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Mediterranean diet and food consumption in an urban adult population of Northwest Algeria

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Abstract

Background: Knowing the eating habits of populations is important to better define appropriate public health interventions. **Aims**: The aim of the current study was to describe the food consumption among adults in an urban population in North-western Algeria and to compare it to the Mediterranean diet. **Subjects and methods:** During 2007-2009, 787 individuals aged 30-64 years, randomly selected from the list of insured persons residing in Oran city. A questionnaire on socio-economic and nutritional habits was completed during a face-to-face interview. **Results:** Mostly, Bread was the most consumed food, three times a day for the majority of the participants (92.2%), followed by vegetal oil (67.9%) and milk (51.2%) twice a day. Dessert was more consumed (64.7%) than vegetables (58.7%), once a day. Olive oil was the least consumed. According to sex, women's diet appears to be different from men regarding several foods. We observed that young subjects (30 to 39 years) displayed a high consumption of desserts (68.7%, p<0.0001) and potatoes (62.7%, p=0.024), as well as peanuts (44.9%, p=0.032). The most educated subjects, likewise, subjects with a sufficient monthly income consumed significantly more animal proteins, red meat and fish, as well as fruits. The food pyramid in the ISOR (Insulino-résistance à Oran) population was different from the MD (Mediterranean Diet), except for cereals and grain products. **Conclusion:** The diet of the urban population of northern Algeria is far to be compared to the Mediterranean diet with a high consumption of desserts and animal proteins, in particular among men with a good income.

Keywords: Northwest Algeria, urban population, Mediterranean diet, monthly income, educational level.

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1 Introduction

The health of an individual and a population in general is the result of interactions between genetics and several environmental factors of major importance [1]. So, diet and nutrition are crucial factors in the promotion and maintenance of good health throughout the entire life cycle [2]. Their role as determinants of non-communicable diseases (NCDs) is well established and they therefore occupy a prominent position in their prevention [2]. The Mediterranean diet (MD) has primarily been associated with reduced risk of NCDs, especially cardiovascular disease [3]. Developed over the centuries around the Mediterranean basin, MD is characterized by low to moderate consumption of animal protein and high consumption of fruits, vegetables, bread, olive oil, beans, nuts, seeds and other cereals. This lifestyle includes daily physical activity.

There is no unified consensus on what the Mediterranean diet is, for the minor details differ from one country to another depending on that specific culture; but, the key concepts are the same across all Mediterranean countries [4]. In 2010, the UNESCO recognized MD as Intangible Cultural Heritage of Humanity [5].

However, adherence to the Mediterranean diet has gradually reduced in the context of demographic changes such as urbanization [6] because of the concentration of populations, higher incomes and greater availability of food. Urban populations tend to consume more calories [7] and more highly processed foods [8].

Thus, the urbanization has quickly increased in the southern region of the Mediterranean sea and the percentage of people living in urban area in Algeria, reached rapidly the rate of 66% in 2008 [9]. In this context, improving life conditions has changed eating habits which moved from Mediterranean diet towards more fat and sugar. The nutritional transition has been accompanied by an epidemiological transition ongoing for the last four decades, which led to an increasing of chronic diseases. According to the latest national survey on risk factors for non-communicable diseases, based on the WHO Stepwise approach, the prevalence of diabetes is close to 14.4% while the rate of obesity and overweight exceeds 50% of the population [10]. High blood pressure has reached a prevalence rate of 23.6% [10]. These diseases represent a real threat to health, social and economic situation in the country and lead to greater demands on health facilities which require more resources [10]. In the current

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investigation, the aim was to describe the food consumption among adults in an urban population of Northwestern Algeria and to compare it to the Mediterranean diet.

2 Subjects and Methods

2.1 Subjects

The ISOR population-based, cross-sectional study was performed between 2007 and 2009. This survey investigated a representative sample of 787 subjects (378 men and 409 women, aged between 30 and 64) recruited in the city of Oran (Western Algeria). Subjects were selected at random from social security registers. A questionnaire on socio-economic and nutritional habits was completed during a face-to-face interview. The study was described in detail elsewhere [11]. Food intake was assessed using a weekly food frequency questionnaire during the previous week: consumption of butter, peanuts, desserts (i.e. sweet dishes, including pastries, custards, pudding, sorbets, etc.), fruits, dried fruits, olive oil, other oils, milk, vegetables, dried vegetables, eggs, bread, potatoes, pasta, fish, chicken and meat products during the week before administration of the questionnaire was recorded and then expressed as the frequency of intake (per day or per week). After calculating the median value for the intake of each food type, we defined two groups: non-/low consumers (i.e. those whose intake was below the median value) and moderate/high consumers (i.e. those whose intake was greater than or equal to the median value).

