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Dietary intakes of an Algerian pregnant women population

Apports nutritionnels d'une population de femmes enceintes Algériennes

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Abstract ***Introduction.*** Nutrition during pregnancy has a significant impact on women health, but also on the long-term health of their offspring. There are a few national data on the usual dietary intake of pregnant women***. Objective.*** To assess the nutritional intake of pregnant population by the 24-hour dietary recall method repeated over 3 days. ***Population and methods.*** A cross-sectional study was carried out using a questionnaire among 100 pregnant women receiving prenatal care at a major mother and child specialized hospital in the Wilaya of Sidi-Bel-Abbès (Algeria). ***Results***. The average intakes of energy, fats and carbohydrates were lower than the recommendations, while those of proteins and dietary fibers were higher. In most women, protein needs were covered whereas carbohydrates and lipids needs were not covered. Proteins represented 16.7%, carbohydrate 55.1% and lipids 28.2% of total energy intake (TEI). Contribution of food groups to TEI was as follows: cereal-based products 23.5%, fruits and vegetables 15.2%, dairy products 15%, sweet products 14.7% and meats 12.6%. Average intakes observed in micronutrients were lower than nutritional requirements, except for vitamins (Vit.) C, B6, B12, beta-carotene, and retinol. More than 40% of women were below the recommendations for Vit. C, D, A, E, B1, B2, B3, B6, B9, B12, magnesium, calcium and iron. ***Conclusion.*** Pregnancy is a privileged moment for carrying out awareness raising actions in nutrition area. Therefore, it should be used to provide advice in favor of a healthy diet and maintaining physical activity in this population.

Key words: *Pregnant women, Nutritional intake, Energy, Macronutrients, Micronutrients, Algeria*

Résumé ***Introduction.*** La nutrition pendant la grossesse a un impact significatif sur la santé de la femme mais aussi sur la santé à long terme de sa progéniture. Peu de données nationales existent sur les apports nutritionnels habituels des femmes enceintes. ***Objectif.***

Évaluer l'apport nutritionnel de femmes enceintes par la méthode du rappel des 24 heures répété sur 3 jours. ***Population et méthodes.*** Une étude transversale a été réalisée à l'aide d'un questionnaire auprès de 100 femmes enceintes recevant des soins prénataux dans un hôpital spécialisé mères-enfants de la Wilaya de Sidi-Bel-Abbès (Algérie). ***Résultats.*** Les apports moyens en énergie, en lipides et en glucides sont inférieurs aux recommandations, alors que ceux en protéines et en fibres alimentaires sont supérieurs. Chez la majorité des femmes, les besoins en protéines sont couverts alors que ceux en glucides et en lipides ne le sont pas. Les protéines représentent 16.7 %, les glucides 55.1 % et les lipides 28.2% de l'apport énergétique total (AET). La contribution des groupes d'aliments à l'AET est comme suit : produits céréaliers 23,5%, les fruits et légumes 15,2%, les produits laitiers 15 %, les produits sucrés 14,7% et les viandes 12,6%. Les apports moyens observés en micronutriments sont inférieurs aux besoins nutritionnels moyens, à l'exception des vitamines (Vit.) C, B6, B12, β-carotène et rétinol. Plus de 40% des femmes se situent en dessous des recommandations, en ce qui concerne les Vit. C, D, A, E, B1, B2, B3, B6, B9, B12, magnésium, calcium et fer. ***Conclusion***. La grossesse est un moment privilégié pour mener des actions de sensibilisation dans le domaine de la nutrition. Il convient donc d'en profiter afin de prodiguer des conseils en faveur d'une alimentation saine et du maintien d'une activité physique auprès de cette population.

Mots clés : *Femmes enceintes, Apport nutritionnel, Énergie, Macronutriments, Micronutriments, Algérie*

Introduction

The central role of nutrition in pregnancy for the health and well-being of pregnant women, for pregnancy outcomes and long-term health and for the development of the offspring has been generally recognized and is supported by the most recent scientific literature [1].

According to the Academy of Nutrition and Dietetics statement, reproductive-aged women should implement a healthy lifestyle, which reduces the risk of fetal defects, inappropriate fetal development and chronic diseases of both mother and newborn. the perinatal outcomes include correct pre-pregnancy weight, appropriate weight gain and physical activity during gestation, consumption of a wide variety of food, vitamins and minerals supplementation, elimination of alcohol and smoking [2].

