Case Series

Evaluation of rural-urban patterns in dietary intake: A descriptive analytical study – Case series

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ARTICLE INFO

Keywords:
Mediterranean diet
Socio-economic data
Demographic data
Morocco

ABSTRACT

Purpose: This article aimed to evaluate the different epidemiological aspects of the population (Fez-Meknes region), expose the secular trends of the food habits related to it, present the basic concepts and mechanisms of food in urban and rural areas in the Fez-Meknes region, and finally to analyze the results in the light of a literature review.

Materials and method: A survey was conducted among a representative sample of the urban and rural population in the Fez-Meknes region (654 people aged 15 years and over, of which 326 people reside in the urban commune of Fez and 328 in the rural commune of Louija in the province of Taounate).

Results: The results are, a difference between the two urban and rural groups concerning the rhythm of taking meals outside the home (P < 0.001); the average frequency of consumption of certain foods according to social class (p < 0.001); the frequency of food consumption per week of legumes, olive oil, fermented milk, and tea is more increased than that recorded in the urban environment (p < 0.001). On the other hand, the quantification of the consumption of sweet products, dairy products, and whole grains did not conclude a significant difference between the two study environments (p > 0.05).

Discussion: Changing dietary patterns over the past few decades, including more shift work, more meals eaten outside the home or family setting, and more irregular eating patterns, including skipping breakfast and eating late at night.

Conclusion: A disparity in eating habits between urban and rural areas was noted. It would be necessary to act judiciously on the environmental factors by encouraging the Moroccan populations to maintain, as much as possible, their good traditional habits, and to reinforce the new good food habits.

1. Introduction

The metropolitan environment has considerably changed over the last few decades, which has also had an impact on people’s eating habits and even on their health [1–3].

The dietary habits can be considered as a set of integrated behaviors linking internal biological events to external environmental events [4, 5]. Furthermore, the act of eating is complex. It has at least two fundamental dimensions.

The first part is from physiology to culture, from the nutritive function to the symbolic function. The second is from the individual to the collective, from the psychological to the social [6]. Its expression can be represented as the last link of an intimate interaction between the physiology and the external environment, within a psycho-biological system [7]. In addition, scientific progress has made it possible in the last decade to deconstruct eating behavior and to shed light on the many molecular factors that allow the regulation of physiological events (food) [4, 5, 7–9].

In high-income (H.I.) countries, monitoring of dietary habits using an objective method has been conducted for decades [10]. Unlike in our context, few studies have used objective methods to assess nutrition, especially in urban and rural settings [11–15].

Our study aimed to evaluate the different epidemiological aspects of the studied population (Fez-Meknes region), to expose the secular trends of the related food habits, to present the basic concepts and mechanisms of food in urban and rural areas in the Fez-Meknes region and finally to...
analyze the results in the light of a review of the literature.

2. Materials & methods

2.1. Sample study

A representative sample of the urban and rural population was surveyed in the Fez-Meknes region which is number of 654 people aged 15 years and over of which 326 people reside in the urban commune of Fez and 328 in the rural commune of Louija in the province of Taounate. To determine the number of women and men to be surveyed, we used the cota method according to age class and type of habitat while respecting the same distribution as the general population of the 2014 census (HCP, 2014).

2.2. Data collection

A food frequency questionnaire (FFQ) was administered to our study population to estimate their food intake during the last month before the survey, combined with the 24-h recall to quantify the participants’ daily food intake.

We obtained information regarding age, gender, socioeconomic status, meal patterns, meal composition, etc.

A short parental questionnaire was distributed to assess factors of individual socioeconomic status. Written informed consent was obtained from the participant’s parents.

2.3. Data analysis

Data management and analysis were performed using IBM SPSS Statistics for Windows, version 26.0.0 (IBM Corporation, Armonk, NY). Categorical data were summarized as frequencies, and cross-tabulations and x2 significance tests were used to make comparisons between groups. Continuous variables were summarized as mean and variation, and comparisons between groups were made using the ANOVA test. All tests of significance used a 2-sided P value of 0.05. For the overall nutritional quality, we referred to the MDS score (based on the Mediterranean diet pattern) (Fig. 5) [16].

In addition to the use of the Ciqual food composition table for caloric intake. As for the social class, we defined it according to the income of our respondents, based on the classification made by the HCP.