2.2 Statistical analyses

Statistical analyses were performed with SAS software (version 9.1, SAS Institute Inc., Cary NC). A median value for the intake of each food type has been calculated, defining two groups of consumers, non or low consumers (i.e. those whose intake was below the median value) and moderate or high consumers (i.e. those whose intake was greater than or equal to the median value). The consumption was secondarily expressed in frequency of intake per day or per week.

The comparison of the 'food intake by sex, age group, educational level and monthly income, was carried out using Pearson's chi-squared test. The threshold for statistical significance was set to $p<0.05$.

2.3 Ethics

The study's objectives and procedures were approved by the independent ethics committee of Thematic Agency of Research in Health Sciences, Oran, Algeria (ATRSS ex-ANDRS). The datasets were anonymized, and all subjects gave their oral informed consent to participate.

3 Results

The seven hundred eighty seven subject of ISOR study (378 men and 409 women) displayed significant socio-demographic differences (Table 1).

Table 1: Clinical characteristics of the genotyped subjects in the ISOR study

Parameters	ISOR subjects (n= 787)	Men (n= 378)	Women (n= 409)	*p*
Age (years)	44.0 ± 10.1	45.0 ± 10.9	43.0 ± 9.3	**0.0068**
Age-group n (%)				
30-39	316 (40.2)	146 (39.2)	168 (41.8)	
40-49	229 (29.1)	93 (25.0)	133 (33.1)	**0.0038**
50-64	242 (30.7)	133 (35.8)	101 (25.1)	
Monthly Income n (%)				
Good	80 (10.7)	40 (10.9)	40 (10.4)	
Average	408 (54.3)	173 (47.4)	235 (64.4)	**0.0005**
Insufficient	263 (35.0)	152 (41.6)	111 (28.8)	
Working n (%)				
Yes	406 (52.1)	251 (66.6)	155 (38.6)	
No	373 (47.9)	126 (33.4)	247 (61.4)	**<0.0001**
Educational level n (%)				
None or primary	172 (21.9)	70 (18.5)	102 (10.1)	
Middle school	174 (22.2)	74 (19.6)	100 (24.6)	
High school	135 (17.2)	59 (15.6)	76 (18.7)	**0.0013**
Professional Training	167 (21.3)	95 (25.1)	72 (17.7)	
University	137 (17.4)	80 (21.2)	57 (14.0)	

Data are expressed as the mean ± standard deviation

3.1 Diet intake

In general, bread was the most consumed food, three times a day for almost all subjects (92.2%), followed by vegetable oil (67.9%) and milk (51.2%) twice a day. Dessert was more consumed (64.7%) than vegetables (58.7%), once a day. Potatoes were consumed four times a week (56.8%), almost every two days. Pasta and fruit were consumed three times a week for 61.5%. Dry vegetables (74.6%) were more consumed than meat (65.7%), twice a week. Chicken (67.3%), eggs (65.7%), fish (62.5%) and butter (61.2%) were consumed once a week by two third of subjects. Less than half subjects consume occasionally dry fruit and peanut. Olive oil was the least consumed. Only one third of people consumed it from time to time (Table 2).

Table 2: Weekly intake of each type of food in the ISOR study

Foodstuffs	Consumers n	(%)	Frequency
Butter	482	61,2	Once a week
Peanut	310	39,4	Occasionally
Dessert	509	64,7	Once a day
Fruit	484	61,5	Three times a week
Dry fruits	324	41,2	Occasionally
Olive oil	275	34,9	Occasional
Oil	534	67,9	Twice a day
Milk	403	51,2	Twice a day
Vegetables	462	58,7	Once a day
Dry vegetables	587	74,6	Twice a week
Egg	517	65,7	Once a week
Bread	726	92,2	Three times a day
Potatoes	447	56,8	Three times a week
Pasta	484	61,5	Three times a week
Fish	492	62,5	Once a week
Chicken	530	67,3	Once a week
Meat	517	65,7	Twice a week

3.2 Food intake according to sex

According to sex, women's diet seems to be different from that of men regarding several foods (Table 3). Women consumed more fats, oil (77.3%, p<0.0001) and butter (70.7%, p<0.0001). Furthermore, they consumed more vegetables (62,1%, p=0.044), and milk (60.4%, p<0.0001), while men consumed more dessert (68.8%, p=0.02), fruits (69.1%, p<0.0001), potatoes (60.3%, p=0.055), and animal protein from meat (70,9%, p=0.0031) and fish (67,0%, p=0.014). Reduced consumption of peanuts was observed among women (68.0%, p<0.0001).

