# NUTRITIONAL PROFILE OF PREGNANT WOMEN IN THE BASSAR PREFECTURE (NORTHWEST OF TOGO)

*Maclewè Nouroudine Tchaou[1], Esso-yabam Abalokoka[1], Kodjo Adi[1, 2], Courdjo Lamboni[1*]*

## ABSTRACT

*A hospital-based survey was conducted on 251 urban and suburban pregnant women in the Bassar prefecture (Northwest of Togo), in order to describe their nutritional profile. In this perspective, an interactive 24-hour dietary recall was used to collect dietary intake data. Meal frequency of subjects was evaluated using the daily meal number. Besides, daily diet diversity was determined using the number of food groups consumed. In addition, food intake data were converted to energy and nutrient intakes. Nutritional adequacy was assessed using nutrient adequacy ratio and mean adequacy ratio. The results of this research show that the meal frequency of pregnant women was affected by the seasons. In addition, dietary diversity of respondents was poor and nutrient-dense food groups were less consumed. Overall, fruits, dairy and eggs were eaten by less than 10% of the respondents. As a result, vitamin (A, $B_1$, $B_2$, $B_3$, $B_9$), protein and mineral (zinc, iron and calcium) intakes of subjects were below nutritional requirements in pregnancy. However, the distribution of daily energy intake from macronutrients in pregnant women is compliant with dietary recommendations. In conclusion, this study shows that the nutritional requirements of pregnant women in the Bassar prefecture are not sufficiently covered. Therefore, specific interventions at both individual and community levels are necessary to improve the food intake of pregnant women in this district of Togo.*

***Keywords***: *Pregnant women, nutritional adequacy, dietary diversity, Bassar, Togo.*

## RESUME

**Titre:** Profil nutritionnel des femmes enceintes de la préfecture de Bassar (Nord-Ouest du Togo)

*Une enquête hospitalière a été conduite auprès de 251 femmes urbaines et semi-rurales de la préfecture de Bassar (Nord-Ouest du Togo) afin de décrire leur profil nutritionnel. Dans cette perspective, la méthode interactive du rappel alimentaire de 24 heures a été utilisée pour collecter les données de consommation alimentaire. La fréquence des repas et la diversité alimentaire ont été évaluées respectivement à partir du nombre journalier de repas et du nombre des groupes alimentaires journellement consommés. Les apports nutritionnels en énergie et nutriments des sujets ont été calculés. L'adéquation nutritionnelle des sujets a été évaluée également à partir du ratio d'adéquation en nutriment et du ratio d'adéquation moyenne. Les résultats de l'étude indiquent que la fréquence des repas des femmes dépend de la saison. De plus, les aliments à haute valeur nutritionnelle sont moins consommés et la diversité alimentaire des femmes enceintes est faible. Au total, les fruits, les laitages et les œufs sont consommés par moins de 10% des sujets enquêtés. Par conséquent, les apports alimentaires des sujets enquêtés en vitamines (A, $B_1$, $B_2$, $B_3$, $B_9$), protéines et minéraux (zinc, fer et calcium) sont en dessous des recommandations nutritionnelles. Cependant, la répartition de l'apport énergétique provenant des macronutriments satisfait aux recommandations nutritionnelles. En conclusion, cette étude montre que les besoins nutritionnels de ces femmes enceintes ne sont pas couverts par leur alimentation. Des interventions spécifiques aussi bien au niveau individuel que communautaire sont nécessaires pour augmenter les apports alimentaires des femmes enceintes de cette région du Togo.*

***Mots clés***: *Femmes enceintes, adéquation nutritionnelle, diversité alimentaire, Bassar, Togo.*

[1]Laboratory of Biochemistry/Nutrition, Faculty of Science, University of Lomé, 01 P.O. Box: 1515 Lomé-Togo.
[2]Laboratory of Physiology/Pharmacology of Natural Substances, University of Lomé, 01 P.O. Box: 1515 Lomé-Togo.

