



Impacts of Eating Behaviors of Pregnant and Lactating Women on the Nutritional Status of Children under 6 Months in the Lake-Chad Region

**Abdel-Aziz Ousmane Mahamat¹, Marie Modestine Kana Sop^{1*},
Himeda Makhoulouf² and Marlyne-Joséphine Mananga^{1,3}**

¹*Department of Biochemistry, Faculty of Science, University of Douala (Food Science & Nutrition),
P.O.Box 24157, Douala, Cameroon.*

²*Nutrition and Food Technology Department, Ministry of Public Health of Chad, Chad.*

³*University of Yaoundé I, Faculty of Science, Department of Biochemistry, P.O.Box 812 Yaoundé,
Cameroon.*

Authors' contributions

This work was carried out in collaboration among all authors. Author AAOM designed the study and wrote the first draft of the manuscript performed the field work the statistical analysis. Author MMKS managed the literature searches wrote the protocol edit the text of the manuscript and translate the document in English. Author HM managed the analyses of the study and supervise the field survey. Author MJM contributed to the edition and chemical analyses. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJTDH/2020/v41i1830378

Editor(s):

(1) Dr. Giuseppe Murdaca, University of Genoa, Italy.

Reviewers:

(1) Judith Okoth, Jomo Kenyatta University of Agriculture and Technology, Kenya.

(2) Ebissa Bayana Kebede, Nursing, Jimma University, Ethiopia.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/61924>

Original Research Article

Received 20 September 2020

Accepted 26 October 2020

Published 11 December 2020

ABSTRACT

Background: Malnutrition causes real problems, especially for the survival and growth of children on the one hand and for the health of pregnant and lactating women on the other.

Purpose: The purpose of our study is to evaluate the impact of pregnant and lactating women's eating behaviors on the nutritional status of children under 6 months in the Lake Chad Region.

Methods: A cross-sectional, descriptive and analytical study of 380 patients including 106 pregnant women 137 lactating women and 137 children under 6 months of age identified in few hospitals and

*Corresponding author: Email: kanamod@yahoo.com;

health centers in the Lake Chad Region was conducted from October 1 to November 30, 2017, using a questionnaire administered to pregnant and lactating women after their consent. The 24-hour recall and the frequency of consumption of the food groups allowed us to evaluate the food intake of the surveyed women. The nutritional status of mothers and children was assessed by anthropometric and biochemical measures. The data was analyzed using the SPSS version 20 software. The Chi-square test allowed us to establish the correlations between the different variables at a significance level set at 5%.

Results: This study found that only 8.5% and 10.9% of pregnant and lactating women respectively had satisfactory dietary diversity scores. The exclusive breastfeeding rate was 11.7% and the immediate initiation rate for breastfeeding after delivery was 50.4%. The children had 19% wasting, 31.4% stunting, 34.3% underweight and 56.4% anemia. Respectively, 34% and 29% of pregnant and lactating women were malnourished; 17% and 10.2% were at risk of malnutrition, with 60.6 % and 50% prevalence of anemia respectively.

Conclusion: The modifiable factors that significantly influenced the nutritional status of children were: maternal feeding behaviors such as low dietary diversity scores and daily meals lack of hygiene and sanitary follow-up, underweight and presence of children anemia in mothers.

Keywords: Food behavior; pregnant and lactating women; nutritional status; children; lake Chad region; Chad.

1. INTRODUCTION

Adequate nutrition is fundamental to maintain good health and optimum human performance. Inappropriate feeding leads to malnutrition. Malnutrition causes real health problems, in particular for the survival and growth of children and for the health of pregnant and lactating women [1]. Malnutrition in children is a global health problem contributing to increased morbidity and mortality rates which slow intellectual development, reduces working capacity and even increases the risk of chronic disease in adulthood [2].

The nutritional status of children is closely linked to that of their mother. The most critical period of her development is the first 1000 days (from conception. during her mother's pregnancy until her two years of age). This means that malnutrition can start as early as in the fetal stage, if the mother herself is malnourished and cannot provide enough nutrients to the fetus due to a non-optimal diet. The damage to the physical growth, the immune system and the development of the brain suffered by the child during this period is generally irreversible [3].

According to the FAO (2017) there were 815 million undernourished people in the world, including 22.7% in sub-Saharan Africa. While 2 billion of people were deficient in essential micronutrients like iron and vitamin A [4]. About 155 million of children under 5 were stunted, 52 million were wasted, 20 million were underweight at birth, and 613 million of women of reproductive age were anemic worldwide [5].

In Africa, 220 million people suffer from a caloric deficiency, of which 58 million children under five were stunted, 13.9 million were wasted, and 163.6 million children and women childbearing age were anemic [6]. In the Chad Republic, around 3.4 million people were affected by food insecurity, or 25% of the population [7]. Among them 26.2% of children under 5 who suffered from stunting, 20% underweight, 11.9% wasting and 68.6% anemic [8].

The Lake Region is one of the 23 regions of the Chad Republic, where the prevalence of global acute malnutrition in children under 5 years old is estimated at 12.2%, and chronic malnutrition or stunting estimated at 36%. higher than the prevalence at national level. The situation is alert according to the WHO classification, with the thresholds above 30% [7]. The percentage of children fed according to optimal infant and young child feeding practices is only 22% in the Lake Region [9].