During pregnancy, mother nutritional needs increase to meet added nutrient demands for fetal growth and development [3]. For a healthy pregnancy outcomes, these nutritional needs must be met.

In some developing countries, inadequate macronutrients intake is common among pregnant women, and certain micronutrient deficiencies are also frequent. Nutrients of particular concern include iron, zinc, folate, Vit. A, Vit. D, iodine, and calcium, which play significant roles in maternal health and fetal development [4].

Despite the crucial role of nutrition for health of mother and offspring, there are unfortunately, a few studies that provide detailed description of the dietary intake of pregnant women and address the compliance issue with dietary recommendations [5].

As with any study on dietary habits, these surveys are specific to a given population and therefore not transposable from one country to another.

In Algeria, the nutritional intakes of pregnant women have been the subject of only a few studies [6-8]. This situation justified the interest of our survey, which contributed to a better knowledge of the nutritional intakes in macro and micronutrients of pregnant women living in the Wilaya of Sidi-Bel-Abbès in order to compare them to the nutritional recommendations.

Population and methods

Population

In this cross-sectional study, 100 women in their first, second or third trimester of pregnancy were recruited from a major Mother-child specialized hospital of Sidi-Bel-Abbès (western Algeria), between december 2019 and march 2020. Pregnancy was initially confirmed by ultrasound, urine or blood beta-human chorionic gonadotropin (βHCG) by the attending gynecologist. Women who were younger than 18 years were

excluded. The informed consent has been obtained from all participants.

Data collection

All data collected were obtained through face-to-face interviews. The interview covered different types of pregnancy aspects, including general information, anthropometry, lifestyle habits, and dietary information.

Nutritional survey

Nutritional intakes assessment of pregnant women was carried out by a nutritional survey. Each participant was provided with a record of food and beverages consumed over three days using the 24-hour recall method (including weekend if possible). The method of repeating the 24-hour dietary recall over 3 days has several advantages as simplicity, efficiency on important samples, ease in data collection, avoid forgetting.

Conversion into nutrients and micronutrients

The answers of the 24-hour dietary recall, were translated into quantities of food consumed per day, estimated using household units and photographs, the equivalence in weight had been established before hand, then converted to nutrients and micronutrients using the CIQUAL table. Microsoft Excel 2010 software was also used to convert consumed food into macro and micronutrients.

Comparison of outcomes to Average Nutritional Requirements (ANR)

Macronutrients and micronutrients intakes were then compared to French ANR, given the absence of Algerian nutritional recommendations. The ANR represent the least biased baseline for estimating the prevalence of insufficient nutrients intakes within a group of individuals.

Statistical analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) 22.0. Quantitative variables were expressed as means ± standard deviation (SD), and qualitative variables as percentages. Pearson Chi-square test was used to examine differences involving categorical variables. Difference was considered significant at *p*-value less than 0.05.

Results

Sample Description

The sociodemographic and anthropometric characteristics of pregnant women are presented in **Table 1**.

Table 1. Sociodemographic and anthropometric characteristics of pregnant women

	n	%
Age (years)		
< 24	32	32
25 - 29	16	16
30 - 35	28	28
36 - 40	18	18
> 40	6	6
Pre-pregnancy BMI category		
Under weight: BMI < 18,5	5	5
Normal: 18,5 ≤ BMI ≤24,9	60	60
Overweight: 25 ≤BMI ≤29,9	24	24
Obese : BMI ≥ 30	11	11
Trimester of pregnancy		
1st trimester	7	7
2nd trimester	20	20
3rd trimester	73	73
Parity		
Primiparity	58	58
Multiparity (Parity of 2 or more)	42	42
Educational Level		
Elementary	19	19
Intermediate	33	33
Secondary	35	35
Bachelor degree or higher	13	13
Professional status		
Employee	14	14
Housewife	86	86
Urbanicity		
Rural	74	74
Urban	26	26

BMI (kg/m^2): Body mass index categories according to WHO classification [9]

The age of the women who participated in the study ranged from 19 to 42 years with an average age of 30±6.6 years. Sixty % of pregnant woman had a normal BMI before pregnancy. As for the gestation trimester, 7% of women were in the first trimester of pregnancy, 20% in the second trimester, and 73% in the third trimester of pregnancy. Forty two % of pregnant women were multiparous.