[*]Correspondence: racoulamboni@gmail.com, [1]Laboratory of Biochemistry/Nutrition, Faculty of Science, University of Lomé, 01 P.O. Box 1515 Lomé-Togo, Tel. (228) 90 03 29 90

## Introduction

Pregnancy is a vulnerable period during which women should be particularly concerned about their diet and health. Physiological adaptations during this stage lead to an important increase in plasma volume that induces a diminution of circulating nutrient-binding-proteins and micronutrients (Lapido 2000; Pinto *et al*., 2008). Thus, energy and nutrient requirements increase greatly during pregnancy to meet the high demands for fetal growth and to prepare maternal tissues for delivery and lactation (Sahoo and Panda, 2006; Lisa, 2010). The mean increase in different nutrient requirements from pre-conception to pregnancy generally varies from 0% to 54% (Picciano, 2003). Although primary health care and nutrition programs instituted in almost all hospitals of countries are targeted at pregnant women, they don't use a long-term approach based on a woman's life cycle perspective. As a result, millions of women become pregnant in developing countries with poor nutritional status characterized by short stature, low body weight and multiple micronutrient deficiencies (Ramakrishnan *et al*., 1999; Mora and Nestel, 2000). Indeed, in low and middle-income countries, dietary patterns of the population are based on unbalanced plant-based diets that do not generally cover the daily recommended nutritional intakes. During pregnancy, the increase of nutritional needs exacerbates energy and micronutrient deficiencies already present in the pre-pregnancy stage (Lee *et al*., 2013). In industrialized countries, on the contrary, over nutrition coexists with undernutrition. For example, it has been demonstrated that more than half of pregnant African-American women had a high energy intake and inadequate supply of micronutrients (Gennaro *et al*., 2011). In Portugal and Spain, similar observations were made by other authors (Pinto *et al*., 2008; Rodriguez-Bernal *et al*., 2013). Indeed, their reports had shown that energy and macronutrient intakes were within recommended dietary allowances for most pregnant women. However, for micronutrients, folate, vitamin E, iron, and magnesium intakes were below nutritional recommendations.

Available nutritional data indicate that about 8.7% of Togolese women of reproductive age have a low body mass index during the pre-pregnancy period and 11.5% of babies born in Togo have a low birth weight (MST, 2012). Household food insecurity level is estimated at 19.6% at the national level, but high regional disparities are recorded. Indeed, availability and access to foodstuff decrease gradually from south to the northern parts of the country. This phenomenon is due to low standards of living, seasonal variations and climatic zone distribution in the country (PAM, 2010). However, dietary intake data of specific vulnerable groups such as pregnant women in Togo are not available. Therefore, the purpose of this study is to document the dietary intake patterns of pregnant women in urban and suburban areas of the Bassar prefecture in the northwest of Togo. To consider seasonal variations in dietary intakes of the subjects, the study took place during lean and harvest periods.

## Methods

*Study area and subjects*

The study was done in the Bassar prefecture located in the northwest of the country in the Kara region. This prefecture roughly covers an area of 3165 Km$^2$ with 119717 inhabitants according to the 2010 census (MPRPDA/DGSCN, 2010). The locality is characterized by a sudannean-guinean climate and one can distinguish two seasons: the rainy season from April to October and the dry season from November to March. The Bassar ethnic group constitutes the most important community living in this area. Besides, other ethnic groups such as the Kabyè-Tem, Konkomba, Adja-Ewé and Peul-Haoussa also settle in the prefecture. The main occupation of the population is farming and trading. Yams, maize, sorghum, peanut and beans are the main cultivated foodstuffs in the area (Wagbé, 1987).

The study took place during the food harvest period (September-December 2012) and during the lean period (May-July 2013). The nutritional survey concerned healthy pregnant women undergoing antenatal care at the two biggest medical centers in the prefecture: the Prefectural Hospital at Bassar and the Social Medical Center at Kabou which is located in a suburban area, 30 Km from the town.

The study was approved by the Ethics Committee on Health Research in the Togolese Ministry of Health (N°3374/2012/MS/CAB/DGS/DPLET/CBRS). All healthy pregnant women (16-45 years) frequenting the above-mentioned hospitals during the survey were eligible. Each participant had to give an informed and verbal consent before submitting to data collection.

Languages such as French, Bassar, Kabyè and Ewé spoken by participants were used during the survey. The gestational age was taken by midwives using the last menstrual period method completed by fundus height measurement. Besides, socioeconomic and demographic variables were assessed using semi-structured questionnaires. The mid-upper arm circumference (MUAC) of the left arm was also measured using an inextensible tape to the nearest 0.1 cm.

