Original Article

Assessment of Nutritional Status of Pregnant Women Attending the City Tebessa PMI (Algeria)

S. Taleb [1], M. Kaibi[1], N. Deghboudj[1]

[1]Faculty of Science and Natural Sciences and Life SNV Department, University Cheikh Laarbi Tebessa Algeria

Received: 04 – 05 - 2011

Accepted: 11 – 05- 2011

Correspondence to:
S. Taleb

E-mail: talebsalima@yahoo.fr

ABSTRACT

Objective- Our study aimed to investigate the food habits of pregnant women in prenatal period, to assess their nutritional status to determine their socio-economic and practice of food taboos.

Materials and methods-The study involved 130 pregnant women aged 19-45 years attending antenatal clinics in PMI (Mother and Child Protection) of the town of Tebessa. We made based on survey questionnaires. And these questions are posed to every woman who has already completed the consultation. The weight and the height were measured by the respondent.

Statistics- The software used for data entry and data processing are Epi-info version 5TM and Stat view version 5 (Abacus ConceptsTM, Berkeley, USA). The significance level was set at 0.05.

Result- Our results showed that 40% of pregnant women suffering from several diseases such as anemia, hypertension, diabetes and inflammatory diseases 17.70% of women surveyed were taking medication, 33.85% were supplemented, including 1.54% by feeding and 32.31% from drugs, 78.46% were overweight (39.23% are overweight and 39.23% are obese). Only 21.54% of women had a satisfactory weight status. The results of the analysis of biological data showed that 26.67%, 55.45% of pregnant women had hemoglobin and hematocrit, respectively, below the WHO standards. The power of women relied more heavily on plant foods than animal, making their poor food choices because of higher feed prices.

Conclusion- Dietary advice must be tailored, must be based on weight and body mass before pregnancy and spontaneous food intake of each woman. The power will be varied without exclusion of food groups to cover the needs for vitamins, minerals and fatty acids.

KEY WORDS: Pregnant women, nutritional state, food, Tébessa, PMI

Introduction

Pregnancy is a dynamic, anabolic, characterized by a series of small adjustments whose purpose is to allow growth and development of the fetus while maintaining maternal homeostasis and preparing for breast feeding. These adjustments relate to changes in maternal behavior, affect the metabolism of all nutrients. They depend primarily on the nutritional status of the mother before conception and explain its ability to adapt to various nutritional situations. [1]

Assessing the anthropometric status of nutritional status during the reproductive period, especially during pregnancy, is a widely used method that requires few resources and is likely to provide many useful information but has rarely been rigorously evaluated. [2, 3] Weight gain during pregnancy is an essential element of fetal growth and fate of pregnancy. [1]

Weight gain during pregnancy should take into consideration the size of women, the weight before conception and the number of fetuses. The expectant mother must be well nourished to meet the needs of her fetus, her own needs and to prepare your body for breastfeeding. [4] The deleterious effects of severe deficiency, especially in the periconceptional period, are established for many nutrients. Few dietary surveys examining the nutritional status of pregnant women in Algeria have been made, so we wanted to have insights into the health and nutritional status of pregnant women from a survey of 130 pregnant women living in Tebessa and attending PMI of the city.

The objectives of this study were:

- Study of the nutritional status of pregnant women in the town of Tebessa
- Comparison of our results with other studies in Algeria and other countries.

Methodology

The study, cross, was conducted between April 1 and May 3, 2008 at Tebessa, a town in eastern Algeria in pregnant women aged 19-45 years. Pregnancy is characterized by an adaptation of the mother's body to promote optimal development of the fetus and to nursing. . It was conducted by questionnaire and includes general information, educational level, occupation, health status, frequency of consumption of major food and anthropometry.

