

Full Length Research Paper

Relationship of household diversity dietary score with, caloric, nutriment adequacy levels and socio-demographic factors, a case of urban poor household members of charity, Constantine, Algeria

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This study was conducted to assess dietary diversity of Algerian urban poor household with household dietary diversity (HDDS) and to study its relationship with nutrient adequacy level and socio-demographic factors. A survey was followed by three 24 h dietary recalls during one year, with household's members of charity in Constantine. Qualitative method has been realised using household dietary diversity score and quantitative method was done by calculating ratio of caloric and nutritional intakes to household needs. The study showed that the mean HDDS was 6.8 ± 0.7 food groups. Animal proteins percentage, caloric adequacy level and adequacy levels of fourteen vitamins and minerals had positive correlation with HDDS. Household with less than six persons and those with children less than five years had a higher HDDS ($p < 0.035$ and $p < 0.0001$, respectively).

Key words: Household dietary diversity (HDDS), poor, caloric, nutriment, adequacy level, constantine, Algeria.

INTRODUCTION

Quality diet encompasses adequate coverage of basic macro and micro nutrient needs and diet variety. Households living in urban areas are more prone to food insecurity, because they source the vast majority of their food through the market. Any decline in household income or increase in food prices can have catastrophic consequences on them. Available studies on food diversity were limited as far as Algeria is concerned.

In an urban setting, where inhabitants are usually

disconnected from the direct production and distribution of food, inability to access food resources can be the most immediate and critical manifestation of the many dimensions of poverty (Battersby and Watson, 2019). Algeria is the largest country on the Mediterranean and the second largest in Africa. The urban population in Algeria is estimated to account for more than 70% of the entire population (United Nations, 2016). Rate of poverty in Algeria was 10.5% in 2012 (World Bank report, 2013).

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Abbreviations: HDDS, Household Dietary Diversity Score; **DZD:** Algerian dinar; **USD:** American Dollar.

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Almost 75% of Algeria's poor live in urban areas, doing informal jobs or depend on subsistence agriculture (World Bank, 2016).

The survey MICS4-2012 (Multiple Indicator Cluster Survey) showed that 1% of urban Algerian population suffered from multiple deprivations. The intensity of poverty¹ in urban areas was 34.8% (CNES, 2016). By mid-1992, most of the food subsidies were eliminated except for semolina, flour for bread, milk, and the other goods like energy and public services were adjusted since 1990 (Louali, 2016). In 2011, sugar and oil were exempted from customs duties and value added tax. Since Households, especially those in urban areas, buy purchased food (Girma et al., 2015), poverty lines are commonly drawn because of how much money is required to meet basic food needs. There is therefore a clear correlation between income and food security. Urban households source the vast majority of their food through the market.

Studies have shown that an increase in dietary diversity is associated with socioeconomic status and household energy availability; lack of dietary diversity is a severe problem among poor populations in the developing world. The household dietary diversity score (HDDS) important in urban areas, where one of the important threats to food security is poor diets. HDDS was developed to measure household food access, one of the levels of food security. Previous research has shown dietary diversity is related to food security (Vellema et al., 2016). Thus, food may be available but not accessible to certain households during a given period of time, if they cannot acquire sufficient quantity or diversity of food through these mechanisms (Fanzo, 2017). The present study was conducted with general aim of assessment of dietary access of low-income urban households, members of charity, from Constantine, Algerian, Eastern city and third largest city with HDDS. Secondary objective was to study the correlation of HDDS with nutritional adequacy levels and socio-economic factors.

MATERIALS AND METHODS

Sampling

The study was carried out with all members of the oldest charitable association of Constantine, urban commune in the northeast of Algeria, capital of the East of Algeria, and the third most populated city in the country. The association exists since 1984. It helps poor households, after verifying their situations.

Study and subjects

A cross-sectional study, repeated 3 times in one year was conducted among the beneficiaries of aid from Constantine.

¹ Is the average percentage of deprivation experienced by people in multidimensional poverty, which identifies multiple overlapping deprivations suffered by households in three dimensions: education, health and living standards.

Households included in the study are declared in need by a specialized organism, after establishing files administrative proving their needs. Households with dependent children without fixed incomes, members of charity, were included in the study.