Food consumption was recorded through a single 24-hour dietary recall during food lean and harvest periods at the two localities. Feast days were not included in the period of the survey. An interactive dietary recall procedure was used to assess food intake (Gibson and Ferguson, 1999). Briefly, each woman was asked to enumerate all foods and drinks consumed during the previous days. After, the participant was asked to describe in detail each meal and to estimate the amount of food intake using local household utensils. Prices of meals bought were also collected. All data given by the pregnant women were carefully checked, to ensure that all meals have been well recorded. In order to obtain average recipes consumed by the subjects, two women (one in each locality) cooked the meals reported during the survey. The ingredients enumerated by the subjects were taken into account during food preparation. The amounts of foods consumed were weighed with a Camry electronic kitchen scale (Model EK3252, China) to the nearest gram. In addition, two to five samples of fruits and out-of-home foods were bought from different vendors in each locality and weighed. These standardized recipes were used to determine the weight of the potion size consumed by the subjects. Nutrient intake data were computed using Excel worksheet (Microsoft Access, 2007) as described by the compilation tool developed by FAO/INFOODS (2009). The ingredient recipe calculation method was used to estimate nutrient intakes of each pregnant woman. In addition, food nutrient values used were taken from local and regional food composition tables (Bergeret *et al*., 1957; Lukmanji, 2008; Stadlmayr *et al*., 2012).

Dietary diversity was measured using a dietary diversity score (DDS) which was defined as the total number of food group items consumed during the day. As recommended for reproductive women (FAO/USAID/FANTA, 2016), ten food groups were considered in the calculation of DDS of pregnant women: all starchy staple foods, beans and peas, nuts and seeds, dairy, flesh foods (meat, poultry and fish), eggs, vitamin A-rich dark green leafy vegetables, other vitamin A-rich vegetables and fruits, other vegetables, other fruits.

Nutrient adequacy ratio (NAR) and mean adequacy ratio (MAR) were used to evaluate energy and nutrient adequacy. NAR and MAR were calculated according to the formulas proposed by previous studies (Hatløy *et al.*, 1998). These food intake indicators took into account energy and 13 nutrients. Recommended dietary allowances were taken from the literature (Nishida *et al*., 2004; WHO/FAO, 2004; Burrowes, 2006).

$$NAR = \frac{\text{Daily mean nutrient intake}}{\text{Recommended daily allowance}}\ ;\ MAR = \frac{\sum NAR(\text{ each truncated at 1})}{\text{Number of nutrients}}$$

*Data analysis*

Data were processed using Microsoft Access 7 and Graph Prism 5. The variables were expressed as mean ± standard deviation (SD). The parametric ANOVA test followed by Newman-Keuls' post-test were used to compare means. In addition, the $\chi 2$ test and Fisher's exact test were used to compare proportions. Significant differences were set at *p-value* < 0.05.

## Results

During the two seasons in which the study took place, a total of 251 pregnant women corresponding to 42.54% of eligible subjects at the two centers were enrolled in the study. Sociodemographic variables and MUAC values of the subjects are summarized in Table I. The most representative age group range was from 21-29 years. Pregnant women in the sample were mainly monogamists and multiparous women. Among the surveyed subjects, more than 96% were in the second and third trimesters of pregnancy. As far as maternal education is concerned, 27.09% were illiterate; 28.68% and 42.62% have attended primary and secondary schools respectively and only 01.59% were university graduates. In addition, the mean value of MUAC of surveyed subjects was equal to 25.96 ± 3.50 cm (range: 22-33 cm).

The data in Table II report the meal frequency and dietary diversity of participants. The daily number of meals of pregnant women decreased significantly ($p < 0.0001$) during the lean period compared to the harvest period in the urban area as well as in the suburban zone. During the lean period, there is no difference in the mean number of meals between the two areas, but during the harvest period, the meal frequency of pregnant women in the urban area is significantly ($p < 0.0001$) higher than their counterparts in the suburban area. In addition, dietary diversity was low (< 5 food groups) and ranged in urban pregnant women from 3.93 ± 1.13 to 4.24 ±