Population

The wilaya of Tebessa, or Tbessa, city of Algeria is located 40 km from the border between Algeria and Tunisia. Tebessa, north of Jebel Dokan, rises 960 m above sea level, this town in eastern Algeria, lies at the foot of mountains that extend Tebessa in Tunisia. Tebessa is the capital of the Wilaya of Tebessa whose population is estimated at nearly 520 000 inhabitants. The Wilaya of Tebessa covers an area of 13,396 sq km. Among the larger towns of the Wilaya of Tebessa who are 28, we find Tebessa, where we conducted our study. Its population is approximately 193,346 inhabitants and spreads over an area of 184 km^2.

The study examined a sample of 130 pregnant women aged 19-45 years attending antenatal clinics in the PMI (Protection Maternal and infant) located in different parts of the town of Tebessa. PMI were chosen because of their location in large urban areas of the town of Tebessa. To be included in the study women had become pregnant. In Algeria, all social groups can attend the PMI because they are free. In the same PMI, you can find wealthy women, average and poor.

At the PMI, the work of midwives is to have consultations on the following basis: Prenatal visits: weight, blood pressure, uterine and demand blood tests, key vaginal gynecological Distribution different types of contraceptives. In each of PMI selected from each pregnant woman in consultation has been included in our study. The acceptance rate was 100%.

Survey Method

A preliminary survey of 10 women was conducted to test the questions posed. Thus, some questions were modified based on comments from investigators and remarks of the respondents. This allowed us to obtain a questionnaire clear and understandable.

In each of PMI investigators collected information on socioeconomic level, number of children, number of pregnancy, term pregnancy, weight before pregnancy and dietary habits. The questionnaire included 40 questions divided in 6 sections.

- ✓ General Information about the respondent: age, educational level, occupation of the spouses and socioeconomic data;
- ✓ Identification of the respondent: that the number of pregnancy, prenatal visits, the term of pregnancy and number of children under 5 years;
- ✓ The health status of women was surveyed from the frequency of certain diseases such as: hypertension, anemia, diabetes and inflammatory diseases;
- ✓ Food habits
- ✓ Anthropometry

* Biological data

Anthropometry

In each of PMI investigators collected information on: the socio-economic, dietary habits and health status of pregnant women. The same investigator, interviewed and then weighed and measured all the pregnant women studied.

Anthropometric measurements were performed on weight and height: weight measurement was taken by a balance type Seca range of 150 kg and 1 kg of precision, the size of a fathom USING 2 meters precision of 1 cm and mark Seca. We also found the available biological data using the results of laboratory tests of the women studied made before the interview. The consultations took place in the morning a week for each faith PMI.

The body mass index (BMI = P / T ² kg / m²) was selected to estimate the prevalence of overweight and obesity according to WHO references [5]. . An adult is overweight when BMI ≥ 25 kg / m² and is obese when BMI ≥ 30 kg / m². We calculated BMI before pregnancy (IMCI) using the weight of the pre-pregnancy BMI and pregnancy (IMCA) = current BMI using the weight of women made the day of the survey.

Among the 130 women interviewed, 105 (80.76%) had test results of hemoglobin, 101 (77.69%) those of hematocrit and 47 (36.15%) those of Mean corpuscular volume (MCV).

Food survey

The behavior and habits allow us to describe the attitude of pregnant women towards food and food during this period. Dietary habits were assessed on the basis of issues that are related to the environment of the meal (taken, composition) and frequency of consumption of foods from some predetermined proposals that are linked directly with the eating habits of the region. The frequencies of consumption were gathered by a direct response to the interviewee to multiple choice questions: Every day, occasionally (3-4 times per week), rarely (1-2 times per week) or never (0 times per week).

Statistics

The software used for data entry and data processing are Epi-info version 5TM and Stat view version 5 (Abacus ConceptsTM, Berkeley, USA). The significance level was set at 0.05.

Results

1 Anthropometric characteristics of women.

The average age of pregnant women studied was 29.28 ± 5.67. IMCI average of 26.06 ± 4.84 and 29.14 ± IMCA is 4.99. Weight gain in pregnancy is confirmed in this study (78% of women in our sample were overweight among which 39% are obese) (Table 1).