Semi-structured questionnaire was used for collecting socioeconomic details and information regarding household dietary practices. Questionnaire was followed by three 24 h recalls during one year. The study was conducted with household heads, all of whom were responsible for family food's preparation. They were asked to recall all foods eaten and beverages taken by the whole household on the previous day. Inclusion criteria were that the participants were able to answer the questions and recall their diet from the previous day. Household heads who prepare the food for family were included in the study.

Socioeconomic characteristics

A questionnaire was used to capture information on socioeconomic characteristics of household, such as sex, age, education level, sources of income, habitation, connecting to electricity, gas, water, cleaning up, and possessions. The questionnaire was administered through face-to-face interview with respondents.

24 h recalls

In order to avoid seasonal differences, three 24h recalls dietary were conducted to determine household food consumption. Head of households were asking to recall food consumed for the past 24h, bearing in mind all foods consumed within their homes. The details included descriptions of all foods and beverages consumed, including cooking techniques. The quantities of food consumed were estimated using household measures. The amount of nutriment consumed was then estimated and calculated using CIQUAL (2015) Table. Mean nutriment intake was estimated from the three recalls for each household.

Caloric and nutriment adequacy levels

Caloric or specific nutriment adequacy levels are the ratio of household intakes to their needs. Intakes were assessed based on caloric or specific nutrient content of each food consumed in each household. Needs are the sum of caloric recommended dietary allowance or specific nutriment recommended dietary allowance by sex, age and physical activity of household members.

Household dietary diversity score

Food access was assessed using HDDS (FAO, 2013). Information on dietary diversification was extracted from 24h recalls, where the consumed food items were grouped into twelve food groups: cereals, roots and tubers, vegetables, fruits, legumes, nuts and seeds, meat, fish and other sea food, eggs, milk/milk products, oil/fats, sweets (sugar, honey, sugar cane), condiments and beverages. Total dietary diversity score was calculated by summing the number of food groups consumed at home. The households were divided into four classes, according to eating habits of Algerians:

Low dietary diversity: When households consume, less than six food groups;

Medium dietary diversity: When households consume, six to seven food groups;

High dietary diversity: When households consume, eight or more food groups;

Table 1. Household's social characteristics

	Number	Percentage
Gender		
Female	478	57.6
Male	352	42.4
Total	830	100
Age range [years]		
0-2	7	0.8
3-6	28	3.4
6-9	61	7.3
10-18	276	33.3
19-65	445	53.6
> 65	13	1.6
Total	830	100
Household size category		
< 6 *	80	52.3
6	31	20.3
> 6	42	27.4
Total	153	100

* is the average household size of urban Algerian household.

Adequate dietary diversity: When households have high dietary diversity.

Analysis

Data was analysed using Epi-Info 3.5.1 (2008). Averages are expressed on mean (\pm standard deviation). Analyse of variance (ANOVA) was used to compare several means. The correlation between quantitative values was tested with Pearson test. t and z tests were used to compare two averages with $N>30$ and $N\leq 30$, respectively. All values were considered significant at $p<0.05$.

RESULTS AND DISCUSSION

There are few studies about diet and dietary quality among the Algerian, this study was conducted to enrich the literature with data from this country. Its objective is the evaluation of poor household dietary diversity, and its relationship with caloric, nutrients adequacy levels and socio-demographic factors.

Household characteristics

One hundred and fifty-three households were involved in the study. They include 830 individuals, among which 478 (57.6%) were females and 352 (42.4%) males. The majority (53.6%) of them were between 19 and 65 years old. About 52.3% of the households had less than six household members (Table 1).

The mean household income per person per day was

80 Algerian Dinars (DZD) (± 37.1) equivalent to 0.701 USD (± 0.325), the first quartile (Q1) have 53 DZD (0.64 USD) per capita per day and the last quartile have 200 DZD (1.74 USD) per capita per day. All respondents were females responsible for household food preparation, they have 47.0 (± 7.7 years) old, majority (46.4%) of them were found in the age range of 40-50 years. Most (52.9%) are widowed, 23.5% are divorced, and 23.6% are married with sick or prisoned husband. More than a quarter was illiterate (27.5%) and 37.9% had previously completed primary education. The pension was the main (62.7%) source of income (Table 2).