Thirty five % of the interviewed women had a secondary school level, 33% had an intermediate school level, while 19% had a lower school level (primary). Only 13% of them had a university degree.

Most of the women who cooperated in the survey were jobless. Seventy four % of women lived in rural areas (**Table 1**).

Energy and macronutrient intakes

Table 2 presents the energy, macronutrients and water intakes (mean ± SD and median) for pregnant women, as well as the percentage of subjects below the ANR.

Overall, average energy, fats and carbohydrates intakes were lower than ANR. Conversely, average intakes of proteins and dietary fibers were higher than ANR. The proportion of women with below-threshold energy intakes was 96% (**Table 2**).

The average daily total fats intake was 43.4±15.2 g/d, and fat needs were not covered for more than three quarters of the population. In addition, the average saturated fatty acid (SFA) intake was 3-fold higher than polyunsaturated fatty acids (PUFA).

The average daily intake of total proteins was 57.8± 18.3 g/d, and requirements were met for most women. A minority of women had protein intakes lower than ANR (1st trimester 14.3%, 2nd trimester 15%, and 3rd trimester 28.8%).

The average daily intake of total carbohydrates was 191.1±53.0 g/d, and needs were not covered for the majority of women (**Table 2**). The proportion of simple sugars in relation to total carbohydrates was 31.5%. The average fibers intake was 24.2±8.4 g/d, and fibers needs were covered in about three-quarters of population.

The average energy distribution of macronutrients showed that proteins represented 16.7% of TEI, lipids represented 28.2%, and carbohydrates accounted for more than half of TEI (**Table 2**).

Micronutrient intakes

Table 3 shows micronutrients intakes (mean ± SD and median) in pregnant women as well as the percentage of subjects below the ANR threshold.

Overall, medians were lower than mean intakes, and both were lower than ANR values for most micronutrients, excepted for Vit. C and B6, B12, β-carotene and retinol, where the mean intakes were higher than ANR. Average intakes of Vit. B2 and B3 were very close to ANR (**Table 3**).

The proportion of women who were below ANR can be divided into 3 categories, the micronutrients for which this proportion was less than 50% for β-carotene; between 50 and 75% for Vit. C, B2, B6, B3, B9, B12, and magnesium, and more than 75% for Vit. D, B1, E, retinol, calcium and iron.

Food typology intakes

Table 4 illustrates the food typology of pregnant women. It can be noted that overall the medians were lower than the average intakes. The absence of zero median values for all food categories indicated that at least half of women consumed these food groups, reflecting a relative food diversity. The contribution of the different food categories to TEI was as follows: cereal products (23.5%), fruits and vegetables (15.2%), dairy products (15%), sweet products (14.7%), and meat (12.6%).

Supplements intake

Most of our participants were supplement users (76%), and prenatal multivitamins were the most prevalent supplement taken by our studied population. According to **Table 5**, supplementation was signify-cantly higher in pregnant women with nutritional intakes below nutritional guidelines.

Table 2. Daily intake of energy, macronutrients and water by pregnant women

	Mean ± SD	Median	ANR	% subjects below recommendations	% Macronutrients contribution to TEI
Energy (Kcal)	1439 ± 368	1463.9	2050	96	
(KJ)	5955 ± 1505	6037.4	8569		
Total protein (g)	57.8 ± 18.3	56.4	*Tr 1:* 36	14.3	16.7
			Tr 2: 40	15	
			Tr 3: 47	28.8	
Total lipids (g)	43.4 ± 15.2	43.1	58.5	82	28.2
SFA (g)	15.8 ± 6.7	15.3			
PUFA (g)	5.4 ± 2.5	4.9			
Total carbohydrates (g)	191.1 ± 53.0	196.1	275	94	55.1
Complex sugars (g)	130.7 ± 39.8	106.8			
Simple sugars (g)	60.3 ± 25.3	58.1			
Dietary fibers (g)	24.2 ± 8.4	24.3	> 20	34	
Water (g)	1540.3 ± 422.3	1468.6	1000-1500		

N = 100 pregnant women. ANR: Average nutritional requirements [10] ; SFA: Saturated fatty acids; PUFA : Polyunsaturated fatty acids ; Tr : Trimester.