**Table I: Characteristics of surveyed pregnant women**

| | **Urban (n=135)** | | **Suburban (n=116)** | | | |
|---|---|---|---|---|---|---|
| **Parameters** | LP (n = 66) | HP (n = 69) | LP (n = 45) | HP (n = 71) | *P-value* | Total (n = 251) |
| Maternal age distribution (years) | | | | | | |
| 16-20 | 09 (13.63) [a] | 18 (26.08) [a] | 09 (20) [a] | 18 (25.35) [a] | NS | 54 (21.51) |
| 21-29 | 26 (39.39) [a] | 35 (50.72) [a] | 24 (53.33) [a] | 36 (50.70) [a] | NS | 121 (48.20) |
| 30-45 | 31 (46.96) [a] | 16 (22.53) [b] | 12 (26.66) [b] | 17 (23.94) [b] | 0.0074 | 76 (30.27) |
| Marital status | | | | | | |
| Monogamy | 51 (77.27) [a] | 51 (73.91) [a] | 31 (68.88) [a] | 44 (61.97) [a] | NS | 177 (70.51) |
| Polygamy | 15 (22.73) [a] | 18 (26.08) [a] | 14 (31.11) [a] | 27 (38.02) [a] | NS | 74 (29.48) |
| Parity | | | | | | |
| Primiparous | 14 (21.21) [a] | 24 (34.78) [a] | 15 (33.33) [a] | 30 (42.25) [a] | NS | 83 (33.06) |
| Multiparous | 52 (78.78) [a] | 45 (65.21) [a] | 30 (66.66) [a] | 41 (57.74) [a] | NS | 168 (66.93) |
| Gestational age | | | | | | |
| First trimester | 00 (00) [a] | 10 (14.49) [b] | 00 (00) [a] | 00 (00) [a] | < 0.0001 | 10 (03.98) |
| Second trimester | 36 (54.54) [a] | 37 (53.62) [a] | 21 (46.66) [ab] | 21 (29.57) [b] | 0.010 | 115 (45.81) |
| Third trimester | 30 (45.45) [ab] | 22 (31.88) [a] | 24 (53.33) [bc] | 50 (70.42) [c] | < 0.0001 | 126 (50.19) |
| Maternal education | | | | | | |
| None | 11 (16.16) [a] | 17 (24.63) [ab] | 18 (40) [b] | 22 (30.98) [ab] | 0.042 | 68 (27.09) |
| Primary school | 19 (28.78) [a] | 22 (31.88) [a] | 09 (20) [a] | 22 (30.98) [a] | NS | 72 (28.68) |
| Secondary school | 34 (51.51) [a] | 30 (43.47) [a] | 16 (35.55) [a] | 27 (38.02) [a] | NS | 107 (42.62) |
| University degree | 02 (03.03) [a] | 00 (00) [a] | 02 (4.44) [a] | 00 (00) [a] | NS | 04 (01.59) |
| MUAC (cm) | 27.25 ± 3.61[a] | 24.46 ± 3.17 [b] | 24.79 ± 2.67 [b] | 24.98 ± 3.22 [b] | < 0.0001 | 25.96 ± 3.50 |

The results are expressed as n (%) or mean ± SD. [a, b, c] Values in the same row with unlike superscript letters are significantly different using $\chi^2$ test and Fisher's exact test (*P-value* < 0.05), MUAC: mid-upper arm circumference, NS: not significant, LP: lean period, HP: harvest period.

**Table II: Meal frequency and dietary diversity of pregnant women during the survey**

| | **Urban (n = 135)** | | **Suburban (n = 116)** | | |
|---|---|---|---|---|---|
| **Parameters** | LP (n = 66) | HP (n = 69) | LP (n = 45) | HP (n = 71) | *P-value* |
| DNM | 2.27 ± 0.62 [a] | 2.75 ± 0.64 [b] | 2.10 ± 0.42 [a] | 2.45 ± 0.72 [c] | < 0.0001 |
| DDS | 3.93 ± 1.13 [a] | 4.24 ± 1.16 [a] | 3.75 ± 0.85 [a] | 4.11 ± 1.03 [a] | NS |
| DDS ≥5 | 19 (28.78) [a] | 29 (42.02) [a] | 11 (24.44) [a] | 21 (29.57) [a] | NS |

The results are expressed as mean ± SD or n (%). **[a, b, c]** Values in the same row with unlike superscript letters are significantly different using ANOVA test followed by Newman-Keuls' multiple comparison test (*P-value* < 0.05), LP: lean period, HP: harvest period, DNM: daily number of meals, DDS: dietary diversity score; NS: not significant.