The whole household heads in this study were widowed, divorced or alone women, the vulnerability of female household heads derived from the fact that many women are unemployed or employed in low paying jobs such as domestic work. Furthermore, most of them were also surviving from a single income, which was not adequate for household food sustenance. In both developed and developing countries, the emergence and strengthening of the phenomenon of single-parent families present remarkable analogies, similarity of causes (family breakdown, loss of responsibility for men, gender inequalities), socio-economic markers (restricted access to education, training and skilled jobs) and consequences (marginalisation, exclusion and feminisation of poverty) (Bessis, 1996).

Household dietary diversity score

Mean HDDS was 6.8 [± 0.7] food groups. Households

Table 2. Socio-economic characteristics of respondents.

Variable	Number	%
Marital situation		
Widowed	81	52.9
Divorced	36	23.5
Married with	36	23.6
Disable husband	31	20.3
Prisoner husband	5	3.3
Total	153	100
Age range years		
< 30	1	0.65
30-40	26	17.0
40-50	71	46.4
50-60	46	30.1
≥ 60	9	5.9
Total	153	100
Education levels		
Illiterate	42	27.5
Primary	58	37.9
Medium	38	24.8
Secondary	15	9.8
Total	153	100
Family incomes		
Pension	99	64.7
Housemaid	30	19.6
Cook/preparing traditional dishes	15	9.8
Other	9	5.9
Total	153	100

consumed minimum 2 food groups, and maximum 11. HDDS was mainly between 6 and 8 food groups (Figure 1). The HDDS doesn't vary through the three recalls (Table 3).

About 7.2% households consumed up to five food groups (low dietary diversity), 86.9% consumed six to seven food groups (medium dietary diversity) and 5.9% of households consumed eight or more food groups (high dietary diversity) in their diet. From the twelve food groups, most of the households have consumed less than eight food groups (94.1%). The proportion of households with adequate dietary diversity in this study was therefore 5.9% (Figure 2). According to Petry et al. (2015), the dietary diversity score in all African countries is similar at minimum 6 points. This result was different from the ones found in Cambodia, 4.7 (± 1.6) (McDonald et al., 2015); in Ethiopia, 5.2 (± 1.9) (Geremew et al., 2019); in South Africa, 5.08 (South Africa, 2015). Also, in Tchad, 5.1 in sedentary households (Bechir et al., 2011); in Sahrawi refugees camp (Tindouf, Algeria), 3.8 (± 1.4) (SandmarkMorseth et al., 2017); and in Indonesia: 9.1 (Trias et al., 2017). These findings are compared to those

in Myanmar, 6.2 (± 1.4) (Victoria, 2014), in Nioro 7 (± 1), in Nara 6 (± 2) (Welthungerhilfe, 2013) and in South Africa 6.63 (Grobler, 2015). Due to rarity of studies on urban household dietary diversity score based on 12 food groups, this study was compared to the studies above, which most of them were conducted with rural households. Differences in study area, study period, cultural beliefs and dietary patterns may be explained differently between studies. In this study, HDDS varied less by seasons, the same result was found in Hirvonen et al. (2016).

Description of food groups consumed

The details of the proportion of households who consumed various types of HDDS food groups, over one year (mean of three 24 h recalls distributed in one year) are presented in Figure 3. Cereals were the most commonly consumed food group by 100% of the households, followed by sugar (98.7%), milk (98.3%), vegetables (94.1%), oil and fats (89.5%), potatoes