Table 3. Daily intakes of pregnant women in micronutrients

Micronutrients	Mean ± SD	Median	ANR	% Subjects below recommendations
Vitamins				
C (mg)	94.6±51.1	87.3	92	53
B1 (mg)	0.8±0.2	0.8	1,4	99
B2 (mg)	1.1±0.7	0.9	1,2	75
B3 (mg)	11.7±6.0	10.2	12	60
B6 (mg)	2.4±3.6	1.3	1,5	69
B9 (µg	268.6±105.2	239.3	300	69
B12 (µg)	5.0±8.4	1.4	2	63
B-carotene (µg)	2222.7±1673.0	1884.1	1600	42
Retinol (µg)	676.0±1223.9	133.6	460	77
D (µg)	1.0±1.0	0.9	8	100
E (mg)	4.3±2.3	4.1	8	93
Minerals and trace elements				
Calcium (mg)	537.4±184.0	537.6	770	91
Magnésium (mg)	232.9±58.3	231.3	264	71
Fer (mg)	9.4±3.7	9.2	23	100

ANR : Average nutritional requirements [7]

Discussion

Although the quantity and quality of nutritional intake in pregnant women are very important for a harmonious course of pregnancy, this topic remains very poorly documented in Algeria.

Our nutritional survey intended to evaluate the nutriational intakes of pregnant women living in the Wilaya of Sidi-Bel-Abbès, by investigating the existence of possible nutritional inadequacies.

The average age of the participants was close to the available pregnancy national statistics [8,11,12].

The average pre-conception BMI was similar to the result reported by Touati-Mecheri *et al.,* in pregnant women living in the Wilaya of Constantine (East of Algeria) [8]

The majority of our population was unemployed, this was previously noted by Touati-Mecheri *et al.* [8]. The activity rate recorded for the Wilaya of Sidi-Bel-Abbes in the fifth general population and habitat census (Algeria, 2008) was 44.7% [12] which was significantly higher than the rate found in our sample.

Regarding the participants parity, our results differed from that found by Touati-Mecheri *et al.* [8] (42% multiparous *vs* 83.2%). Comparison of our education level with data of Touati-Mecheri *et al*., [8] indicated that the both results were close: elementary level (19% *vs* 20.9%), intermediate level (33% *vs* 32.1%), secondary level (35% *vs* 28.5%), and university level (13% *vs*. 6%). However, comparing to the official statistics of the Wilaya of Sidi-Bel-Abbes[12], this sub-population of pregnant women was well above the average in terms of its level of education (elementary (27.5%), intermediate (27.2%), secondary (17%), and university (7.4%). The official proportion of illiterate women in Sidi-Bel-Abbès is estimated at 26.1% [12], but in this survey no illiterate women were found. This indicates that these women have access to information and will be more likely to search for information on their own. Maternal education is among the most relevant social determinants of child health; It is assumed that maternal education acts indirectly by changing women's health behaviors in prenatal care and dietary intake during pregnancy. Some studies reported that mothers with low educational attainment are at higher risk of delivering low birth weight infants [13].

The low average energy intake in this survey was consistent with that observed by Touati-Mecheri *et al.,* [8]. Normally, the energy intake should never be less than 1500 Kcal/d, below this threshold maternal undernutrition affects the fetus. Indeed, the energy intake which is too low compared to the needs can affect the fetus growth, resulting in a weight deficit at birth [5]. Regarding the macronutrients contribution to TEI, it can be noticed that the distribution of the average intake of macronutrients in proportion to energy fully satisfies the recommendations (15% of protein, 30 to 35% of fat and at least 55% of carbohydrates) [14]. Touati-Mecheri *et al.,* [8] found slightly