In the Chad Republic, the most frequent nutritional problems affecting children, pregnant and lactation women are: protein-energy malnutrition and micronutrient deficiencies (vitamin A deficiency, iodine deficiency and iron deficiency anemia). Those most affected are children of preschool age and pregnant and breastfeeding women. Food insecurity and malnutrition are linked to recurrent food crises in the Sahelian strip Poverty and poor education levels of women are very limiting to good nutrition [7]. The risk of premature birth and birth low birth weight children are very high in women with iron deficiency anemia [2,4]. The essential

nutrients and energy needs of the child increase from birth to reach their maximum between 3 and 8 months where the intake of breast milk tends to decrease, [6]. Some non-communicable diseases including malnutrition, trauma, cardiovascular and metabolic diseases are also major causes of morbidity and mortality, with malaria, acute respiratory infections, diarrheal diseases and malnutrition being more frequent [10].

A deficiency of the pregnant and lactation women in vitamin A and iron, for example, predisposes them and their children to iron deficiency anemia which will have negative repercussions on the fetus and subsequently on its nutritional status and during childhood [10].

Several studies showed positive association between lack of care during the pregnancy and low birth weight [11]. This predisposes and exposes those children in this Region to malnutrition like in many Regions of the Chad, making it a major public health problem in Chad. Despite the efforts of the Chadian government and its partners, the rate of malnutrition in pregnant and lactating women and children aged from the birth to 59 months remains a concern. It is with a view to contributing to the reduction of malnutrition in this Region that this work has been carried out. The general objective of our work was "to assess the impact of the eating habits of pregnant and breastfeeding women on the nutritional status of children under 6 months in the Lake Chad region".

2. MATERIALS AND METHODS

2.1 Study Setting

The study was carried out in the Lake Chad Region. More specifically at (Bol Regional Hospital, Bol Urban Health Center, Baga-sola District, Baga-sola Urban Health Center, Dar-es-Salam Health Center "Refugee Camp", District of Liwa, Liwa Urban Health Center, Ngouri District and Ngouri Urban Health Center), where pregnant and lactating women, including children under 6 months of age, were surveyed.

2.2 Population and Type of Study

This was a cross-sectional, descriptive, analytical study that took place from October 1 to November 30, 2017. The target population is made up of pregnant women, breastfeeding

women and their children under 6 months of the Lake-Chad Region.

2.3 Sampling

2.3.1 Selection criteria

2.3.1.1 Inclusion criteria

Were included in this study, patients or women who met the following criteria: willing lactating women with children aged less than 6 months living on the study side and present during the day of the survey who accepted to participate to the study after reading and signing the informed consent; pregnant women present at the health center for ante-natal consultation or for other purposes or objectives during our visits.

2.3.1.2 Non-inclusion criteria

The following people were excluded from this study: all the lactating or pregnant women who refused to participate in the study; breastfeeding women whose children had more than 6 months.

2.4 Sample Size

For breastfeeding women and their children under 6 months of age, the Lorentz, 1975 formula was used for sample size calculation. The prevalences were those of the exclusive breastfeeding rate of 7.3% according to SMART-2016, and those of pregnant women, calculated with the same formula, from the rate (4%) of women who gave birth by the assistance of qualified personnel in the Lake Chad Region (EDST, 2015). The calculation gave the minimum sample sizes of 104 for breastfeeding women, and 59 for pregnant women. However, the number has been increased to 137 and 106 respectively for breastfeeding women and pregnant women, for greater reliability, bearing on the fact that, the sample size gave the minimal figure for the sampling:

$$N = \frac{Z\alpha^2 \times p(1-p)}{d^2}$$

N = Minimum sample required.

Z α = 95 % confidence interval i.e. 1.96.

d = Margin of error at 5 % (standard value 0.05).

1 - p = q (complement) .

P = Prevalence. P1 = 7.3% ; and P2 = 4%

$$N1 = \frac{1,96^2 \times 0,073 (1 - 0,073)}{0,05^2} = 104 ;$$

$$N2 = \frac{1,96^2 \times 0,04 (1 - 0,04)}{0,05^2} = 59$$

The calculation gave the minimum sample sizes at 104 for lactating women (N1), and 59 for pregnant women (N2). However, the number of women has been increased to 137 and 106 in our study for greater reliability considering N1 and N2 as minimal figures.

2.5 Data Collection during Study

A structured and coded questionnaire was used to collect data on anthropometric, biochemical data, 24-hour reminders and eating habits, socio-demographic, cultural, economic, health characteristics and on eating and hygiene behaviors. These data were obtained mainly by measurement and interview. After explaining to mothers the importance of the study, the procedure to follow, and having obtained their consent, the anthropometric parameters (age, weight, height and BP) were taken immediately. The patients were subjected to a questionnaire which made it possible to study their eating behavior and frequency of food consumption. Also, the hemoglobin level was assessed after the blood test.

2.6 Measurement Weights

Electronic scale for babies (EBSA Kinlee-20, Germany) accurate to 0.01kg (maximum weight 20 kg and 0.05 precision) and an electronic scale for women (SOEHNLE, maximum weight 150 kg and precision 0.1 g) were used for weight measurements. Children or to lie on the platform without touching anything while mothers height were measured stood without shoes and heavy clothing. The weights were observed and recorded in the questionnaire form.

