.7% were from urban areas. For fathers' occupation, 67.4% were unemployed, and 85.99% of the mothers were housewives. Concerning maternal education, 38.6% were illiterate compared with 21.9% of fathers. Only 16.56% of parents earned > 5000 MAD, 66.07% earned 2001–4999 MAD and 17.37% earned
Table 1
).

Table 2 shows the results of KIDMED according to sociodemographic and economic factors. KIDMED classification was good in 39.98% of the population, medium in 57.90% and poor in 2.12%. There was no significant correlation between KIDMED scores and sex, family size and maternal education. However, urban region showed a significant increase (2.17%) in poor adherence to MedDiet compared with rural region (2.04%) (P = 0.002). The percentage of the population with a low KIDMED score was 1.22% among those that spoke Arabic versus 2.57% among those that spoke Amazigh, and this correlation was highly significant (P

According to multiple logistic regression, adherence to the MedDiet was more associated with maternal ethnicity and school time (Table 3).

The associations between KIDMED scores and BMI classification are shown in Table 4 . Two hundred and eighty-five (7.74%) children were underweight, 2930 (79.53%) had normal corpulence, 399 (10.83%) were overweight and 70 (1.90 %) were obese according to WHO growth reference for school-aged children and adolescents. There was no significant association between body weight and KIDMED score (P > 0.05). Consumption of fruit, vegetables, fish (at least 2 or 3 times per week), pulses/beans, pasta or rice (≥ 5 times per week), nuts/dry fruits (at least 2 or 3 times per week) were correlated with body weight of children (P = 0.004, 0.008, 0.004, 0.002, 0.040 and 0.025, respectively).

Discussion

The main purposes of the present study were to evaluate the level of adherence to the MedDiet in school-age children in Tafilalet Oasis and to analyse associated factors such as socioeconomic characteristics and body weight. The degree of adherence to the MedDiet differs among Mediterranean countries and even within the same country. In the current study, 2.1% of school-age children had low adherence to the MedDiet. In national studies, despite their rarity, low adherence to the MedDiet was more frequent than in the present study at 29.90% in Fez (11) and 14.50% in Ouarzazate (12). These findings may be explained by the particular features of Tafilalet Oasis related to degree of urbanization, and food and culinary culture that may have an impact on food habits and food preparation rather than resistance to changes in dietary intake and nutritional transition. Our results also differ from other Mediterranean countries, especially the Eastern Mediterranean Region and Arab countries. A meta-analysis of 41 countries showed that most have tended to drift away from a Mediterranean-like dietary pattern

(13). The Mediterranean European countries, especially Greece, experienced the greatest decrease in Mediterranean Adequacy Index value (an assessment of how close a diet is to the MedDiet (13). Poor adherence was noted at 46.8% in Greece among 4786 children aged 10–12 years (14); 32.8% in Italy in 1740 children aged 8–9 years (15); 42.7% in 354 Turkish medical school students (206 first year and 148 third year) with a mean age of 19.57 (1.65) years (16); and 21.8% in 193 students enrolled in public and private universities in Cyprus (17).

There was no significant association between adherence to the MedDiet and sex. The same result was found in other studies (15,18). This trend is more likely to be closer to the reality in this Oasis population, probably because of the chosen age of the participants. However, there was a significant correlation between age and MedDiet adherence, children aged > 9 years were more likely to have a good MedDiet score. Similar results were found in the study of Bibiloni et al. (19) but contrary to the studies of Farajian et al. (14) and Grosso et al. (20). There were significant differences in adherence to the MedDiet according to monthly family income and paternal education and occupation. Low standard of living and education were less likely to lead to good adherence to the MedDiet. This is in agreement with previous studies that correlated high consumption of non-Mediterranean food with low socioeconomic status (21, 22) but contrasted with the results of El Rhazi et al. (11) who did not find any correlations. Regarding place of residence, lower adherence was associated with living in an urban area compared to rural area. Outcomes were in line with the findings of Grosso et al. (20) but were in disagreement with those reported by El Rhazi et al. (11). Significant differences in adherence to the MedDiet were noted with regard to maternal ethnicity. This may be explained by the effect of cultural differences in food preparation, food habits and consumption patterns. Body weight was not associated with adherence to the MedDiet, but 9 components of KIDMED score were correlated with BMI of children, unlike the study conducted by Anzid et al. (12) who found only one positive correlation with fish consumption. In fact, high consumption of Mediterranean food was associated with normal weight.