Table 4. Food typology during pregnancy

Foods	Mean ± SD (g/d)	Median	* %	Contribution to TEI %
Meat, Poultry, Fish, Eggs	92.7±116.7	53.7	8.6	12.6
Meat, Poultry	80.5±115.7	40.8	7.4	
Meat (sheep, beef)	26.6±53.4	17.4		
Poultry	39.6±96.2	13.9		
Liver	1.4±13.7	1.5		
Offals	12.9±46	8.9		
Fish	4±15.8	4.1	0.4	
Sardine	0.2±4.3	0.3		
Tuna fish	3.8±15.3	3.8		
Eggs	8.4±26.5	5.3	0.8	
Milk and dairy products	184.9±156.8	175.2	16.9	15
Milk	153.5±139.0	154.5	14	
Yoghurt	28.9±79.9	15.9	2.7	
Cheese	2.5±10.6	1.0	0.2	
Cereal products	274.3±201,1	266,4	18,3	23.5
Bread	90.2±63.5	92.8		
Pasta, rice	109.6±164.6	19.3		
Legumes	74.4±134.9	47.9	6.8	10
Potatoes	133.5±189.4	71.3	12.2	8
Vegetables and fruits	349,1±317.1	441.4	31.9	15.2
Fruits	84.6±122.8	8.9	7.7	
Vegetables	264.5±252.9	258	24.2	
Fats	1.6±6.1	0.7	0.1	1
Oils	0.2±1.3	0.2		
Butter	1.4±6.1	0.5		
Water + Beverages	906.8±410.8	812.7		
Water	637.7±372.6	517.5		
Fruit juice	111.1±143.4	71.9		
Coffee	127.0±92.6	110.2		
Tea	6.4±20.2	6,4		
Lemonade	24.5±64.4	15.5		
Sugar and sugar-containing products	57.2±58.6	50	5.2	14,7
Total	1093.3 (+ 637.7 =1731)		100	100

*N = 100 pregnant women. *: Percentage in relation with foods weight.*

Table 5. Supplementation based on nutritional intake

	Supplement users (n=76)	Supplement nonusers (n=24)	Chi^2 *p value*
Nutritional intakes below recommendations %	82.9	62.5	0.03
Nutritional intakes adequate to recommendations %	17.1	37.5	

different proportions of proteins 14.9%, lipids 20.7%, and carbohydrates 64.4%. Compared to these results, our population had satisfactory macronutrients balance. In terms of daily intakes of fats, proteins, and carbohydrates, our results are similar to those of Touati-Mecheri *et al.,* (2011) [8].

The low lipid intake was related to the fact that oils and fish (dietary lipid sources) were the least consumed food category by these pregnant women.

Lipids and fatty acids present in maternal diet play an

important role in development and health of young children, involving in particular brain and visual functions, but also inflammatory pathologies (asthma, allergy diseases). In the longer term, the quality of maternal lipid intake could lead to lifelong metabolic disturbances, promoting the development of pathologies, such as obesity and its associated metabolic complications in children and adults [15].

In children, observational studies show that n-3 PUFA deficiency during pregnancy is related to a delay in visual development. In addition, the consumption of long-chain n-3 PUFA during pregnancy could prevent the incidence of allergy childhood diseases, and data are available on certain food classes (fish, dairy products), and these diseases [15].

Carbohydrates are the main nutrient used for fetal development. If the fetus needs are important, as during the last trimester of pregnancy, the woman will mobilize her lipid reserves to meet this demand. On the other hand, hypoglycemia can easily be harmful to the child [16]. The proportion of simple sugars in relation to total carbohydrates was 3-fold higher than normal value which must represent a maximum of 10% of the calorie intake. High sugars intake was related to increased consumption of fruits, sugar and sweet products by the participants. Therefore, these sugars should be limited during pregnancy because they promote cravings, weight gain and diabetes, causing stillbirth, and aspiration of meconium, a large fetus for gestational age and macrosomy [17].

The average fiber intake of our population was higher than that found by Touati-Mecheri *et al.,* [8]. The satisfactory fiber intake was due to fruits and vegetables (sources of dietary fiber) which were the most consumed (referring to the weight of foods) by our pregnant women. Plant fibers play an important role in the diet of pregnant women, who often have constipation. The vegetable fibers of fruits and most vegetables have the advantage of being in the form of pectin and non-aggressive hemicelluloses [8]. Epidemiological and clinical studies demonstrate that dietary fiber intake is inversely related to obesity, type two diabetes, cancer, and cardiovascular diseases [18].