2.7 Measurement of Sizes

The height gauge was used for size or length measurements. Respectively, children and mothers were made and to lie /to stand without shoes on the horizontal and vertical platform. Their heels, buttocks, shoulders and back of head were made to touch the upright part of the meter, with their feet parallel. The head was held comfortably erect in the same horizontal or vertical plane as the external auditory meter. Size measurement was then read and recorded in the survey form.

2.8 Nutritional Status of Children's Assessment

DHS, and WHO standard references were used for anthropometric measurements data analyzes

[2,10]. Weight for age, height for age and weight for height Z-scores were used for nutritional state indicators. When one of their anthropometric indices were abnormal (less than -2 z-scores below the average reference), children were considered as malnourished. If their weight-for-height index was below -2 z-scores compared to WHO standard reference, they were reported to be wasted. Weight-for-height index below -3 z-scores below the average reference had severe emaciation. Those considered to be underweight had their weight-for-age index was below -2 z-scores below the average reference. If their weight-for-age index was below -3 z-scores below the average reference they were classified as severe underweight. Children height for age index was below -2 z-scores below the average reference were considered to be stunted.

2.9 Assessment of the Nutritional Status of Mothers

The size and weight were used to determine the body mass index (BMI) according to the formula, weight (Kg) divided by the square of height (m^2) (Kg/m^2). BMI categories were selected in accordance with WHO recommendations. The definition for overweight was taken as $BMI \geq 25$ and $<30 kg/m^2$, and obesity as $BMI \geq 30 kg/m^2$ (Obesity I: BMI between 30 and 35 kg/m^2 , Obesity II: BMI between 35 and 40 kg/m^2 ; Chronical Obesity: $IMC \geq 40$).

2.10 Feeding Practices Assessment

- **The 24-hour recall** which focused on breakfast, lunch and dinner without forgetting snacks consumed the day before the survey, we asked subjects to recall of all food consumed in a 24 hours before.
- **Frequency of meal consumption** per day which covered the number of times the food was eaten on the eve of the survey; the frequency was classified as follows: Low frequency <3 meals per day; Normal frequency 3 meals per day; high frequency > 3 meals per day.
- **The type of foods mentioned/known** by the women, which made it possible to know the foods recommended and not recommended for pregnant or breastfeeding women in order to offer nutritional advice.

- **Dietary diversity scores:** it focused on the number of food groups consumed by an individual the day before the survey [4]. For this assessment diversity scores were defined as follows: Low score with consumption ≤ 2 food groups; Average score, consumption between 3 and 4 food groups ; satisfactory Score consumption of ≥ 5 food groups.

expressed as percentages, means \pm standard deviations of the mean.

3. RESULTS AND DISCUSSION

Distribution of the study population in the Lake Region

The 380 patients in this study, included 106 pregnant women, 137 breastfeeding women and 137 children under 6 months of age, who met our eligibility criteria. These populations were recruited in different departments of the Lake Region, notably Bol, Baga-sola, Liwa and Ngouri. Socio demographic and cultural characteristics of mothers and children surveyed in the Lake-Chad Region in October and November 2017. Table 1 presents the socio-demographic and cultural characteristics of the women and children surveyed.

2.11 Statistical Analysis

The statistical Package for the Social Sciences (SPSS) version 17 was used to determine the mean and standard deviation of the height and weight measurements. In order to compare the values of different parameters by gender, χ^2 test was used at the significance level ($p < 0.05$). The questionnaire answers on breastfeeding and complementary feeding practices were interpreted using percentiles. Results were

Table 1. Sociodemographic and cultural characteristics of mothers and children surveyed in the Lake-Chad Region

Variables	Pregnant women (N = 106) Frequency (%)	Breastfeeding women (N = 137) Frequency (%)
Average age group (years)	Average (24.5\pm5.6)	Average (24.1\pm5.7)
< 18	10.4	7.3
18 – 24	37.7	47.4
25 – 30	42.5	31.4
> 30	9.4	13.9
Educational level		
Out of school (non educated)	77.4	62.8
Primary	14.2	21.9
Secondary	5.7	13.1
High school	2.8	2.2
Professional status		
Inactive (with job)	95.3	92.0
Active (no job)	4.7	8.0
Pregnancy follow-up (CPN)		
Yes	90.6	76.6
No	9.4	23.4
Children under 6 months of age (N = 137) Frequency (%)		
Age group (months)	Average(2.67\pm1.58)	
0 – 3	52.6	
4 – 6	47.4	
Gender		
Male	51.1	
Female	48.9	
Vaccination Statut		
Yes	83.9	
No	16.1	

During the survey, there were 137 children under 6 months, with a slight predominance of 51.1% male against 48.9% female. The predominance of the male sex has been observed in certain studies, notably the Hanane's study in 2008 in Morocco, who found 51% of male children and 49% female. The ages of the children surveyed ranged from birth to 6 months with an average of 2.6 ± 1.5 months [12]. The dominant age group was that of children aged from birth to 3 months with 52.6% of children, against 47.4% for children aged 4 to 6. According to the vaccination status in this survey, 83.9% of children had received at least one dose of the vaccine, compared to only 16.1% of children who had never been vaccinated. Vaccination coverage in the study was quite good, because the Government had made the Expanded Program on Vaccination one of its priorities by adopting the health development plan. These results were higher than those observed nationally in 2015, where only 32% of children had been vaccinated [9].