1.16 food groups during lean and harvest period respectively and in suburban pregnant women from 3.75 ± 0.85 to 4.11 ± 1.03 food groups during lean and harvest period respectively. Besides, according to the locality and the season, less than 45% of surveyed subjects have eaten 5 or more food groups the previous day.

The data in Table III describe the percentage of pregnant women consuming each food group. In decreasing order, cereals and starchy roots, flesh foods, vitamin A-rich dark green leafy vegetables, other vegetables, nuts and seeds, other vitamin A vegetables and pulses were the most consumed food groups. Dairy products and other fruits were consumed by at most 6.37% and 8.36% of pregnant women respectively during the two seasons in the urban area. Eggs were not eaten at all by pregnant women.

during the lean period in urban pregnant women in comparison with the harvest period. Besides, energy and carbohydrate intakes were significantly ($p \leq 0.01$) higher in suburban pregnant women during harvest period in comparison with the lean period.

Nutritional adequacy data are presented in Table V. These results indicate that the NAR of carbohydrate and vitamin C were above 1RDA during the two seasons. Besides, the NAR of phosphorus was high and ranged from 0.92 to 1.14 in urban subjects and from 1 to 1.19 in suburban subjects during the lean and harvest seasons, respectively. Concerning energy and the remaining nutrients, their NAR varied from 0.21 to 0.81. Finally, the MAR of pregnant women in both areas during the two seasons was under 0.75. In addition, the MAR of urban and suburban pregnant women according to season was not significantly different.

**Table III: Percentage of pregnant women consuming each food group**

| | Urban (n=135) | | Suburban (n=116) | | | Total (251) |
|---|---|---|---|---|---|---|
| **Food groups [n (%)]** | LP (n = 66) | HP (n = 69) | LP (n = 45) | HP (n = 71) | *P-value* | |
| Cereals and starchy roots | 66 (100) [a] | 69 (100) [a] | 45 (100) [a] | 71 (100) [a] | NS | 251 (100) |
| Pulses (beans, peas) | 16 (24.24) [a] | 16 (23.18) [a] | 06 (13.33) [a] | 14 (19.71) [a] | NS | 52 (20.71) |
| Nuts and seeds | 23 (34.84) [a] | 26 (37.68) [a] | 12 (26.66) [a] | 25 (35.21) [a] | NS | 86 (34.26) |
| Dairy | 07 (10.60) [a] | 03 (4.34) [a] | 01 (02.22) [a] | 05 (07.04) [a] | NS | 16 (6.37) |
| Flesh foods | 57 (86.36) [a] | 65 (94.20) [a] | 41 (91.11) [a] | 63 (88.73) [a] | NS | 226 (90.03) |
| Eggs | 00 (00) | 00 (00) | 00 (00) | 00 (00) | - | 00 (00) |
| Vitamin A-rich dark green leafy vegetables | 48 (72.72) [a] | 42 (60.86) [a] | 29 (64.44) [a] | 48 (67.60) [a] | NS | 167 (66.53) |
| Other vitamin A vegetables and fruits | 14 (21.21) [a] | 16 (23.18) [a] | 07 (15.55) [a] | 15 (21.12) [a] | NS | 52 (20,71) |
| Other vegetables | 19 (27.53) [a] | 30 (43.47) [b] | 13 (28.88) [a] | 27 (38.02) [b] | NS | 89 (35.45) |
| Others fruits | 04 (6.06) [a] | 10 (14.49) [a] | 01 (02.22) [a] | 06 (08.45) [a] | NS | 21 (8.36) |

The results are expressed as n (%). [a, b, c] Values in the same row with unlike superscript letters are significantly different using $\chi 2$ test or Fisher's exact test (*P-value* < 0.05), LP: lean period, HP: harvest period, NS: not significant.

The daily energy and nutrient intakes according to season and locality are presented in Table IV. Protein, vitamin $B_1$ and mineral (Mg and P) intakes decreased significantly ($p \leq 0.01$)

Furthermore, the results in figure 1 show that the distribution of daily energy intake from macronutrients in pregnant women is compliant with dietary recommendations.