With regard to micronutrients, two elements emerged from this survey results. More than one-third of the average micronutrient intakes were satisfactory if the average nutritional requirement (ANR) was used as a reference. However, there was in each case, a fraction of the population between 40 and 90% (or even 100% for Vit. D and iron) below the ANR, the risk of deficiency being in this fraction, with varying degrees of severity, indicated and discussed below.

In the case of fat-soluble vitamins, Vit. A and β-carotene intakes were on average higher than the recommendations, whereas Vit. D and E intakes were lower than ANR. However, the average Vit. D intake was higher than the result of Touati-Mecheri *et al.,* [8] (1.0±1.0 *vs*. 0.4±1.1 µg/d), but was lower than the requirements. Otherwise, this prejudicial situation, particularly for pregnant women who had extra needs due to the fetus, was a general fact in all populations. This unsatisfactory intake of Vit. D may be related to the low consumption of fatty fish, mainly sardines, salmon, tuna, etc., cheese, and eggs by women in our study. Inadequate levels of Vit. D are known to promote gestational diabetes and pre-eclampsia, and increase the risk of C-section delivery [19].

Vitamin E intake appeared to be insufficient compared to ANR. The average intake of this vitamin was lower than that of Touati-Mecheri *et al.,* [8] (4.3±2.3 *vs* 7.7±3.1 mg/d). This insufficient intake was due to inadequate consumption of fats and oils.

The average Vit. C intake exceeded the ANR [10]. Indeed, more than half of the population had satisfactory intakes of Vit. C. This could be explained by the consumption of fruits and vegetables, especially those very rich in this vitamin. Our result was higher than that noted by Touati-Mecheri *et al.,* [8] (94.6± 51.1 *vs* 72.8±52.6 mg/d).

Concerning Vit. B9 (folic acid), the average intake (and median) was below the ANR, with almost 69% of the population below the ANR. These results are consistent with those of Touati-Mecheri *et al.,* (2011) [8] (269±105 *vs*. 239±146 µg/d). This situation is detrimental at all stages as it affects fetal growth, but especially, in the first trimester. Indeed, several developmental abnormalities have been associated with Vit; B9 deficiency, as small birth weight, prematurity, growth retardation, but also neural tube closure abnormalities that result in the exposure of neuronal tissue from the cranial region (anencephaly), or spinal region (spina bifida) [20]. A prophylactic measure for folates must therefore be very early and even precede conception. One of the lessons of this study is therefore to alert the health authorities about the possible deficiency of this vitamin intake in the not pregnant young women group, so that it is corrected before possible pregnancies. According to the World Health Organization (WHO), a daily oral folic acid supplementation of 400 mg is recommended for pregnant women [21].

For other water-soluble vitamins, the average intakes of Vit. B6 and B12 were higher than ANR, those of vitamin B2 and B3 (PP) were very close to ANR, however, the average intake of Vit. B1 was lower than ANR. These findings are consistent with those of

Touati-Mechri *et al.,* [8]. Pregnancy is associated with several factors that promote this deficiency as increased needs, lack of intake by vomiting, important carbohydrate intakes to correct these vomiting. This deficiency could reach 40% of pregnant women. However, it seems marginal in case of properly followed pregnancy, with the administration of vitamin supplements.

For minerals and trace elements, the average calcium intake was less than ANR, but it was higher than that reported in the study of Constantine [8] (537±184 *vs.* 422±289 mg/d). These intakes deficiencies can then lead to maternal and fetal hypocalcemia, which are also incriminated in the occurrence of gravid arterial hypertension. The frequency of calcium deficiency accompanies Vit. D deficiency. This vitamin is necessary for bone calcium fixation and is insufficient in pregnant women, especially in periods of low sunlight, and if the skin is colored [22].

In populations where dietary calcium intake is low, daily supplementation of 1.5-2.0 g oral elemental calcium is recommended by the WHO for pregnant women to reduce the risk of pre-eclampsia [21].

For magnesium, the average intake was slightly below estimated requirements. The same result was previously found by Touati-Mecheri *et al*., [8] (233±58 *vs*. 185±67 mg/d).