Table 01: Anthropometric characteristics of women.

	M ± SD	Median	Minimum	Maximum
Age	29.28±5.67	28.25	19.00	43.50
Initial weight (kg)	67.91±12.09	65.00	45.00	110.00
Current weight (kg)	75.25±13.25	72.00	52.00	114.00
Height (m)	1.60±0.06	1.60	1.48	1.78
Initial BMI	26.06±4.84	25.35	17.58	43.51
Current BMI	29.14±4.99	28.44	19.83	45.09

M ± SD = mean ± standard deviation

2 Prenatal visits

Half of the women studied had consulted their doctors or midwives once, 46.92% two to four times (Table 2). Given that 64.61% are in the second quarter and 31.54% in their 3rd quarter.

Table 2 : Visites Prénatales

Prenatal visits	Number	Percentage
1 fois	65	50
2-4 fois	61	46.92
> 4 fois	4	3.08
Total	130	100

3 Distribution of pregnant women by presence of certain diseases

According to statements of the women interviewed 40% suffer from several diseases such as anemia, hypertension, diabetes and other diseases such as (allergy, renal failure, brucellosis, etc. asthm.), the difference is significant (p = 0.0001). 15.38% of women reported anemia is the most common nutritional problem encountered during pregnancy (Table 3)

Table 3: Distribution of pregnant women by presence of certain diseases

Diseases	Number	Percentage
Hyper Blood Pressure	6	4.62
Anemia	20	15.38
Diabetes	3	2.31
Inflammatory	11	8.46
Other diseases	12	9.23
No disease	78	60
Total	130	100

4 Supplementation

The results show that 32.31% of pregnant women are supplemented by medication. Suplémentation by the food remains very low. The suplémentations given are for the food component, the consumption of liver and spleen and the drug component, making poly-vitamins, iron, folic acid and vitamin B12 (anti-anemic) Table 4.

Table 4: Supplementation

Supplémentation	Number	Percentage
Food	2	1.54
Drug	42	32.31
No	86	66.15
Total	130	100

5 Biological data

We also found the available biological data as shown in Table 5. According to these data we found that the rate of red blood cells of pregnant women, the hemoglobin and hematocrit are substandard. From the table we see that normal distribution because the median is about average, except for hematocrit and hemoglobin.

6 Values of hemoglobin, hematocrit and MCV of respondents.

If one refers to the WHO definition. [6] (Hemoglobin below 11 g / dL), 26.67% of women have anemia (Table 6). hematocrit values show that more than half (55.45%) of pregnant women are at the beginning of anemia. 21.28% of pregnant women with an MCV below 85 fl. This means that these women may be deficient in iron (red blood cells are very small). Ideally the diagnosis of anemia should be based on the study of red cell mass and not on the concentration of hemoglobin. In practice, rates above 11 g / dL should be considered normal under a MCV of 84 to 99 fentolitres. [1]

Table 5: Biological data.

Biological data	M ± SD	Median	Minimum	Maximum	Standards
White blood **×103/ mm3**	8.48 ± 2.18	8.40	3.60	14.20	5.00 – 10.00
Red cells **×106 / mm3**	3.96 ± 0.63	3.97	2.53	7.50	4.00 – 5.50
Hemoglobin **(g/dl)**	11.84 ± 1.69	12.00	5.64	18.40	12.00 – 17.40
Hematocrits **(%)**	34.78 ± 4.42	35.00	17.8	45.00	36.00 – 52..00
Platelets **×105 /mm3**	2.58 ± 0.96	2.30	1.56	6.87	1.50 – 4.00
MCV **(fl)**	91.48 ± 8.04	91.80	69.00	115.00	76.00 – 96.00

MCV = Mean corpuscular volume, fl = fentolitre,

7.Meals

7.1. Frequency of meals taken

The meal is the most consumed daily lunch

Table 6: Interpreting hemoglobin, hematocrit and MCV of respondents According to recommendations. [6,7]