To ensure a rigorous analysis of the data from the questionnaires, we have put forward an exploitation sheet.

This case series has been reported in line with the PROCESS criteria [17].

3. Results

3.1. The sociodemographic profile of population by place of residence

The characteristics of the people are divided into groups, and the epidemiological considerations are presented in Table 1. The survey reveals that the rural population is younger than the urban population, with a median age of 33 years compared to 35 years in urban areas. The 25 to 34-year-old age group represents 65% in rural areas compared to 25% in urban areas. Widowers (3.7%) and divorcees (3.2%) remain in the minority, with a significant difference between urban and rural areas (p < 0.001).

One-third (33.5%) of our sample did not have access to school, of which 77.2% reside in rural areas and 22.8% in urban areas, while 97.6% of those with higher education are from urban areas (p < 0.001).

The poor population represents 91.2% of the rural population against 35.9% of the urban population, the middle class also called the modest class represents only 8.8% of the respondents in rural areas against half (51.5%) of the urban population, and the wealthy class in this sample appears only in the urban area with a proportion of 12.6%, thus a statistically significant difference for the social class between the two environments (p < 0.001) (Table 1).

3.2. The dietary habits

Concerning the average number of meals consumed per day, the results show that the rural population residing in the commune of Louija consumes $3.83 \pm 0.48$ meals per day, i.e. one meal more than that of the city of Fez, which opts on average for $2.90 \pm 0.31$ meals per day, without any significant difference according to age and gender (p > 0.05) (Table 2).

In addition, the survey reveals that only 5% (18 people) of those surveyed in rural areas declare that they do not eat regularly during the day, compared to 35% (114) of those surveyed in “Fez”, which is a very significant difference between the two urban and rural areas (p < 0.001).
The average number of meals consumed by residence setting, gender, and age (p > 0.05).

| Meals per day | Urban | Rural |
|---------------|-------|-------|
| Gender        |       |       |
| Men           | 2.91 ± 0.29 | 3.91 ± 0.48 |
| Women         | 2.89 ± 0.32 | 3.75 ± 0.47 |
| Total         | 2.90 ± 0.31 | 3.83 ± 0.48 |
| Age (y.o)     |       |       |
| 15 to 24      | 2.90 ± 0.30 | 3.73 ± 0.44 |
| 25 to 34      | 2.88 ± 0.32 | 3.83 ± 0.48 |
| 35 to 49      | 2.93 ± 0.25 | 3.91 ± 0.50 |
| 50 to 64      | 2.91 ± 0.29 | 3.85 ± 0.51 |
| ≥ 65          | 2.77 ± 0.43 | 3.85 ± 0.46 |
| Total         | 2.90 ± 0.31 | 3.83 ± 0.48 |

As for the way these meals are eaten, the average number of days of food consumption outside the home in the rural area does not even reach one day per week, i.e. 0.65 ± 0.48, and the meals eaten in the home cover an average of 6.74 ± 0.9 days per week. This is in contrast to what was recorded in the urban area, where the surveyed population spends an average of 2.26 ± 1.8 days per week eating meals away from home and 4.74 ± 2.5 days for meals eaten at home, which is a very significant difference between the two survey settings (p < 0.001).

Concerning the types of cooking often or always adopted by the surveyed population, the survey shows that the types of cooking used are the same in both urban and rural areas, except the use of microwaves, which is directly related to the urban world in this survey, in addition to grills, which are used by only 2% of the rural population (Fig. 1).

### 3.3. The food intake

#### 3.3.1. Average quantity of food consumed per person per day and per place of residence in the Fez-Meknes region

The quantification of food portions consumed by the target population shows that the average quantities ingested per person per day for certain foods are greater in urban areas than in rural areas, namely vegetables, fruits, nuts and grains, meat, and fish. These quantities are respectively (112.04g ± 64.14; 82.99g ± 58.77; 33.17g ± 17.14; 115.43g ± 63.38; 29.68g ± 20.29) in urban areas compared to (62.91g ± 40.26; 31.62g ± 27.04; 12.22g ± 14.94; 75.68g ± 36.64; 8.3g ± 10.38) in rural areas (p < 0.001). Other foods, notably olive oil and legumes, were consumed much more in rural areas (120.67g ± 64.5; 224.35g ± 83.54) than in urban areas (36.79g ± 27.3; 81.17g ± 49.42) (p < 0.001).