The WHO states that subclinical deficiencies of magnesium prevail in both developed and developing countries [23]. Early signs of magnesium deficiency can include appetite loss, nausea, vomiting, fatigue, and weakness [24]. Evidence from the literature suggests that optimum magnesium levels are essential for health of mother and their fetus during pregnancy and for health of child post-partum. However, some studies have significant limitations, and well-designed trials are needed to fully elucidate the role of magnesium and to establish optimum levels of intake and/or supplementation [25].

In this study, iron intakes seemed very deficient compared to recommendations, it is really unable to assure pregnant women to maintain a normal hematological state. However, our result was higher than that reported by Touati-Mecheri *et al.,* [8] (9.4±3.7 *vs*. 6.7±2.7 mg/d). It is estimated that more than 40% of pregnant women worldwide are anemic, at least half of them because of iron deficiency [26].

According to the WHO, daily oral supplementation of iron and folic acid with 30 to 60 mg of elemental iron and 400µg of folic acid is recommended for pregnant women to prevent maternal anemia, puerperal sepsis, small birth weights, and pre-term births [21].

If anemia is diagnosed in a woman during pregnancy, the daily elemental iron supplementation should be increased to 120mg until the hemoglobin level reaches a normal value (110 g/L or higher) [27]. Next, this woman may return to the normal prenatal daily dose to avoid recurrence of anemia [21].

When compared food intake proportions in relation to energy with those of Touati-Mecheri *et al.,* [8], results showed firstly cereal products (23.5 *vs* 46.8%), then fruits and vegetables (15.2 *vs* 5.4%), dairy products (15 *vs* 10.4%), sweet products (14.7 *vs* 12.2%), and meats (12.6 *vs* 12%). This nutritional profile corresponded to that described in the FAO report. Indeed, in this report on the nutritional profile of Algeria, cereals are the basis of food [28].

This study revealed that 76% of pregnant women consumed vitamin and mineral supplements. However, this supplementation rate was slightly lower than the rates recorded in MENA region (Middle East and North Africa), where the food supplements consumption was widespread among pregnant women (96.8% in Jordan [29], 88% in Egypt [30], and 71.5% in Saudi Arabia [31]). A recent Algerian study reported also a higher rate of 83.1% [32].

It is known that multiple micronutrients deficiencies can often coexist in pregnant women due to the increased needs during pregnancy, especially in developing countries. In this regard, women are usually multi-supplemented early in pregnancy with a combination of different vitamins and minerals in a single supplement [32].

This study had some limitations, as memory bias which may occur in some interviewed women a few studies available on nutritional intakes in Algerian pregnant women to compare findings, and the absence of Algerian nutritional recommendations. Other limitations were also noted as the small sample size due to low response rate and lack of time, and the refusal of a few women to answer some questions (family financial situation, type of housing), they were removed from the survey. Also, because of the COVID-19 outbreak, total weight gain (at birth) could not be determined.

Conclusion

The results of this study indicate that energy, fats and carbohydrate requirements are not adequately met for the majority of the pregnant women. The average proteins intake appears to be sufficient to cover the needs of the surveyed women, and their pregnancies. For micronutrients, the mean intake values are below the ANR values for vitamins B1, B3, B9, D and E as well as for calcium, magnesium and iron.

This can be a concern for the mother-child couple, as

maternal nutrition is a crucial factor in fetal growth, birth weight and infant morbidity. In extreme cases, micronutrients deficiencies may occur, which in the absence of supplementation can lead to fetal malformations. To overcome these problems, it is necessary to promote balanced and healthy eating habits to correct insufficient micronutrients intakes by specific supplementation measures, especially with regard to iron, Vit. B9 and D.

Although this work is carried out on a small scale, it provides recent and detailed data on macro and micronutrient intakes in pregnant women in Algeria to be compared with other studies on larger scale.

Finally, nutrition is one of the most sensitive and major hazards of pregnant women health and their fetus, so it should be taken seriously and in an urgent and rigorous way. For this, it could be suggested: the establishment of a platform that aims to raise awareness among pregnant women about the importance of a balanced diet and maintaining a physical activity through the media coverage of nutritional information, and the monitoring of pre- and post-natal nutritional status.

Conflict of interests

The authors declare no conflict of interests.

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