		Nombre	Pourcentage %
Hemoglobin (g/dl)	Anemia < 11	28	26.67
	≥ 11	77	73.33
	Total	**105**	**100**
Hematocrits **(%)**	< 21	1	0.99
	Anemia iron dificiency < 36	56	**55.45**
	Normal pregnancy ≥ 36	44	43.56
	Total	**101**	**100**
MCV (fl)	Anemia iron dificiency < 85	10	21.28
	Normal pregnancy > 85 et < 95	22	46.81
	Anemia, folate deficiency > 95	15	31.91
	Total	**47**	**100**

followed by breakfast and dinner with the same proportion (73.85%) (Figure 1) 6.15% of pregnant women never take supper.

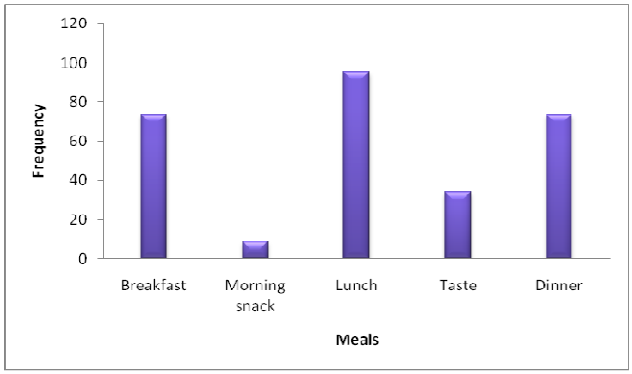

Figure 1: Frequency of eating meals in women studied

7.2. Breakfast

At breakfast, the foods most consumed by pregnant women were: dairy products (milk, yogurt and cheese) and grains (bread, cake and cake). Then came the sweet butter ...

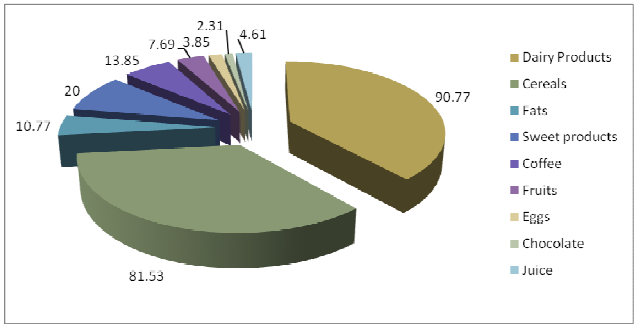

Figure 2: Frequency of food consumption at breakfast

7.3. Morning snack

The morning snack was taken by 8.46% of pregnant women. The foods most consumed were: juices, dairy products and fruits (Figure 3).

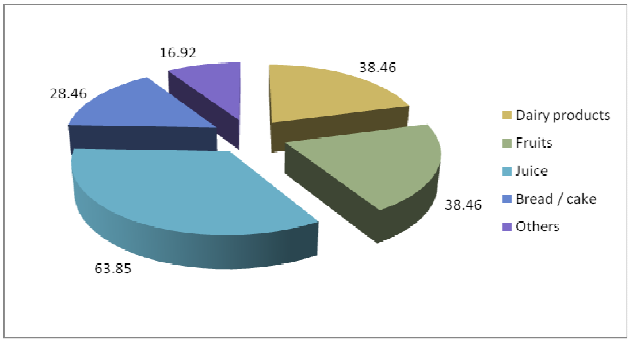

Figure 3: Frequency of consumption of food at morning snack

7.4. Lunch

The results of this study, we found that the composition of lunch for pregnant women was diverse. However, meat main source of animal protein was taken by 76.92% of pregnant women (Figure 4).