3.1 Dietary Behavior of Women Surveyed in the Lake-Chad Region

3.1.1 Usual diet of the surveyed women

Table 2 below shows what women consume in the usual way in the Lake-Chad Region. The study on eating habits highlighted the different dishes, sauces, snacks and drinks usually consumed by targeted women. The results show that the meals of these women generally consist of a very simple base (cereals, tubers and legumes) accompanied by a sauce. Throughout the Region, the cereals consumed were mainly corn, rice and wheat. The roots, tubers and legumes encountered were cassava, taro, potato, sweet potato, peanut, bean and soy. These dishes were mostly accompanied by various sauces and were mainly their source of energy. Depending on the season, the basic ingredients were fresh or dried okra and tomatoes. On the other hand, it should be noted that many leaves were used for making sauces.

The survey also concerned children under 6 months comprising 137 children, with a slight predominance 51.1% male against 48.9% female. The predominance of the male sex has been observed in certain studies, notably the Hanane's study in 2008 in Morocco, who found 51% of male children and 49% female [12]. The ages of the children surveyed ranged from 0 to 6 months with an average of 2.6 ± 1.5 months.

Feeding patterns and nutrition status of pregnant and lactating women surveyed in the Lake-Chad R are summarized in Table 2.

Fruits were poorly consumed

Fruits play an important role in the diet of mothers and children but few of them eat them. The nature of the fruit very much depends on the season. The most frequently encountered fruits were orange, sweet banana, mango, guava and papaya.

Fresh or dried meat (generally beef and goat) and fish (fresh, dried or smoked) were consumed enough by the respondents. Proteins were a little more frequently provided by meat and fish which is used in the composition of sauces.

These surveyed women consumed too much tea. It is known that the consumption of tea and non-nutritive substances such as clay bring antinutritional constituents, which reduce the iron bioavailability and were responsible of the occurrence of anemia [13,14]. Few of them consume milk. However milk is rich in calcium, phosphorus and proteins, it strengthens the bones to support the weight of the mother and the ossification of the fetus. Proteins increase blood volume during pregnancy, promote the formation and regeneration of the placenta. This study also revealed that the proportion of women surveyed who washed their hands before eating was 58.5% and 51.1% respectively among pregnant and lactating women. This saved them from contact with pathogens. Almost half of the women did not practice this rule of hygiene, and they were more infected with pathogens. The hand is the main mode of transmission of microorganisms. These infections can be reduced by applying hygienic rules such as washing and disinfecting the hands. Hand washing, according to Semmelweis's work, has been recognized for over a century as an effective infection prevention measure.

The frequency of meal consumption per day and the dietary diversity score of the women surveyed in the Lac-Chad Region Figs. 1 and 2 show the frequencies of daily meal consumption and dietary diversity scores among the women surveyed. It follows from Fig. 1 that 56.6% of pregnant women and 50.4% of breastfeeding women surveyed eat three (3) times a day. Indeed, in Chad families eat the morning meal (breakfast), the afternoon and the evening. In addition, respectively 31.1% and 34.3% of these

Table 2. Foods frequencies of pregnant and lactating women surveyed in the Lake-Chad region

Items	Breastfeeding women Frequency (%)	Pregnant women Frequency (%)
Usually consumed dishes		
Corn balls	46.4	51.9
Rice	23.2	25.4
Pasta (macaroni, Spaghetti.)	15.6	13.2
Pape	26.5	6.6
Beans	12.5	2.8
The sauces		
Okro (Abelmoschus esculentus)	48.2	43.4
Tomatoes (Solanum lycopersicum)	23.2	26.4
Fermented vegetables (kawal)	25.5	14.1
Vegetables and leaves	12.5	9.4
Soup (fish or meat)	10.3	6.6
Snacks		
Bread	18.5	13.2
Donut	16.0	14.4
Fruits, vegetables	12.5	13.2
Cassava and white sweet potato	16.0	6.6
Drinks		
Tea	51.9	75.4
Milk	24.3	19.8
Coffee	10.3	5.6
Sweets	6.6	7.5
Drinking water sources		
Pump water	80.0	66.0
Tap water	18.5	27.4
Well water	1.5	6.6
Hand washing		
Yes	58.5	51.1
No	6.6	15.3
Sometimes	34.9	33.6

women (pregnant and breastfeeding) benefit from less than three (> 3) meals a day. These women all come from households with low family incomes. And about 12.3% and 15% respectively of pregnant and lactating women receive more than three meals a day. Sometimes they can also snack between meals. The amount of energy an individual can consume each day depends on the number of meals, the amounts consumed at each meal and the energy density [15].

Fig. 2 shows the distribution of the surveyed women according to the dietary diversity score. It appears that more than half 59% of the surveyed women have an average DDS that is to say that the number of food groups consumed is between [3,4]. On the other hand, the proportion of women with a satisfactory dietary diversity score ≥ 5 groups represents around 10%, and almost

30% had low DDS. This can be explained, among other things, by the difference in economic category of the study population, food insecurity in this region, culture and tradition play an important role in the food imbalance, certain foods were not consumed and also the population is not informed about the concept of a balanced diet.

Food practices of surveyed children under 6 months old in the Lac-Chad Region are summarized in Table 3.