3.3 Diet according to age groups

We pointed out that young individuals (30 to 39 years) displayed a high consumption of desserts (68.7%, p <0.0001) and potatoes (62.7%, p=0.024), as well as peanuts (44.9%, p=0.032). In the middle ages, subjects consumed significantly more dairy products, butter (69.9%, p=0.0057) and milk (56.8%, p=0.037) (Table 4). The consumption of olive oil was similar in all groups, and significantly better over 60 years (48%, p=0.014).

Table 3: Weekly intake of each type of food according to sex in the ISOR study

Foodstuffs	Men (n= 378)		Women (n= 409)		*P*
	Non or weak consumers, %	Consumers or high consumers, %	Non or weak consumers, %	Consumers or high consumers, %	
Butter	185 (48.9)	193 (51.1)	120 (29.3)	289 (70.7)	**<0.0001**
Peanut	199 (52.7)	179 (47.3)	278 (68.0)	131 (32.0)	**<0.0001**
Dessert	118 (31.2)	260 (68.8)	160 (39.1)	249 (60.9)	**0.02**
Fruit	117 (30.9)	261 (69.1)	186 (45.5)	223 (54.5)	**<0.0001**
Dry fruit	219 (57.9)	159 (42.1)	244 (59.7)	165 (40.3)	0.624
Olive oil	242 (64.0)	136 (36.0)	270 (66.0)	139 (34.0)	0.558
Oil	160 (42.3)	218 (57.7)	93 (22.7)	316 (77.3)	**<0.0001**
Milk	222 (58.7)	156 (41.3)	162 (39.6)	247 (60.4)	**<0.0001**
Vegetable	170 (45.0)	208 (55.0)	155 (37.9)	254 (62.1)	**0.044**
Dry vegetables	173 (45.9)	204 (54.1)	196 (47.9)	213 (52.1)	0.568
Egg	118 (31.2)	260 (68.8)	152 (37.2)	257 (62.8)	0.080
Bread	182 (48.2)	196 (51.8)	196 (47.9)	213 (52.1)	0.949
Potatoes	150 (39.7)	228 (60.3)	190 (46.4)	219 (53.6)	**0.055**
Pasta	139 (36.8)	239 (63.2)	164 (40.1)	245 (59.9)	0.338
Fish	125 (33.1)	253 (67.0)	170 (41.6)	239 (58.4)	**0.014**
Chicken	109 (29.3)	263 (70.7)	122 (31.4)	267 (68.6)	0.536
Meat	110 (29.1)	268 (70.9)	160 (39.1)	249 (60.9)	**0.0031**

Table 4: Diet according to the age groups in the ISOR study

Foodstuffs	30-39, % (n= 316)		40-49, % (n= 229)		50-64, % (n= 242)		*P*
	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	
Butter	41.5	58.5	30.1	69.9	43.4	56.6	**0.0057**
Peanut	55.1	44.9	63.8	36.2	64.9	35.1	**0.032**
Dessert	31.3	68.7	28.8	71.2	46.7	53.3	**<0.0001**
Fruit	35.1	64.9	42.4	57.6	39.3	60.7	0.221
Dry fruit	56.3	43.7	61.1	38.9	59.9	40.1	0.488
Olive oil	68.4	31.6	66.8	33.2	59.1	40.9	0.060
Oil	33.9	66.1	26.6	73.4	35.1	64.9	0.100
Milk	48.1	51.9	43.2	56.8	55.0	45.0	**0.037**
Vegetable	43.0	57.0	38.4	61.6	41.7	58.3	0.551
Dry vegetables	47.5	52.2	50.2	49.8	43.0	57.0	0.276
Egg	34.8	65.2	33.2	66.8	34.7	65.3	0.914
Bread	52.8	47.2	46.7	53.3	43.0	57.0	0.062
Potatoes	37.3	62.7	47.6	52.4	46.7	53.3	**0.024**
Pasta	39.9	60.1	35.4	64.6	39.7	60.3	0.512
Fish	39.6	60.4	38.4	61.6	33.9	66.1	0.367
Chicken	31.6	60.2	26.6	67.2	28.9	70.2	0.511
Meat	31.3	36.7	36.7	63.3	36.0	64.0	0.349

3.4 Food intake according to educational level

The most educated subjects consume significantly more animal proteins, red meat (81.8%, (p<0.0001) and fish (71.5%, p=0.002), as well as fruits (80.3%, p<0.0001). The consumption of olive oil is more common among high levels of education, high school and university (42 to 43%, p=0.0008).