**Table IV: Daily energy and nutrient intake of pregnant women**

| | Urban (n = 135) | | Suburban (n = 116) | | |
|---|---|---|---|---|---|
| **Daily intake** | SP (n = 66) | HP (n = 69) | SP (n = 45) | HP (n = 71) | *P-value* |
| Energy (Kcal) | 1482 ± 670.8 [a] | 1700 ± 553.9 [ab] | 1405 ± 432.0 [a] | 1753 ± 852.6 [b] | 0.0114 |
| Carbohydrate (g) | 259.4 ± 116.6 [a] | 302.3 ± 99.95 [ab] | 257.0 ± 84.65 [a] | 318.1 ± 144.7 [b] | 0.0054 |
| Fat (g) | 32.62 ± 23.09 [a] | 35.40 ± 22.57 [a] | 24.08 ± 17.03 [a] | 32.51 ± 25.43 [a] | NS |
| Proteins (g) | 37.97 ± 16.55 [a] | 47.90 ± 18.17 [b] | 41.23 ± 12.09 [b] | 49.19 ± 24.00 [b] | 0.0014 |
| Vitamin A (µg) | 654.3 ± 728.5 [a] | 500.3 ± 565.4 [ab] | 332.3 ± 459.9 [b] | 436.0 ± 510.9 [ab] | 0.0289 |
| Vitamin $B_1$ (mg) | 0.56 ± 0.29 [a] | 0.71 ± 0.26 [b] | 0.63 ± 0.20 [ab] | 0.73 ± 0.42 [b] | 0.0101 |
| Vitamin $B_2$ (mg) | 0.58 ± 0.74 [a] | 0.62 ± 0.60 [a] | 0.45 ± 0.17 [a] | 0.55 ± 0.38 [a] | NS |
| Vitamin $B_3$ (mg) | 4.97 ± 3.04 [a] | 6.27 ± 3.71 [ab] | 5.25 ± 1.83 [ab] | 6.56 ± 4.01 [b] | 0.0194 |
| Vitamin $B_9$ (µg) | 137.4 ± 96.61 [a] | 161.9 ± 90.94 [a] | 128.7 ± 61.07 [a] | 166.6 ± 120.1 [a] | NS |
| Vitamin C (mg) | 71.55 ± 102.2 [a] | 73.01 ± 93.85 [a] | 59.35 ± 79.70 [a] | 77.87 ± 88.82 [a] | NS |
| Ca (mg) | 549.8 ± 330.3 [a] | 663.8 ± 315.7 [a] | 579.3 ± 293.8 [a] | 604.2 ± 302.4 [a] | NS |
| Fe (mg) | 15.18 ± 9.85 [a] | 18.17 ± 11.50 [a] | 16.29 ± 7.45 [a] | 16.24 ± 8.26 [a] | NS |
| Mg (mg) | 242.9 ± 127.3 [a] | 299.5 ± 104.9 [b] | 268.3 ± 82.32 [ab] | 317.1 ± 170.8 [b] | 0.0055 |
| P (mg) | 645.0 ± 330.3 [a] | 803.2 ± 286.2 [b] | 701.3 ± 221.7 [ab] | 836.9 ± 418.8 [b] | 0.0031 |
| Zn (mg) | 5.87 ± 3.65 [a] | 6.71 ± 2.37 [a] | 5.78 ± 1.87 [a] | 6.91 ± 3.48 [a] | NS |

The results are expressed as mean ± SD. [a, b.] Values in the same row with unlike superscript letters are significantly different using ANOVA test followed by Newman-Keuls' multiple comparison test (*P-value* < 0.05), LP: lean period, HP: harvest period NS: not significant.