Table 3 presents the eating practices of the 137 surveyed children. It appears from this table that, among the mothers questioned, only 11.7% of them had exclusively breastfed their children with breast milk, without introduction of other liquids until the day of the survey, against 88.3% who had given various liquids in addition to breast

milk, the mothers had not complied with the recommendations of the WHO and UNICEF which recommend, exclusive breastfeeding until the age of 6 months. However, exclusive breastfeeding helps to reduce the rate and the occurrence of diarrhea and pneumonia which were the two main causes of child deaths. It allows the child to grow well and to avoid falling into malnutrition [16].

Early breastfeeding prevents neonatal mortality. Early initiation of breastfeeding could prevent up to 20% of neonatal deaths by serving as the baby's first "vaccination" against infections and diseases [17]. According to UNICEF and WHO recommendations, all infants should be breastfed from the first minutes to one hour after delivery because early breastfeeding provides colostrum to the baby, teaches the infant to suckle effectively, optimizes the development and growth of the newborn, and increases the duration of breastfeeding [18]. Unfortunately, 60.7% of mothers surveyed do not comply with this recommendation, thus exposing their children to malnutrition. A total of 58% of mothers gave sugar or hot water instead of colostrum to the children.

The main reasons given by mothers for the introduction of water or other solid or liquid foods at the same time or in place of breast milk were; insufficient milk supply, nipple pain, and the feeling that the baby is thirsty. These difficulties have also been identified by several studies in Africa and in the world [19,20]. Mother and child illnesses were also an important reason for the addition of other foods than the breast milk. This phenomenon has also been observed in a lot of research [21,22]. Problems with lack of advice on exclusive breastfeeding were also the reason for introducing other foods before the age of six months [23].

Regarding the results presented, on the mother's knowledge about exclusive breastfeeding, 100 mothers out of 137 or 73% affirmed that they did not know the benefits of breast milk for the child and the duration of blade. The mothers surveyed for this study were unaware of the recommendations of UNICEF and WHO, and this has implications for the nutritional status of their children. This finding could be explained by the lack of communication and insufficient training of health workers on the benefits of exclusive breastfeeding and infant and young child feeding [24].

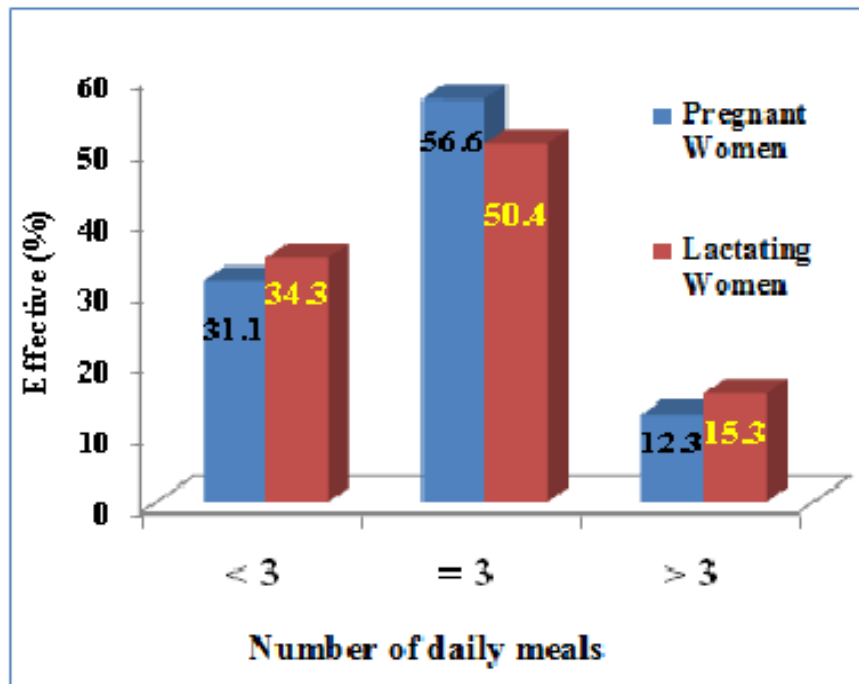


Fig. 1. Frequency of daily meals

Table 3. Eating practices of children under 6 months of age surveyed in the Lac-Chad Region

Characteristics	Effective (n)	Percentage (%)
Breastfeeding modes		
EBF	16	11.7
NEBF	121	88.3
Introduction to breastfeeding		
few minutes after birth	69	50.4
Few hours after birth	56	40.9
Few days after birth	12	8.8
Type of food given to the child		
Hot water	79	57.6
Porridge	62	45.2
Millet / blue water	47	34.3
Artificial milk	22	16.0
Sugar water plus honey	19	13.8
Family dishes/meals	18	13.1
Cow butter	12	8.8
Reasons		
Custom	44	56.0
The child is crying	13	16.5
Health problemes	12	15
Child is thirsty	10	12.5
Knowledge of mother on EBF		
No idea	100	73.0
6 months	31	22.6
3 months	2	1.5
others	4	2.9

EBF= Exclusive Breast-feeding; NEBF = Nonexclusive Breast-feeding

3.2 Anthropometric and Nutritional Status of Children and Mothers Surveyed in the Lac-Chad Region

Table 4 presents the distribution of the surveyed children and mothers according to the anthropometric indicators measured (W / H, W / A and H / A in children and BP (brachial perimeter) and BMI in mothers). This table shows that 19% of children suffered from wasting according to the W / H index expressed in Z-score, with 5.8% in severe form and 13.2% in moderate form. And according to the W / A index, 31.4% of children were underweight overall, 9.5% the severe form and 21.9% in the moderate form. Similarly, according to the H / A report, it appears that 34.3% of children were stunted, 8.8% in severe form and 24.5% in moderate form. Indeed, out of 137 children surveyed, 116 of them presented at least one of the latent forms of malnutrition, i.e. a prevalence of 84.6%. This could be explained by the non-observance of good infant feeding practices and the poor nutritional status of their mothers. A high frequency of child malnutrition would have

negative consequences on the health of this population as well as on the families' economy.