Bread is commonly consumed by the low educated groups (58%, p=0.042) and milk is more observed among middle school (74.1%, p=0.042). Professional training consume more peanuts (49.7%, p=0.004) (Table 5).

Table 5: Food according to educational level

Foodstuffs	Unlettered/Koranic/ primary, % (n=172)		Middle School, % (n=174)		High school, % (n=135)		Professional Training, % (n=167)		University, % (n=137)		*P*
	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	
Butter	41.3	58.7	32.2	67.8	35.6	64.4	43.7	56.3	41.6	58.4	0.171
Peanut	70.3	29.7	62.1	37.9	57.0	43.0	50.3	49.7	62.8	37.2	**0.004**
Dessert	42.4	57.6	37.9	62.1	31.9	68.1	32.3	67.7	30.7	69.3	0.136
Fruit	54.7	45.3	43.7	56.3	31.1	68.9	37.7	62.3	19.7	80.3	**< 0.0001**
Dry fruit	66.9	33.1	58.6	41.4	59.3	40.7	50.3	49.7	59.9	40.1	**0.050**
Olive oil	73.8	26.2	60.9	39.1	57.8	42.2	73.1	26.9	56.9	43.1	**0.0008**
Oil	31.4	68.6	25.9	74.1	39.3	60.7	28.7	71.3	38.7	61.3	**0.042**
Milk	54.7	45.3	47.1	52.9	45.9	54.1	52.1	47.9	42.3	57.7	0.198
Vegetable	47.7	52.3	40.2	59.8	40.7	59.3	36.5	63.5	41.6	58.4	0.337
Dry vegetables	45.9	54.1	46.6	53.4	52.6	46.7	38.3	61.7	53.3	46.7	**0.055**
Egg	40.1	59.9	38.5	61.5	30.4	69.6	30.5	69.5	29.2	70.8	0.111
Bread	41.9	58.1	42.0	58.0	51.9	48.1	49.7	50.3	57.7	42.3	**0.024**
Potatoes	49.4	50.6	42.0	58.0	41.5	58.5	37.7	62.3	45.3	54.7	0.262
Pasta	38.4	61.6	37.9	62.1	31.9	68.1	39.5	60.5	43.8	56.2	0.375
Fish	47.1	52.9	37.4	62.6	43.7	56.3	30.5	69.5	28.5	71.5	**0.002**
Chicken	35.5	64.5	29.5	70.5	26.4	73.6	34.9	65.1	23.3	76.7	0.094
Meat	48.8	51.2	44.3	55.7	29.6	70.4	25.7	74.3	18.2	81.8	**< 0.0001**

3.5 Food intake according to monthly income

Participants with a sufficient income displayed a better consumption of fruits (88.7%, p<0.0001), vegetables (71.3%, p=0.049), and milk (66.3%, p=0.0003). All animal proteins were highly consumed, particularly red meat (82.5%, p<0.0001), then fish (75.0%, p=0.034). Dessert was also high consumed (78.8%, p=0.003). In the group's average and insufficient income, food consumption appears to be identical (Table 6).

Table 6: Weekly intake of each type of food according to monthly income in the ISOR study

Foodstuffs	Good (n=80)		Average (n=408)		Insufficient (n=263)		*P*
	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	Non or weak consumers	Consumers or high consumers	
Butter	38.7	61.3	35.5	64.5	42.2	57.8	0.221
Peanut	57.5	42.5	58.6	41.4	63.5	36.5	0.390
Dessert	21.3	78.8	34.1	65.9	41.4	58.6	**0.003**
Fruit	11.3	88.7	38	62	45.6	54.4	**< 0.0001**
Dry fruit	51.3	48.8	58.1	41.9	61.2	38.8	0.278
Olive oil	68.8	31.2	62.7	37.2	65.8	34.2	0.505
Oil	26.3	73.7	28.7	71.3	35	65	0.150
Milk	33.8	66.3	44.4	55.6	56.7	43.3	**0.0003**
Vegetable	28.8	71.3	40.4	59.6	44.1	55.9	**0.049**
Dry vegetables	46.8	53.2	49.8	50.2	44.9	55.1	0.458
Egg	36.2	63.8	32.6	67.4	35.7	64.3	0.641
Bread	52.5	47.5	48	52	44.9	55.1	0.454
Potatoes	40	60	43.9	56.1	43	57	0.813
Pasta	28.8	71.2	41.9	58.1	36.9	63.1	0.065
Fish	25	75	37.7	62.3	41.1	58.9	**0.034**
Chicken	23.1	76.9	29.0	71.0	35.8	64.2	**0.055**
Meat	17.5	82.5	27.9	72.1	49.4	50.6	**< 0.0001**