**Table V: Nutritional adequacy of pregnant women**

| Energy and nutrients | RDA | Urban (n = 135) LP (n = 66) | Urban (n = 135) HP (n = 69) | Suburban (n = 116) LP (n = 45) | Suburban (n = 116) HP (n = 71) | P-value |
|---|---|---|---|---|---|---|
| | | NAR | | | | |
| Energy (Kcal) | 2743 | 0.54 | 0.61 | 0.51 | 0.63 | - |
| Carbohydrate (g) | 175 | 1.48 | 1.72 | 1.46 | 1.81 | - |
| Proteins (g) | 71 | 0.53 | 0.67 | 0.58 | 0.69 | - |
| Vitamin A (µg) | 800 | 0.81 | 0.62 | 0.41 | 0.54 | - |
| Vitamin $B_1$ (mg) | 1.4 | 0.4 | 0.5 | 0.45 | 0.52 | - |
| Vitamin $B_2$ (mg) | 1.4 | 0.41 | 0.44 | 0.32 | 0.39 | - |
| Vitamin $B_3$ (mg) | 18 | 0.27 | 0.34 | 0.29 | 0.36 | - |
| Vitamin $B_9$ (µg) | 600 | 0.22 | 0.26 | 0.21 | 0.27 | - |
| Vitamin C (mg) | 55 | 1.3 | 1.32 | 1.07 | 1.41 | - |
| Ca (mg) | 1000 | 0.54 | 0.66 | 0.57 | 0.6 | - |
| Fe (mg) | 27 | 0.56 | 0.67 | 0.6 | 0.6 | - |
| Mg (mg) | 400 | 0.6 | 0.74 | 0.67 | 0.79 | - |
| P (mg) | 700 | 0.92 | 1.14 | 1 | 1.19 | - |
| Zn (mg) | 14 | 0.41 | 0.47 | 0.41 | 0.49 | - |
| MAR* | | $0.58 \pm 0.25^{a}$ | $0.64 \pm 0.23^{a}$ | $0.57 \pm 0.26^{a}$ | $0.63 \pm 0.23^{a}$ | NS |

*The results are expressed as mean ± SD. [a, b] Values in the same row with unlike superscript letters are significantly different using ANOVA test followed by Newman-Keuls' multiple comparison test, NAR: nutrient adequacy ratio, MAR: mean adequacy ratio, NAR value were calculated using mean group energy or nutrient intake, RDA: Recommended dietary allowances, LP: lean period, HP: harvest period, NS: not significant.

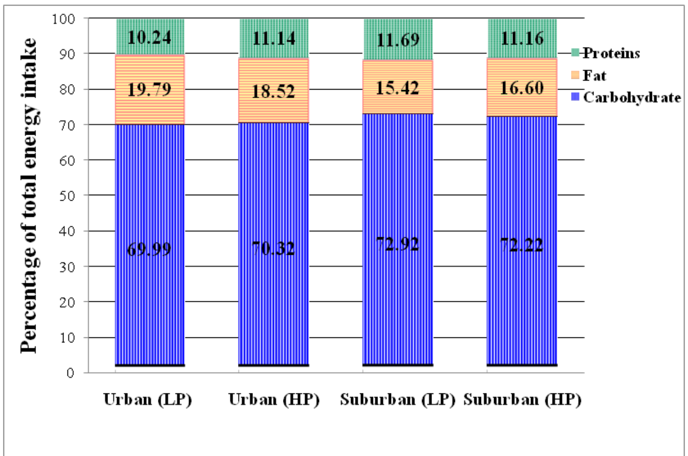


**Figure 1: Distribution of daily energy intake from macronutrients in pregnant women**

LP: lean period, HP: harvest period. According to WHO/FAO recommendations, energy from proteins, fat and carbohydrate should be from 10 to 15%; from 15 to 30% and from 55-75% respectively of the daily total energy intake

## Discussion

The nutritional status of pregnant Togolese women is not fully studied. This study is the first to explore nutritional adequacy and dietary diversity of suburban and urban pregnant women throughout the two critical periods of food availability during the year in the north of the country. According to the cutoffs (22-24 cm) defined by FANTA/USAID (Tang *et al*., 2013); the mean MUAC values of the surveyed pregnant women in the two localities indicate that they don't suffer from acute malnutrition. However, food intake data obtained during the study highlight the poor dietary intakes of pregnant women. This situation suggests that these women are food insecure. Indeed, the mean daily number of meals taken by subjects during the lean period was less than three. This situation confirms previous reports indicating that food consumption of the Togolese population is in general, characterized by two daily meals (lunch and dinner). Besides, this daily meal number is often reduced to one during food lean periods especially in rural areas in the north of the country (FAO, 1999). The food consumption pattern of our subjects was similar to most of developing countries in which the majority of pregnant women do not have a snacking habit (Alam *et al*., 2003; Sholeye *et al*., 2014). The consumption by food group shows that cereals, starchy roots and vitamin A-rich dark green leafy vegetables are more eaten even if a non-negligible proportion of subjects have consumed flesh foods during the previous day. Indeed, meat, poultry, fish and fish products are eaten in such small quantities that their contribution to the protein requirements of these pregnant women is low. Nutrient-dense food items like fruits and dairy products are also less consumed. Although eggs are not pregnancy food taboos for ethnic groups in our sample, they were not at all consumed by subjects. The same observations were made by other investigators studying the food intake of women during pregnancy in sub-Saharan countries (Nti *et al*., 2002; Huybregts *et al*., 2009). According to previous studies, hedonics reasons, the food properties, physical environment including financial constraints, physical health, nutrition and health knowledge are the barriers to or facilitators of egg consumption by humans (Van den Heuvel *et al*., 2015). In our context, financial constraints may be the main reason for no consumption of eggs amongst surveyed pregnant women. Finally, most of the respondents in our sample have a monotonous food consumption pattern consisting of a little less than five food groups. As a result, these pregnant women had a poor food intake habit.