In mothers, following Brachial Perimeter (BP) measurements, we had 34% of malnourished pregnant women and 17% at risk of malnutrition, that is to say with BP <210 mm. They tend to give birth to premature or low and / or low birth weight infants, and they were at increased risk of morbidity and mortality.

This table also shows that, 29.2% of malnourished breastfeeding women and 10.2% were at risk of malnutrition according to the Brachial Perimeter measurement. In addition, the calculation of the (BMI) of these mothers showed that, 40.1% of them were underweight. The high prevalence of malnutrition observed in the present study could be linked to the food insecurity which affected this region, the low index of dietary diversity and the lack of knowledge of women on nutrition.

Prevalences of anemia in children and mothers surveyed in the Lake Chad region are reported in Table 5.

Table 4. Anthropometric indices of children and mothers surveyed in the Lac-Chad Region

Anthropometric indicators of children	Severe		Moderate		Global		Normal	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Wasting (W / H)	8	5.8	18	13.2	26	19.0	11	81.0
Stunting (W/ A)	13	9.5	30	21.9	43	31.4	94	68.6
Underweight (H / A)	12	8.8	35	25.5	47	34.3	90	65.7
Anthropometric indicators of mothers	Pregnant women				Breastfeeding women			
	Effective (n)		Percentage (%)		Effective (n)		Percentage (%)	
Arm perimeter								
Malnourished	36		34.0		40		29.2	
At risk	18		17.0		14		10.2	
Normal	52		49.0		83		60.6	
Body mass index								
Underweight	-		-		55		40.1	
Normal status	-		-		62		45.3	
Overweight	-		-		20		14.6	

W / H = Weight-for-Height Index; W / A = Weight-for-Age; H / A = Height-for-Age

Table 5. Anthropometric nutritional State of the children and the mothers surveyed in the Area of Lake-Chad

Anthropometric indicators of the children	Severe		Moderate		Total		Normal	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Waisting(W/H)	8	5.8	18	13.2	26	19.0	11	81.0
Stunting (W/A)	13	9.5	30	21.9	43	31.4	94	68.6
Underweih(H/A)	12	8.8	35	25.5	47	34.3	90	65.7
Anthropometric indicators of the mothers	Pregnant women				Lactating women			
	Manpower (n)		Percentage (%)		Manpower (n)		Percentage (%)	
Brachial perimeter								
Malnutries	36		34.0		40		29.2	
At the risk	18		17.0		14		10.2	
Normal	52		49.0		83		60.6	
Body Mass Index								
Under weight	-		-		55		40.1	
Normal weight	-		-		62		45.3	
Over weight	-		-		20		14.6	

W / H = Weight-for-Height Index; W / A = Weight-for-Age; H / A = Height-for-Age

Prevalences of anaemia in the children and the mothers surveyed in the Area of Lake-Chad are shown on Fig. 2.

In Fig. 2, it is observed that, the prevalence of anemia in pregnant women was high, with the total percentage of 60.6% in all its forms. More especially, 30.3% for mild anemia, 24.2% for moderate and 6.1% for severe anemia respectively. In lactating women, the prevalence of anemia was 50% in all its forms. And the prevalence among children was 56.4% in all its forms. Those values were above the 40% emergency threshold set by the WHO. The high prevalence of anemia among respondents could be linked to the lack of health coverage, low consumption of iron-rich foods and high consumption of tea. According to the WHO,

severe iron deficiency anemia increases perinatal mortality, the risk of preterm deliverance and fetal hypotrophy. Severe untreated anemia may be responsible for hypoxemia and fetal distress. The risks of preterm deliverance and low birth weight were 2.5 times higher in women with iron deficiency anemia compared to others, showing the risk of malnutrition on child development [14,25].

4. FACTORS INFLUENCING THE NUTRITIONAL STATUS OF CHILDREN UNDER 6 MONTHS IN THE LAKE REGION

Relationship between mothers' eating habits and the nutritional status of children under 6 months of age.