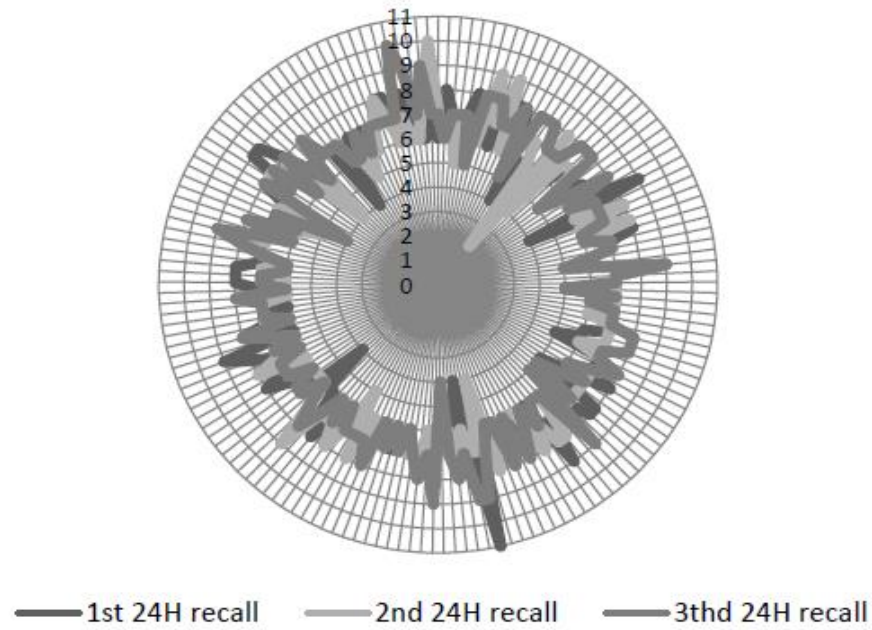


Figure 1. HDDS in the three dietary recalls.

Table 3. Household dietary diversity score variation.

	HDDS			P
	1 st Recall	2 nd Recall	3 rd Recall	
Average value	6.90	6.70	6.93	0.099
Standard Deviation	1.04	1.02	1.01	
Minimum	4.00	2.00	4.00	
Maximum	11.00	10.00	10.00	

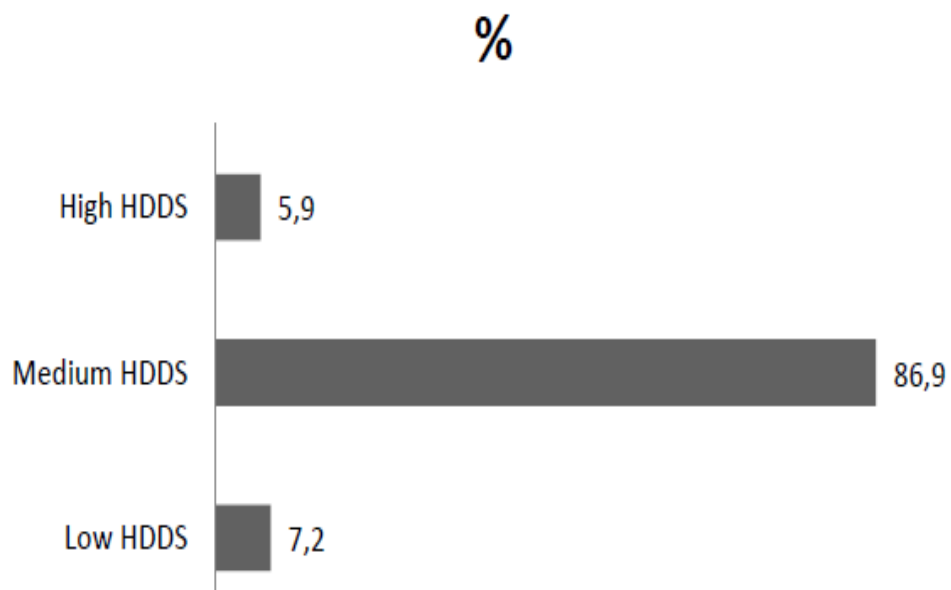


Figure 2. Household's distribution according to HDDS classes.