However, the quantification of the consumption of sugary products, dairy products, and whole grains did not conclude any significant difference between the two study settings (p > 0.05) and respectively as follows (p = 0.08, p = 0.054, p = 0.069) (Fig. 2) (see Fig. 3).

#### 3.3.2. The average daily caloric intake by gender and residence setting

#### 3.3.3. Frequency of food consumption per week by social class

The survey reveals that the average frequency of consumption of certain foods (fruits, vegetables, milk, yogurt, cheese, meat, fish, poultry, pastries, sweets and chocolates, soft drinks and coffee, fast food, and cold cuts) remains higher in the wealthy class followed by the middle class and the poor class comes last (p < 0.001).

For nuts and grains, the difference is significant between the three groups (p = 0.003). However, the frequency of consumption of legumes, olive oil, fermented milk, and tea is increased among the poor class than among the middle and wealthy class (p < 0.005). As for eggs and whole grains, no difference was recorded according to social class (p > 0.005) (Table 3).

#### 3.3.4. The food consumption by week and residence

The investigation of weekly food consumption frequencies by area of residence of our target population shows that the average number of days of consumption of certain foods in urban areas is higher than in rural areas. These include fruits and vegetables, which are consumed more frequently in urban areas than in rural areas, i.e., on average two days more per week (p < 0.001). (Table 4).

Similarly, yogurt and cheese are consumed all week in urban areas, whereas in rural areas they are consumed only 2.5 times a month (p < 0.001). Also, fish consumption remains higher in urban areas (1.33 ± 0.86) than in rural areas (0.43 ± 0.51) (p < 0.001). (Table 4).

In addition to fast food, soft drinks, chips, breakfast cereals, and ice cream, are consumed once or twice a week (2.05 ± 1.29; 1.14 ± 0.96; 1.74 ± 1.27 respectively) in urban areas compared to a frequency that does not even reach once a week in rural areas, i.e. (0.05 ± 0.01) for fast food, (0.45 ± 0.62) for soft drinks and (0.57 ± 0.44) for potato chips (p < 0.001).

On the other hand, in rural areas, the frequency of weekly consumption of legumes, olive oil, fermented milk, and tea was higher than in urban areas (p < 0.001) (Table 4).
3.4. The nutritional quality

The estimation of the global nutritional quality via the calculation of the MDS score by place of residence shows that the average of this score reaches its peak in the rural area with an average of 5.51 ± 1.54 [1–10], while it is 4.96 ± 1.71 [0–9] in the urban area, i.e., a significant difference between the two areas of the study (F (1,652) = 18,888, p = 0.0001).

Furthermore, the food typologies identified according to the total score calculated for the two areas of residence reveal that more than half (53.4%) of the rural population studied opts for a Mediterranean diet, compared to only 28.2% of the urban population.

Our survey also shows that processed food is adopted by 1/3 of the urban population compared to only 13.1% of the rural population. For these two dietary typologies, the difference is very significant between the two study environments (P < 0.001). Concerning the two remaining diets, the mixed diet composed of both the Mediterranean and processed foods and the poor diet represented by a low MDS score without processed products, the results are not conclusive of a significant difference between the two study settings. (Table 5).

4. Discussion

Globally, the proportion of people living in large cities has increased dramatically in recent decades and is expected to increase further; during the 20th century, the proportion of people living in urban areas rose from 14% to 50% [18–21]. This process of urbanization, that is, the growth of cities in terms of population and physical size [22–25], began a few centuries ago and was triggered by the invention of electric light in 1879 by Thomas Edison, during the industrial revolution.

This transition is occurring primarily in developing countries, and these demographic changes are having a major impact on public health, possibly related to effects on sleep and eating habits [26]. This new field of nutritional science research that studies the impact of the timing of food on health is called Chrono nutrition and combines elements of nutritional research and chronobiology [27–32].

The Mediterranean diet is a dietary pattern rich in plant foods (grains, fruits, vegetables, legumes, nuts, seeds, and olives), with olive oil as the main source of fat, as well as high to moderate intakes of fish and seafood, moderate consumption of eggs, poultry and dairy products (cheese and yogurt), low consumption of red meat (Fig. 5) [33].

The various epidemiological data reveal a similar percentage of participants for both sexes. Some authors note a slight male predominance, others note a certain female predominance [16,33,35–41].