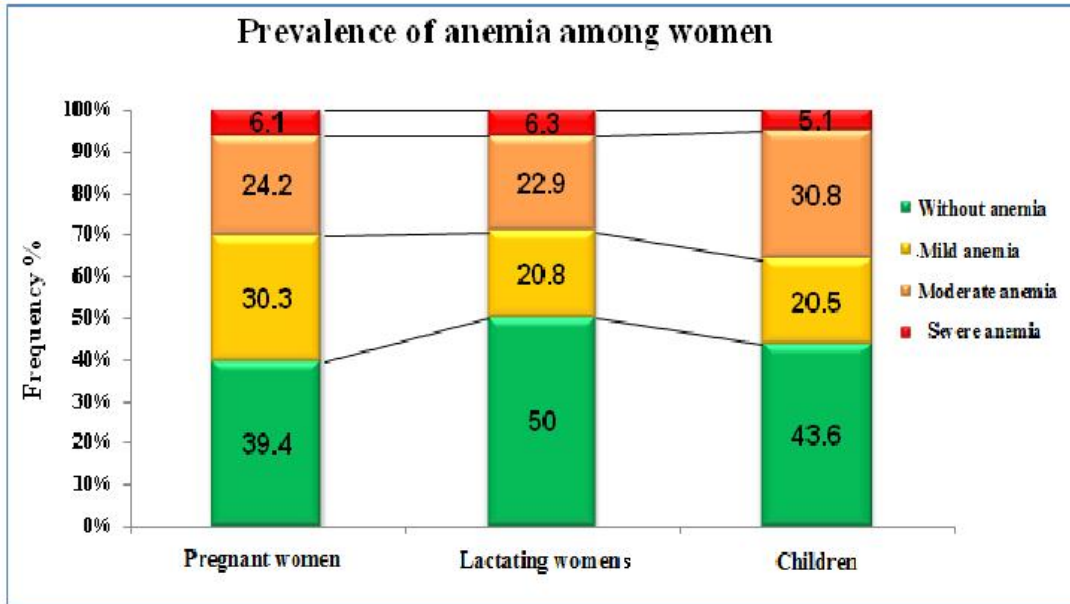


Fig. 2. Prevalences of anemia in the children and the mothers surveyed in the Area of Lake-Chad

Table 5 presents the relationship between mothers' eating habits and the occurrence of malnutrition in children under 6 months of age. It can be seen in this table that all three factors significantly influence the nutritional status of the child.

The study observed a highly significant link ($P = 0.001$) between the daily meal frequency (DMF) of mothers and the nutritional status of children. We noted that, children whose mothers feeding contained less than 3 meals a day were the most affected by malnutrition at 69.2%, against 11.5% of children whose mothers benefited from more than 3 meals a day.

This could be explained by the fact that the amount of food ingested by the mother plays an important role in the energy supplied to the child. When caloric intake or nutritional balance does not meet the body's needs, it runs the risk of malnutrition.

With regard to the quality of the mother's diet, there was also a statistically significant difference ($p = 0.001$) between the mother's dietary diversity score (DDS) and the nutritional status of the child. It was observed that, for 65.4% of malnourished children, their mothers' DDS were low, and that for 11.5% of malnourished children, their mothers' DDS were satisfactory, meaning

that the children had personal problems not linked to their mothers directly.

The association between washing the mother's hands before feeding the child and the occurrence of malnutrition in the child was statistically significant ($p = 0.001$). Generally in 28.6% of malnourished children, their mothers do not wash their hands before feeding them, compared to only 7.1% of malnourished children including mothers who regularly wash their hands before feeding.

Body hygiene is an essential practice, which greatly contributes to reducing infections by pathogenic microorganisms, in particular by limiting contamination between individuals. And poor food hygiene practices increase the risk of food-borne infections like diarrhea, which in turn worsens the nutritional state, which weakens the immune system.

Relationship between mothers' feeding behavior and the nutritional status of children under 6 months of age in the Lake Chad region.

The results reported on Table 6 showed that late breastfeeding was very significantly associated with the occurrence of malnutrition ($p < 0.05$). Children who were breastfed lately were the most affected by malnutrition with a frequency of

923 % while children who were breastfed immediately after childbirth were less affected 7.7 %. Generally, if the newborn is not breastfed within minutes following their birth, he received various fluids instead of breast milk that can put him in contact with pathogens. This is a factor in the occurrence of malnutrition in children.

Regarding the choice of breastfeeding mode, 20.7% of malnourished children were those who were not exclusively breastfed versus 6.2% who were exclusively breastfed. According to this observation, there is no statistically significant difference between the mode of breastfeeding and the occurrence of malnutrition ($P > 0.05$). The statistically insignificant link between the choice of breastfeeding mode and the nutritional status of children can be explained by the low frequency of children exclusively breastfed with breast milk in our sample. It is likely that there is an association that our sample did not allow us to observe. In fact, the non-exclusive breastfeeding of infants under 6 months of age is

an important cause of diarrhea and tends to decrease milk production in the mother, which promotes the onset of malnutrition. Furthermore, Laingo in Madagascar observed a significant association ($p < 0.05$) of breastfeeding mode (EBF) on the nutritional status of children [26].

The relationship between the nutritional status of mothers and that of children under 6 months in the Lac-Chad Region are reported on Table 8.