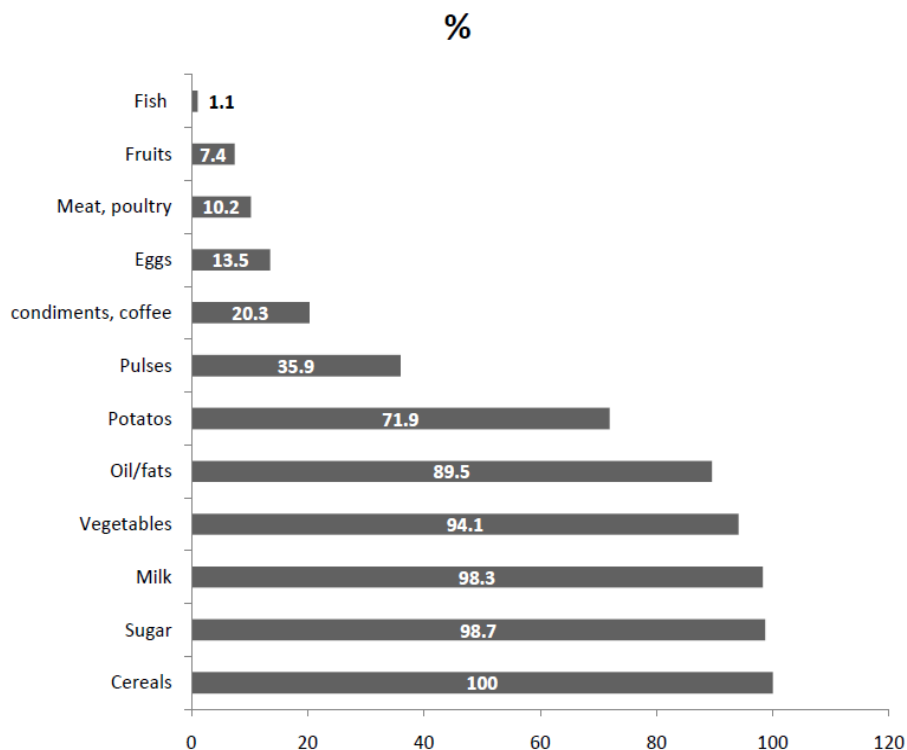


Figure 3. Household's distribution (%) according to HDDS food groups consumed.

(71.9%), pulses (35.9%), condiments and coffee (20.3%), eggs (13.5%), meat and poultry (10.2%), fruits (7.4%) and fish (1.1%).

The most commonly consumed food groups were cereals, sugar, milk and oil. The exemption from customs duties and value added tax for raw materials of sugar and oil and the subvention of milk and flour for bread have made it possible, to maintain these products at an affordable cost for all the Algerian population. On the other hand, these food groups are the staple of Algerian kitchen: cereals are consumed daily in all meals; sugar and milk are also consumed daily at breakfast and at afternoon snack. While vegetables (onion and garlic specially) with oil are presumably used at the beginning of sauce in Algerian cooking methods. Potatoes and pulses were also widely consumed; condiments are used in meals preparations while coffee is a stimulant drink and the most consumed in northern Algeria.

However, fish, meat, egg and fruits were the least consumed food groups. These food groups except eggs were the most expensive in markets. These results are consistent with the study of Padilla (2008), the Southern Mediterranean countries diets, which is mainly vegetarian as only a small proportion of calories is of animal origin; cereals are the basic ingredient and pulses the main protein source. Cereals are staple food in North Africa. The proportion of energy intake from cereals, roots and tubers is about 55% (Tanyeri-Abur, 2015).

Relationship of HDDS with socio-demographic factors

The study showed that HDDS did not vary between education level and marital status of household head. The HDDS was higher at the household with less than six persons and at those with under five years' children (Table 4). Several studies have shown that education was positively correlated to high dietary diversity (McCordic, 2016), schooling impact positively on dietary diversity. However, in this study, the level of education did not show any association with household dietary diversity; the same result was found in (Grobler, 2015; Mayanja et al., 2015). The HDDS was higher at the household with less than six persons compared to those with more than 6; this result is similar to Odusina Olaniyi (2014), which found that households with larger sizes ($p < 0.1$) had the propensity of being food insecure and Grobler (2015) which showed that an increase in household size will decrease household dietary diversity.

Relationship of HDDS with number of meals per day

Households consuming four or more meals a day had a higher HDDS compared to those taking three or less meals a day (6.99 ± 6.63 versus 6.63 ± 0.65 $p < 0.0001$). The HDDS was positively correlated with the number of

Table 4. HDDS according to household socio-demographic factors.