3.6 Comparison of food consumption in the ISOR study to Mediterranean diet

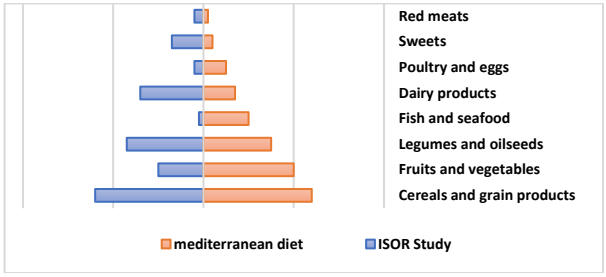

Figure 1: ISOR vs Mediterranean diet comparison

Ultimately, food pyramid, in the ISOR population, is different from the MD, except for cereals and grain products (Figure 1). Diet in urban area of Northwest Algeria is largely dominated by sweets (twice a day vs two to three times per week), red meats (twice a week vs once a week), dairy products (twice a day vs three times per week) and legumes with oilseeds (three times per week vs twice a week). The consumption of poultry and eggs (twice a week vs three times per week) then fruits and vegetable group (three times per week vs twice a day) remains insufficient. Fish with seafood were the least consumed (once a week vs three times per week) as well as olive oil.

4 Discussion

According to the WHO, the Middle East and North Africa (MENA) region is classified as a region in a nutritional transition stage, with high levels of overweight and obesity, and moderate under nutrition and micronutrient deficiencies in some population subgroups [12]. Compared to several other countries, eating habits in Algeria have changed, moving away from the Mediterranean diet towards food richer in fat and sugar, which has led to the development of CVDs and diabetes. In the present study, the assessment of food consumption in the ISOR study by means of a weekly frequency questionnaire, allowed us to establish a picture of food in the urban Algerian north-west. Indeed, we noted on one hand, a high consumption of desserts (sweet foods), milk, bread, and vegetable fats (vegetable oil) and on the other hand, a very low consumption of fish and olive oil in ISOR study subjects. Likewise, the study by Karamanos *et al.* revealed a high consumption of vegetable fats and carbohydrates in Algeria [13]. The same result was observed in a study carried out on 454 university students and 50 university teachers, in three wilayas of western Algeria (Ain Témouchent, Tlemcen and Sidi-Bel-Abbes). A high consumption of bread (88% of subjects), milk and dairy products (81.3% of subjects) and sweets and candies (66.6%) has been noticed [14]. Similarly, a study to define food consumption in west Algerian population carried out on one hundred and fifty healthy subjects (men/women, 100/50), indicated similar energy consumption in healthy subjects compared with those of the Mediterranean diet (10±1.4 vs 8MJ/24h, respectively) [15].

The present study indicates that the West Algerian population was characterized by high consumption of dried vegetables rich in fiber, low proportion of nutrients from animal origin (meat, milk products) with fish intake (essentially sardine) and high consumption of poultry meat [15]. Otherwise, a study carried out in the Moroccan population showed that bread, pasta, potatoes, meat and poultry, dairy products, eggs, fruits and vegetables were the principal foods consumed, when olive oil was very low consumed [16] compared to other Mediterranean studies [17,18]. These results have been confirmed by other studies in Maghreb populations [1]. Dietary behavior was shaped by interrelating factors that fell into six main topics: sociodemographic characteristics, migration-related factors, culture and religion, pregnancy, nutrition-related knowledge, beliefs and perceptions, and competing priorities [19].