The present study had some limitations. First, the validity of the KIDMED questionnaire has not been previously assessed in Morocco. Second, children who had specific diets under certain conditions (e.g. low glycaemic diet for diabetes management) were not excluded.

Conclusion

The level of low adherence to the MedDiet in the present study was lower than in other studies in Morocco and the Mediterranean Region, especially in the Eastern Region. High adherence to MedDiet by oasis children can be explained by preserving eating habits. The socioeconomic factors were the most associated with adherence to the MedDiet, especially maternal ethnicity and school time.

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Observance du régime méditerranéen chez les enfants d'âge scolaire dans les oasis au Maroc, région de Draa-Tafilalet

Résumé

Contexte : Au Maroc, les habitudes alimentaires, le comportement alimentaire et le mode de vie sont en train de changer. Il serait donc intéressant d'identifier et d'évaluer cette transition dans son contexte méditerranéen.

Objectifs : Examiner l'observance du régime méditerranéen et analyser les facteurs associés chez les enfants d'âge scolaire résidant dans des environnements d'oasis.

Méthodes : Une étude transversale a été menée auprès de 3 684 enfants d'âge scolaire entre mai 2015 et novembre 2017 dans l'oasis de Tafilalet. L'âge moyen des enfants était de 9,81 (2,13), dont 51,3 % de filles, et 62,7 % résidaient en zone urbaine. Les participants ont été recrutés dans des écoles primaires publiques. L'observance du régime méditerranéen a été évaluée au moyen de l'indice KIDMED, qui mesure la qualité du régime méditerranéen. Des caractéristiques socioéconomiques et des mesures anthropométriques ont également été obtenues.

Résultats : Seulement 2,12 % des enfants avaient un indice KIDMED médiocre, 57,9 % avaient un indice moyen et 39,98 % avaient un indice élevé. L'appartenance ethnique de la mère était associée au degré d'observance du régime méditerranéen. Une observance médiocre a été notée chez 2,17 % des participants vivant en milieu urbain, contre 2,04 % en milieu rural. Les participants disposant de revenus élevés étaient plus susceptibles d'avoir une

bonne observance du régime méditerranéen. En outre, les familles où les parents avaient de faibles niveaux d'éducation étaient plus susceptibles d'avoir des niveaux plus élevés d'observance médiocre. Il n'y avait pas de corrélation entre le poids des enfants et l'indice KIDMED.

Conclusions : La majorité de la population d'étude avait une observance du régime méditerranéen comprise entre moyenne et bonne , mais nous avons également observé de faibles niveaux d'indice KIDMED. Des interventions et des stratégies devraient être mises au point afin de préserver et de promouvoir des habitudes alimentaires saines dans cette population cible.

WHO EMRO | Adherence to the Mediterranean diet of school-age children in Moroccan oases, Draa-Tafila

المشاركين الذين ينتمون إلى مناطق حضرية، مقابل 2.04% من المشاركين الذين ينتمون إلى
مناطق ريفية . كما تبين أن المشاركين الذين يتمتعون بدخلٍ أعلى من الأرجح أن يلتزموا
أكثر بالنظام الغذائي المتوسطي . ورُجح أيضاً ارتباط انخفاض المستوى التعليمي للأبوين
بارتفاع مستويات عدم الالتزام بالنظام الغذائي المتوسطي . ولم يكن هناك ترابط واضح بين
وزن الجسم ومؤشر جودة النظام الغذائي المتوسطي (KIDMED).

: تراوح التزام السكان الذين شملهم المسح بالنظام الغذائي المتوسطي بينالاستنتاجات
متوسط إلى جيد، ولكن لوحظ انخفاض مؤشر جودة النظام الغذائي المتوسطي (KIDMED). وينبغي
إعداد تدخلات واستراتيجيات للحفاظ على العادات الغذائية الصحية في هذه الفئة
السكانية المُستهدَفة وتعزيزها .

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9 / 11

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