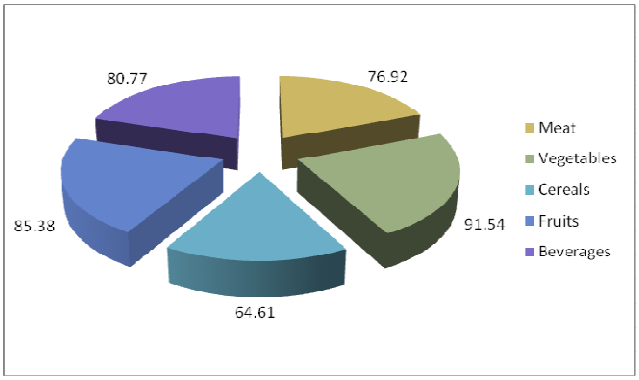

Figure 4: Frequency of food consumption at lunch

7.5 The snack

The snack was taken by 33.85% of pregnant women. The foods most consumed were: dairy products and cereals. Followed by vegetables and fruits, coffee ....

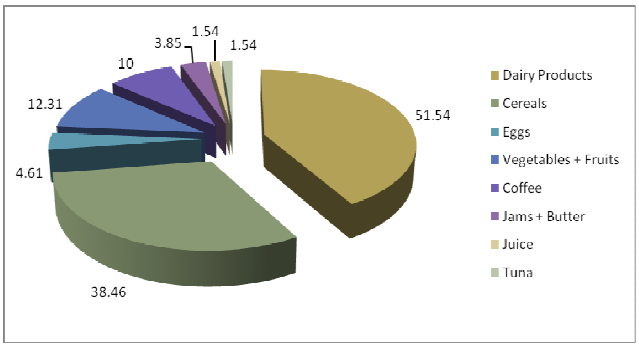

Figure 5: Frequency of food consumption at snack

7.6. Dinner

We found a marked decrease in the consumption of all food groups at lunch compared to breakfast (Figure 6). This was certainly due to the fact that pregnant women wanted to have a light stomach the night before bed to avoid vomiting and stomach burns.

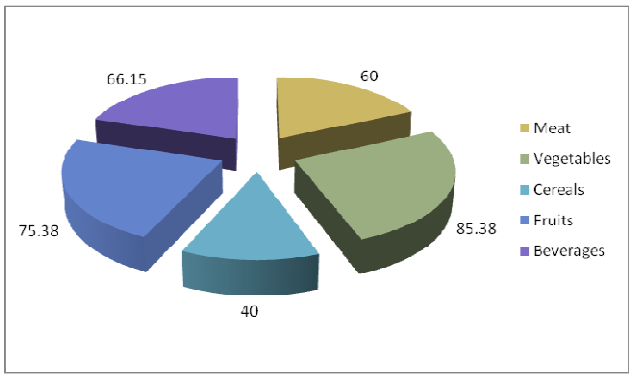

Figure 6: Frequency of food consumption at dinner

7.7. Snacking

Eight percent (8% of pregnant women reported snacking all day. The foods most eroded were: dairy products, cereals, fruits and vegetables ... (Figure 7).

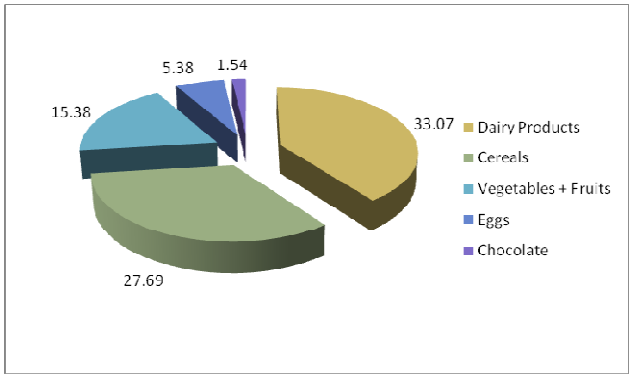

Figure 7: Frequency of consumption of food gnawed

Discussion

Anthropometry

Anthropometric indicators may reflect past events predict future events or indicate the current nutritional status. Anthropometric point of view, pregnancy is unique in two respects: the observation period is relatively short and anthropometric indices change rapidly. [8]

In our study 68.89% of women surveyed took less than 12 kg compared to their initial weight. This weight gain is less than that found in the study [9] where pregnant women took 12.5 kg in late pregnancy. We believe this is due to the fact that 64.61% of women in our study were in the 2nd trimester of pregnancy. A significant correlation was found between the weight and size of female respondents ($r = 0,256$, $p = 0.003$). According to WHO [8] to the extent where the weight is usually highly correlated with the size, it can serve as a general indicator of the quality of growth in the mother.