Comparing men foods consumption with women in ISOR study allowed us to conclude that diet in women was different from that in men's diet for the consumption of some foods. Women consumed more butter, oil, vegetables and milk than men. However, men consumed more dessert, fruits, peanuts, fish and meat than women in ISOR study. Different results have been observed in other studies in Maghreb population [15], where the most commonly consumed food groups in women were dairy products, meat, fish, raw vegetables, and fruits [20,21]. Furthermore, other study revealed that women consumed more fruits than men and less soft drinks [22]. These results agree with several previous studies [23]. This difference could stem both from actual gender differences in dietary intake regarding these "feminine" vs. "masculine" foods or reporting bias linked to social desirability issues or a combination of both [24].

Our nutritional needs change with different life stages. To be fit and healthy, it is important to take into account the extra demands placed on the body by these changes. The analysis of food consumption in three different age groups (30-39 years, 40-49 years and 50-64 years), allowed us to observe changes in consumption according to age. In fact, the 40-49 years age group consumed significantly more butter, oil and dessert than the other groups. While subjects aged over 60, consumed significantly more olive oil than younger subjects in the ISOR population. The same result was mentioned in a recent Tunisian study, where consumption of food groups with a high free sugar content, such as soft drinks were high and to a lesser extent sweets among 20-49 years old [22]. However, among the different ages of rural women in the Moroccan population, the consumption of saturated and monounsaturated fats decreased while poly-unsaturated fats increased significantly [16].

As reported in the literature that a high educational level and assets index may influence the acquisition of healthier lifestyles, including better diet quality, as well as problem-solving capacity and values. Therefore, we expected to find a positive association of educational level and assets index with diet quality among adults. Whereas, in our funding the most educated ISOR individuals consumed significantly more animal protein, fruits and olive oil. This underlines that the higher the level of education, the more people consumes better quality foods. In addition, contrasted social disadvantage issues in the no formal schooling vs. superior categories would result in similar differences

in diet, higher than for the intermediate categories (as a sort of a "non-linear" intersectionality) [22].

Systematic reviews, based on data from low- to middle-income countries, have shown variation in dietary patterns by national income or socioeconomic status, which would indicate that the socioeconomic status may play an important role in diet quality variations [25,26]. The distribution of income in the ISOR population is not really fair. Our funding indicates that subjects with a sufficient income consume more fruits, vegetables, desserts as well as animal proteins, especially red meat and fish. This outcome can be explained by the price of these foodstuffs. Indeed, meats and fruits are more expensive and therefore inaccessible for individuals with insufficient income. However, the costs of both fruits and vegetables (relative to household income) were substantially higher for individuals in countries with low gross national income than in other economic regions. Furthermore, relative fruit cost increased costs of fruits and vegetables relative to household income were associated with reduced consumption [27].

Algeria, a country on the southern shore of the Mediterranean, is experiencing, as neighboring countries, changes in eating habits, moving away from the Mediterranean diet to move towards food richer in animal fats and sugar. The modernization of food production technology, accompanied by industrial policy with little regard for nutritional considerations, has deeply affected Algerians' diet and food habits, and has led to the emergence of CVDs, diabetes and further pathologies, without resolving all the problems of malnutrition [14].

Indeed, European and Northern African diets differ significantly in terms of their qualitative composition [13]. The most striking differences usually concern the proportion of fat in energy intake. European populations are characterized by a high fat dietary intake, whereas Northern African populations possess a high carbohydrate dietary intake [13]. Most of the Algerian cereal and cereal products come from white flour, bread, couscous and pasta. Despite the fact that the Mediterranean diet is healthy [28], paradoxically, it is being abandoned, mainly by the young generations in most Mediterranean countries documented and acknowledged as a healthy diet [29]. Southern and Eastern Mediterranean countries are passing through a 'nutritional transition' in which problems of undernutrition and malnutrition coexist with overweight, obesity and diet-related chronic diseases[30].

Our study presented some limitations: - dietary consumption was assessed using a weekly food frequency questionnaire; portion sizes were not taken into account, which prevented us from calculating the quantities of food types consumed; - the cross-sectional nature of the ISOR study enables associations to be identified but cannot provide information on causality; - in addition, we did not have access to other populations with a similar ethnic background, and were thus unable to replicate our findings.

5 Conclusions

Obviously, diet in urban area in Algeria has largely deviated from MD. This diet pattern is characterized by a high consumption of fatty and sweet foods that remain the major factors leading to NCDs. The challenge is how to make MD the main dietary lifestyle for the majority of people living in urban area and around, involving the socio-economic conditions in the population. It will be important to take these results into consideration prior any healthy diet promotion.

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