In our case series, we noted a 51% female predominance with no significant difference between the two geographical areas.

We note that our average age is lower than that reported in the Western series. The Moroccan and African series, on the other hand, has a relatively young average age (Davis et al. [42], Petterson et al. [43]).

Currently, there are no official guidelines in either the U.S. or Africa
regarding the number of meals and snacks to be consumed; however, the sample meal plans on the USDA’s MyPlate SuperTracker website call for three meals and a mid-morning and mid-afternoon snack [44].

Regions of the world differ in the distribution of energy intake in food episodes throughout the day. The lack of differences in the mean number of meals consumed per day in our study (Rural: 3.83 ± 0.48; Urban: 2.90 ± 0.31), by age and sex in both areas, confirms that of Davis et al. [42], Kenney et al. [45] and Ennemana et al. [46], and significantly lower than those found in the study by Kent et al.: 4.96 [47].

The difference between the two urban and rural groups regarding non-regular meal patterns (5% in the rural group VS 15% in the urban group) can be explained by changes in eating habits in recent decades, including more shift work, more meals eaten outside the home or family setting, and more irregular eating habits, including skipping breakfast and eating late at night [26]. The differences between groups were statistically significant (P < 0.001) (see Fig. 4).

Buratti et al. [48] examined the effects of three cooking methods (boiling, steaming, and microwaving) on the nutritional and physical properties of cauliflower, carrots, and sweet potatoes in a study. Nutritional quality was assessed by determining concentrations of key components and antioxidant activity. Cooking method and time significantly influenced the quality of all three products. Boiling had a negative effect on ascorbic acid, total phenolic concentration, and antioxidant activity, but improved carotene accessibility. Steaming resulted in losses of ascorbic acid, but increased total phenolic and carotenoid concentration. Microwave cooking resulted in minor changes resulting in losses of ascorbic acid, but increased total phenolic and carotenoid concentration. Microwave cooking resulted in minor changes.
children consumed fruits and vegetables more frequently and/or more fruits and vegetables [8].

In the United States, current work and school routines are not conducive to eating a large breakfast or lunch. More comprehensive dietary information, including questionnaires and consistently defined food groups and outcomes, would provide a better understanding of the dietary habits of the rural and urban populations, as well as potential differences between them [8].

The consumption of milk and dairy products in different regions of the world is subject to great disparity, mainly due to strong cultural factors, but also partly due to the availability of products and their cost in developing countries, the lack of refrigeration equipment, and the high prevalence of lactose intolerance in the Asian population [49].

The consumption of sweetened products, dairy products, and whole grains in our study did not find any statistically significant difference between the two urban and rural environments (p > 0.05) and respectively as follows (p = 0.08, p = 0.054, p = 0.069).

In contrast, a study conducted in Algeria found that the sense and cognitive perception of modernity in the urban population was related to the consumption of sweetened beverages, and snacks by older people [40].

In addition, fruit and vegetable consumption in our series was higher in urban areas: 4.44 ± 2.89 than in rural areas: 1.87 ± 1.56, i.e., on average 2 more days of consumption per week (p < 0.001). Our results are close to those of the Stepwise survey (Morocco) [50], the number of days per week is more important in urban 4.6 ± 0.1 than in rural 3.6 ± 0.2. Our results are also similar to those of Liu et al. [51].

In addition, the High Council for Public Health (HCSP) recommended (during the 2017/2021 report), that the food day should be globally close to the benchmarks as much as possible without each meal necessarily being so. If the consumption of certain products should be limited (in terms of frequency and quantity), there is no question of banning them. Their consumption can be part of a healthy diet [52].

According to the study by Stefler et al. [35], many factors (female gender, being married, high household equipment score, high total energy, and regular intake of vitamin supplements) were related to a high MDS. In our series, half (53.4%) of the rural population studied opted for a Mediterranean diet compared with only 28.2% of the urban population. The mean MDS score in the rural population was 5.51 ± 1.54 [1–10], whereas it was 4.96 ± 1.71 [0–9] in the urban population, i.e., a significant difference between the two study settings (F (1,652) = 18, 888, p = 0.000).

In the Benyach et al. study [36], the authors were able to demonstrate that the strength of adherence to the Mediterranean diet (MR) differed between the urban and rural populations, as well as according to the level of physical activity and the two forms of obesity (abdominal and peripheral). Our results are similar to those found in the literature.