Energy intakes reported during this study are below the optimal dietary reference. During the food lean period, mean energy intakes of urban and suburban pregnant women were reduced. The values are unfortunately under the critical energy requirement limit of 1500 Kcal/day proposed for pregnant women by Putet (1997). This situation is harmful to the pregnant woman and her fetus. Indeed, although energy sparing adaptive responses are possible in pregnant women, long-term energy deficiency stress during pregnancy impairs fetal development leading to intrauterine growth retardation and low birth weight. This situation can also predispose the fetus to metabolic diseases in child and adulthood (Prentice and Goldberg, 2000; Watson and McDonald, 2007). During the harvest period, on the contrary, energy intake of surveyed pregnant women has increased in both areas. However, it remained under the optimal energy needs for pregnancy. Energy intakes of our subjects are also lower than those of their counterparts in Koho and Karaba villages (Burkina Faso) (Huybregts *et al*., 2009). This situation can be explained not only by their food intake patterns but also by the reduction in crop production due to climatic irregularities in the region that year. Energy intake results of subjects were, however, consistent with nutrient intake data on Nigerian and Thai pregnant women (Oguntona and Akinyele, 2002; Sukchan *et al*., 2010; Sholeye *et al*., 2014). Concerning macronutrient intakes, it is important to note that carbohydrate intakes were suboptimal while protein and fat intakes were low. In addition, energy contributions from proteins, carbohydrate and fats are well balanced throughout the two seasons of the survey. Nevertheless, a slight supplementary intake of fat and protein-rich foods can improve caloric intake and fat-soluble vitamin absorption in these women.

Vitamin C and phosphorus intakes were relatively higher than other vitamin and mineral intakes. Intakes of minerals such as zinc, iron, calcium, and magnesium were also less than recommended values. These results are in agreement with previous reports on the nutritional status of pregnant women in low and middle-income countries (Huybregts *et al*., 2009; Bae *et al*., 2010; Sholeye *et al*., 2014). Adequate vitamin $B_9$ intake is very important for women of reproductive age and pregnant women's health (Lisa, 2010). However, the NAR of this nutrient in surveyed subjects is very low. Since preconception folic acid and iron supplement usage in women of reproductive age is not common in our conditions, these deficiencies could be partially corrected early during pregnancy by antenatal dietary supplement programs. Unfortunately, the majority of pregnant women in our sample have started going to antenatal care consultation from the second trimester of pregnancy, after the formation of the fetal neural tube.

This study has some limitations which should be mentioned. First, the study was a hospital based survey and consequently results obtained did not take into account the food intake of all pregnant women in the two localities during the survey. Besides, the 24-hour dietary recall used to estimate nutrient intake can be considered as a weakness since this method is subject to memory lapses and does not describe habitual food intake behavior. However, the survey was carried out by trained nutritionists and standardized methods were used during the study.

## Conclusion

Overall, the pregnant women surveyed have energy and nutrient intakes below recommended dietary allowances. There were no marked differences between urban and suburban pregnant women's dietary intakes. A substantial increase in the number of daily meals to 3 or 4 per day and sufficient consumption of fruits, dairy products, eggs, fish and meat are necessary to cover all nutritional requirements of pregnant women in the Bassar prefecture. In addition, reproductive age women in these regions should be counseled to begin antenatal care consultation early during the first trimester of pregnancy in order to take maximum advantage of folic acid and iron supplementation.

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