The average BMI of pregnant women before and during pregnancy were 6.26 ± 4.84, 29.14 ± 4.99. These results were higher than those of a Franco-Spanish study. [10] Compared to WHO standards, 21.54% of the women interviewed were of normal weight, 39.25% were overweight and 39.25% were obese. Changes in BMI reflect the physiological changes of body size during pregnancy. The prevalence of overweight found in other studies in Algeria [11], seemed less than our results.

Health status

Anemias in pregnant women are frequent in general, and depend in part on nutritional status of the population. In developed countries, they affect 10-20% of women from wealthy backgrounds and over 30% of women in disadvantaged areas. [12] The prevalence of anemia among women pregnant at Tebessa (26.67%) was higher to that revealed by other studies in developing countries 8% in northern Cameroon. [13] However, other studies in Africa and other developing countries reported higher prevalence's of 50% in India [14], 52% in Nigeria [15], 34% in Zambia [16], 41% in Tunisia [17], and about 45% in Togo [18, 19]. In Algeria among women of childbearing age 49% were suffering from mild anemia and severe anemia 15%. [20] The prevalence of anemia in this study could be related to poor education and lack of a systematic iron supplementation.

Hypertensive disorders of pregnancy remains a common and serious disease despite clear advances in knowledge of their pathophysiology. They represent the third cause of maternal mortality and the leading cause of perinatal mortality. [21] The prevalence of hypertension found in this study seemed higher than that found in the study. [21] All studies agreed in saying that a good monitoring of pregnancy is a better prognostic factor for hypertension in fetal and pregnancy. [21]

Food

Eating is a vital activity for the individual and more for pregnant women. Now it is clear that during pregnancy, the woman lives in almost pathological paradox insofar as it is subject to nutritional desires. We examined the motivation of the pregnant woman to Tebessa and compare their feeding behavior in relation to other studies on food habits of pregnant women.

The nutrition of pregnant women interviewed in this study was based on grain products, meats, fruits and vegetables, dairy products and beverages. These are foods allowed during pregnancy. Dairy products and coffee were consumed at breakfast, tea and snacks. Milk occupied the first position among the foods mentioned.

The foods most consumed at breakfast were dairy products (milk, yogurt and cheese), followed by bread and cake and in last place the butter and jam. They were the main foods consumed at breakfast in the town of Tebessa and also throughout the country. Dairy products are the richest food sources of calcium.

They also contain protein and some fat-soluble vitamins. On the other meals, consumption of fruits and vegetables was very important because of their availability on the market during the execution of our survey (spring period) and made affordable. These are the main sources of vitamins and minerals. Beverages also showed significant frequency of consumption, including fruit juice was the most consumed 64% of women surveyed drank it as a snack. Pregnant women consumed no soft drinks for digestive reasons.

Meat products and eggs were also consumed with great frequency during the two main meals of the day. These drinks involved much more chicken, fish and eggs; the price is cheaper than red meat as well as lamb and veal. These foods are rich in protein (15-25%) and fat (5-30%), while they afford virtually no carbohydrates. [22] The consumption of these foods was higher in our study than in other studies 76.9% and 60% for lunch dinner vs. 38.5% in the 2003 study in the municipality of El Khroub by BOUTOUTA and ACHOURI cited by BELLHRECHE and OUARGLI.[11]

The consumption of cereals (bread, cake, pasta, etc...) was also important. Consumption reached 81.5% at breakfast, lunch 64.61%, 44.61% and 40% at tea or dinner. These foods are therefore a source of carbohydrate energy source. Energy requirements of pregnant women increase during pregnancy because of fetal development, placenta and its annexes, and because the heavier the mother makes her movements more energy costly. [23] Feeding surveyed appeared to be diverse because different foods were found in different meals.