Household socio-demographic factors	HDDS	
Household head education level	Mean±standard deviation	P
Illiterate	6.71±0.77	0.113
Primary	6.68±1.03	
Medium	6.94±0.55	
Secondary	7.18±0.71	
Household head marital status		
Married	6.62±0.74	0.0651
Divorced	6.83±0.67	
Widowed	6.95±0.67	
Household size category		
<6	6.79±0.78	0.035
=6	7.13±0.74	
>6	6.74±0.70	
Household with under 5 years		
Yes	6.89±0.74	< 0,0001
No	6.83±0.69	

Table 5. Correlation between HDDS and adequacy level intakes of nutriments.

	Energy	Total carbohydrates	Sugar	Fiber	Lipid	%Vegetable protein	%Animal protein	Vit B ₁
r	0.345	-0.123	0.032	0.004	0.336	-0.257	0.257	0.274
P	<0.0001	0.130	0.698	0.961	< 0.0001	0.001	0.001	0.001
	Vit B ₂	Vit B ₃	Vit B ₅	Vit B ₆	Vit B ₉	Vit B ₁₂	Vit A	Vit D
r	0.090	0.099	0.295	0.408	0.192	0.219	0.338	0.232
P	0.268	0.223	<0.0001	< 0.0001	0.017	0.006	< 0.0001	0.004
	Vit E	Vit C	Iodine	Iron	Zinc	Selenium	Magnesium	Calcium
r	0.426	0.268	0.144	0.241	0.313	0.173	0.134	0.197
P	< 0.0001	0.001	0.076	0.003	< 0.0001	0.033	0.098	0.014

meals taken per day ($r= 0.250$, $p=0.002$). HDDS was correlated with the number of meal per day: the more the household takes meals, the more food groups are used and score increase. Food groups consumed increase with the number of meals.

Relationship of HDDS with caloric and nutriments adequacy levels

On twenty-two nutriments studied, HDDS was positively correlated with adequacy level intakes of energy and fourteen nutriments: lipids, vitamin B1, B5, B6, B9, B12, A, D, E, C, iron, zinc, selenium and calcium. HDDS increase with increasing of percentage of adequacy level

of these nutriments. In the other hand, HDDS was positively correlated with animal proteins percentage and negatively correlate with plant proteins percentage (Table 5).

Adequacy levels of nearly 70% of the nutriments studied, caloric and percentage of protein from animal sources were positively correlated with HDDS, as the percent of nutritional adequacy increases, the HDDS increases; which means that more households consume a balanced diet, more their HDDS increases.

According to Swindale and Bilinsky (2006) a more diversified household diet is associated with caloric and protein adequacy, percentage of protein from animal sources, as well as household income. Poor households frequently depend on a diet high in starchy foods with

limited protein and other nutrients (South Africa, 2015). The increase in animal protein share in diet increases the HDDS, while the increase in those of plant origin lowers the HDDS. This may be explained by the fact that HDDS contains four-food groups vector of animal protein: eggs, meal, milk and dairy, fish and seafood; while vegetable, mostly pulses group, represents proteins. Our results are consistent with Kennedy et al. (2010), HDDS increases with increase of food groups that provide micro- and macronutrients. Increased dietary diversity correlates with increased intake of micronutrients such as calcium, vitamin A, and iron with greater consumption of animal source foods, fruits and vegetables, and dairy.

Conclusion

Nutritional mistakes made during the growth period can be permanent and irreversible, hence the importance of nutritional studies on populations at food insecurity risk. The diet of Algerian poor urban household from Constantine was quite monotonous; they have less varied diet. They have poor quality diet, based on plant sources and very few animal sources; they tend to buy less meat, dairy products, fruits and fish. Cereals, milk, sugar, vegetables, oil and potatoes are their food staple. Except vegetables and potatoes, all of them are subsidized foods. Milk and pulses are their main source of protein; while meat, eggs and fish are scarcely consumed, which may reveal a possible under nutrition.

The study findings confirm that less varied diets are found in poor households from Algeria and more diversified household diet is associated with caloric and nutrients adequacy level, with a percentage of protein from animal sources. The score was easy to use, but requires some exactness in definition of universal class HDDS. Greater household access to varied food, nutrition education and development of household's chance to increase incomes should be considered. The nutrition education may include topics that can help increase maternal knowledge and improve practices related to feeding. On the other hand, the amount of fresh diet and animal food sources could increase with distribution vouchers.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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