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Greater adherence to the Mediterranean diet was associated with a reduced risk of total death, death from cardiovascular disease, and the occurrence of mental disorders in these large urban populations in Eastern Europe. Application of the MDS with absolute cut-offs appears to reduce the incidence of cardiovascular disease and reduce mental disorders in our population [33,35,36] (Table 6).

5. Limites

Given these findings, the adoption of eating patterns (in urban and/or rural settings) that advocate a decrease in meal frequency and a shift in the timing of eating may be challenging.

The type, extent, and impact of measurement error, as well as variation in eating patterns within and between subjects, is an open area of research.

6. Conclusion

In the field of eating behavior, one of the issues is whether food intake is primarily influenced by psychosocial/environmental parameters or by physiological events.

Obesity, associated metabolic disorders, and mental disorders are

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**Table 6**

| Authors               | Year | Country | Type | Age range (y.o) | Variable          | Résultats                                                                 |
|-----------------------|------|---------|------|-----------------|-------------------|---------------------------------------------------------------------------|
| Davis et al. [53]     | 2008 | U.S     | T    | 2-18            | Rural vs urban    | No significant differences.                                               |
| Davis et al. [42]     | 2011 | U.S     | T    | 2-18            | Rural vs urban    | No significant differences.                                               |
| Liu et al. [51]       | 2012 | U.S     | T    | 2-19            | Rural vs urban    | Ages 2-11: Rural people consumed more calories and consumed more than 2-3 cups of dairy products. Ages 12-19: Fewer rural people consumed <2 cups of fruit. Urban children eat vegetables more frequently than rural children. |
| Ettienne-Gittens et al. [54] | 2013 | U.S     | T    | -               | Rural vs urban    | No significant differences.                                               |
| Kenney et al. [45]    | 2013 | U.S     | T    | <18             | Non-metropolitan vs. metropolitan | No significant differences.                                               |
| Patterson et al. [43] | 2005 | U.S     | D    | 18-75           | Rural vs urban    | Socio-demographic, environmental correlates of obesity and physical inactivity in rural areas. Positive trend for additional fruit and vegetable consumption in rural areas. Modernity: the consumption of sweetened drinks and snacks for older people. No geographic differences were observed in dietary variety or diversity. Nutritional education or intervention practices must be adapted according to the socio-economic level and location (North/South) of individuals. |
| Ayala et al. [41]     | 2013 | U.S     | T    | -               | Rural vs urban    | No significant differences.                                               |
| Chikhi et al. [40]    | 2014 | Algeria | T    | -               | Rural vs urban    | No significant differences.                                               |
| Ennemana et al. [46]  | 2009 | Guatemala | T   | 6-12           | Rural vs urban    | No significant differences.                                               |
| Dauchet et al. [46]   | 2011 | France  | T    | 12-17           | Rural vs urban    | No significant differences.                                               |
| Bell et al. [37]      | 2016 | Australia | T   | 9-11           | Rural vs urban    | No significant differences.                                               |
| Torres-Laque et al. [36] | 2018 | Spain   | T    | 3-5            | Rural vs urban    | No significant differences.                                               |
| Benyaich et al. [36]  | 2014 | Morocco | T    | -              | Rural vs urban    | Adherence to the Mediterranean diet is higher in rural than in urban areas. Women consume more carbohydrates than men in both settings. |

**Note:** T: Cross-sectional study, D: Descriptive study.
one of the major public health threats we face today. At the end of our study, we deduce a disparity in eating habits between urban and rural areas. It would be wise to act on environmental factors by encouraging Moroccan populations to maintain, as much as possible, their good traditional habits, and to reinforce the new good eating habits.

Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Source of funding

The authors declared that this study has received no financial support

Author contribution

Samira Nabdi: Corresponding author writing the paper, study concept and analysis of data, Said Boujraf: Study design and Correction of the paper, Mohammed Benzagout: Study design and Correction of the paper.

Trail registry number

Name of the registry: researchregistry
Unique Identifying number or registration ID: 8230.
Hyperlink to your specific registration (must be publicly accessible and will be checked).

Garantor

Samira Nabdi.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of competing interest

Authors of this article have no conflict or competing interests. All of the authors approved the final version of the manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.104972.

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