We found that the consumption of different foods varies depending on the term of pregnancy. Women who were first-term pregnancy had a reduced percentage of consumption of different foods from those that were in the third quarter. This was due to mental changes as well as vomiting, nausea and disgust that appeared in early pregnancy.

The nutritional status of pregnant women should be monitored closely to avoid gaps and different diseases that can have serious repercussions on the life of the mother and fetus. Of course, again better safe than sorry. For this and more of a balanced diet, taking iron salts should be recommended whenever a dangerous situation is sensed. This is obviously the case of pregnant women: in the latter, anemia is common (26.67% in our study according to WHO standards) and carries serious risks for mother and fetus. Laboratory tests in search of a deficiency or iron deficiency anemia is strongly recommended before the end of the third month of pregnancy.

Conclusion

Our investigation in whatever limited time allowed us to draw the following conclusions: Pregnant women in our study were overweight and obesity compared to WHO standards. Which encourages pregnant women with metabolic complications, vascular and perinatal and even birth defects? No woman had an underweight according to WHO standards. The frequency of diseases associated with pregnancy was important, 15.4% of women surveyed sulfur anemia and 8.46% were suffering from inflammatory diseases. Forty-five point four percent (45.4%) of pregnant women had their first pregnancy. Almost all women consumed daily milk, meat, vegetables and fruits, foods inducers of protein, vitamins and minerals. The feeding of respondents was diverse but it relied a bit more on products of plant origin that animal. The results of laboratory tests of hemoglobin, hematocrit, and MCV showed that an important proportion of women interviewed had a low hemoglobin <11 g / dL and an elevated MCV. According to our results, we noticed that the dietary knowledge of pregnant women were not quite perfect. That is why it is desirable that each PMI has a dietitian to inform pregnant women about

their nutritional status and effects of unbalanced diets on the mother and her fetus. Current recommendations can only provide benchmarks. Only inadequate weight gain requires intervention on the amount of energy consumed by the woman spontaneously. Dietary advice must be tailored, must be based on weight and body mass before pregnancy and spontaneous food intake of each woman. The power will be varied without exclusion of food groups to cover the needs for vitamins, minerals and fatty acids.

These results do show that the nutritional status of a sample of women attending PMI City Tebessa. Studies on the nutritional status of pregnant women in Algeria are necessary for appropriate nutritional recommendations. Such a qualitative approach should be complemented by a quantitative assessment of food and an estimate of energy expenditure.

REFERENCES

1. Basdevant A, Laville M, Lerebours E, 1er édition, édition Flammarion, French (2001) ; 723p ; 283-291.
2. Beaton G et al. Appropriate uses of anthropometric indices in children: a report based on an ACC/SCN workshop. New York, United Nationals Administrative Committee on Coordintion/Subcommittee on Nutrion, (ACC/SCN State of the Art Series, Nutrition policy Discussion Paper n° 7)1990.
3. Habicht J-P, Pelletier DL. The Importance of context in choosing nutritional indicators. Journal of nutrition, 1990, 120 (Suppl. 11): 1519-1524
4. Charpentier. B. M, Diététique pour l'aide soignant et l'auxiliaire de puériculture, édition Masson ; 2002, 144p ; 50.
5. World Health Organization. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva : Technical report series n° 894 WHO, 2004.
6. Organisation Mondiale de la Santé. Les anémies nutritionnelles, OMS Sér. Rapp.Techn., 1972, 503, pp 1-31.
7. Lansac J., Berger C., Magnin G., Obstétrique, 4éme édition, les éditions Masson ; 2003 ; 544p.
8. OMS Utilisation et interprétation de 'anthropométrie, série de rapports techniques.OMS, 1995 ; Genève ; 845p
9. Morin. Y, Dictionary Larousse Health. Edition Larousse; 2004, p;98.
10. Prado C., Rovilles S. F. Acevedo P. Nutritional state of the pregnant women of Maghrebian origin and their infants: the situation in France and Spain, Anthropo, 2004. 7, 139-144
11. Bellahreche K, Ouargli Z. Nutritional status of pregnant women attending PMI el Meniaa (Ghardaia) And Ghriss (Mascara), Engineer status in nutrition and food technology, INATAA, Mentouri university of Constantine, Algeria, (2007),
12. Barbarino Monnier P. Anemia of pregnancy: mechanisms and prevention. From theory to practice. The Gazette of the Transfusion , 1994, (104) : 11-19.
13. Coulibaly M, Costagliola D, Zittoun J, Et Mary J.Y. ssessment of nutritional status of pregnant women from hématobiologiques parameters, following a displacement of populations in northern Cameroon. IIIème International Scientific Days of GERM. 1987. p 46.
14. Madan N, Rusia U, Sharmas S, Sood S.K. Occurrence, causes and control of nutritional anemia in pregnant women in India : Studies carried out during the last two decades.In : Aspect actuel des carences en fer et folates dans le monde. HERCBERG, S. GALAN, P. DUPIN. H. eds. Ed. Colloque INSERM, 1990, 197 55-63.
15. Fleming A.F. Malaria deficiencies of iron and folate, and anaemia in pregnancy in the Guinea Savanna of Nigeria. In : Aspect actuel des carences en fer et folates dans le monde. Hercberg, S. Galan, P. Dupin. H. eds. Ed. Colloque INSERM. 1990, 197 : 71-74.
16. Fleming A.F. Anaemia in pregnancy in Ndola, Zambia: Frequency and aetiology. In : Aspect actuel des carences en fer et folate dans le monde. HERCBERG, S. GALAN, P. DUPIN. H. eds.Ed. Colloque INSERM, 1990, 197 : 75-77.

17. Hamdaoui M, Sakly R., Alguemi Cc, Bennour A, Jallouli K, Doghri T, Nutritional anemia in pregnant women in the region of Kairouan (Tunisia). In : Current appearance of iron deficiency and folate in the world .HERCBERG S, GALAN P, DUPIN H, eds. Ed. Colloque INSERM. 1990, 197: 83-85.

18. Dop M.C, Blot I, Dyck J.L, Assimadi K, Hodonou A.K.S, and Doh A. Anemia at delivery in Lome (Togo) : Prévalence, causes et répercussion chez le nouveau-né.IIIème Journées Scientifiques Internationales du GERM. 1987. p 37.

19. Dyck J.L, Blot C, Dop M.C, Schneider D, Hodonou A.F.K, and DOH A. Anemia, iron deficiency and pregnancy in pregnant women loméenne. IIIème International Scientific Days of GERM. 1987. p 43.

20. MSPRH. The health of the Algerian people in 2002. Annual Report April 2003. Department of Health, Population and Hospital Reform. Algiers. 2003, 113 pp. and annexes.

21. Randriambololona DMA, Botolahy ZA, Randrianantoanina FE, Randriamahavonjy R, HERY RAKOTOVAO A. Arterial hypertension and pregnancy: maternal-fetal prognosis Tropical Journal of Surgery 3 (2009) 32-34.

22. Jacotot. B, Campillo. B, Nutritional Epidemiology and Prevention in Human Nutrition, edition Masson, paris; 2003, 311p; 273-274.

23. Passmore. R, Nickol. B. M, Narayana. R. M, Beaton. G. H, Demaeyer. E. M, Handbook on human nutritional needs , FAO ET OMS, Rome; (1975), p19-25-32-54.

Source of Support: Nil. **Conflict of interest**: None declared