Table 8 below presents the relationships between the nutritional status of mothers and that of children under 6 months of age. The study finds a highly significant relationship ($p = 0.001$) between the nutritional status of the mother and the occurrence of malnutrition in children. We note that malnourished mothers have malnourished children, in 61.5% of cases, against 23.1% of mothers in good nutritional status who have malnourished children. Also anemia in the mother and the occurrence of

Table 6. Relation between the food practices of the mothers and the nutritional statute of the children of less than 6 months in the Area of Lake-Chad

Factors of risks		Malnourished (W/H < - 2 Z score)	Normo-nourished (W/H > -2 Z score)	Test of Khi ²
		Percentage	Percentage	
DMF	< 3 meals	69.2	26.1	p = 0.001
	= 3 meals	19.2	57.7	
	> 3 meals	11.5	16.2	
FDS	Weak	65.4	21.6	p = 0.001
	Average	23.1	67.6	
	Satisfying	11.5	10.8	
Washing of the hands	Yes	7.1	92.9	p = 0.001
	Not	28.6	71.4	
	Sometimes	32.6	67.4	

DMF = Daily Meals Frequencies; FDS = Food Diversity Score; W / H = Weight-for-Size

Table 7. Behavior of mothers in terms of child feeding associated with the nutritional status of children under 6 months of age in the Lake Chad region

Risk factors	Malnourished (W/H < - 2 Z score)	Normo-nourished (W/H > -2 Z score)	Test de Khi ²
	Percentages	Percentage	
Breastfeeding Mode			
EBF	6.2	93.8	p = 0.167
NEBF	20.7	79.3	
Initiation to breast feeding			
Few minutes after	7.7	56.8	p = 0.001
Few hours after	46.2	36.0	
Few daysafter	46.2	7.2	

EBF = Exclusive Breastfeeding; NEBF = Non-exclusive Breastfeeding

Table 8. Relation between the nutritional status of the mothers and that of the children of less than 6 months in the area of Lake-Chad

Factors of risks	Malnourished (W/H < - 2 Z score)	Normo-nourished (W/H > -2 Z score)	Test of Khi ²
	Percentage	Percentage	
Arm perimeter			
Malnourished	61.5	21.6	p = 0.001
At risk	15.4	9.0	
Normal	23.1	69.4	
Anemia status			
Normal	8.3	91.7	p = 0.002
Mild anaemia	20.0	80.0	
Moderate anaemia	45.5	54.5	
Severe anaemia	100.0	0.0	

malnutrition in the child is statistically very significant ($p = 0.002$). It is found that the nutritional status of the child deteriorates with the severity of the anemia in the mother. The mothers with severe anemia their children were 100% malnourished, and the mothers with moderate anemia 45.5% of their children were malnourished and the mothers with mild anemia 20% of their children were malnourished. According to UNICEF (2014) a deficiency of the future mother in vitamin A and iron for example, predisposes her to iron deficiency anemia, which will have negative repercussions on the fetus and subsequently on its nutritional status.

Finally we can say that, the nutritional status of children under 6 months was closely linked to that of their mothers. The more the mother was malnourished, her child was malnourished and the more the mother anemic her child was malnourished and anemic.

Relation between the nutritional statute of the mothers and that of the children of less than 6 months in the area of Lake-Chad.

Table 8 below presents the relations between the nutritional statutes of the mothers and that of the children of less than 6 months. The study raises a highly significant relation ($p=0.001$) between the nutritional statute of the mother and which has occurred of malnutrition in the child. One notices that the mothers malnourished have children malnourished, in 61.5% of case, against 23.1% of the mothers nutritional in good condition who have children malnourished. Also anaemia in the mother and which has occurred of malnutrition in the child was statically very significant ($p = 0.002$). It was noted that the nutritional state of the child was degraded with the severity of anaemia in the mother. The

weakened mothers severe their children were to 100% malnourished, and the moderate weakened mothers 45.5% as of their children were malnourished and the weakened mothers light 20% as of the their children were malnourished. According to UNICEF (2014) a deficiency of the future mother in vitamin A and iron for example predisposes with a iron deficiency anaemia which will have negative effects over the fetus and thereafter on its nutritional state.

Finally we can say that, the nutritional statute of the children of less than 6 months was closely related to that their mothers. More the mother was malnourished, more her child was malnourished and affected by many forms of malnutrition (Table 8).

5. CONCLUSION

The general objective of this study was to assess the impact of the current eating behavior of pregnant and lactating women on the nutritional status of children under 6 months in the Lake Chad Region. It appears that the nutritional status of children under 6 months was negatively influenced by the poor eating and hygienic behavior of their mothers and their ignorance of good feeding practices linked to their low education level and poverty. The results showed that mothers' nutrition statuses were inadequate in quantity and quality, due to low dietary diversity scores, to low frequency of daily meals and to poor hygiene practices.

The prevalence of malnutrition in mothers and children under 6 months of age in this study was above the emergency threshold set by the WHO, with association to the high prevalences of anemia.

Exclusive breastfeeding was practiced only by a small proportion of mothers. And early initiation to breastfeeding was low. In view of these results, particular attention should be paid for the fight to reduce malnutrition in this Region.

Consequently, in order to reduce the rate of maternal and child malnutrition from this study, we especially suggest maternal education in for better health and nutrition. Particular importance must be given to the nutritional status of children under 6 months old in order to offer them a better life in their future. This is possible by putting all possible means to eradicate malnutrition true nutritional education of the population and mainly, women of reproductive age. It is recommended to develop a write food guide lines for optimal feeding of pregnant and lactating women. Integrated community outreach program on pregnant and lactating nutritional education combined to food and nutrition education to pregnant and lactating mother's in community and health care centres, after the training of community and health workers is also recommended.

CONSENT AND ETHICAL APPROVAL

Ethical approval and permission were obtained from the Ministry of Health of the Chad Republic. Informed, signed consent to participate in the study was obtained from all participating mothers or caregivers.

ACKNOWLEDGEMENT

The authors thanks all the pregnant and lactating mothers who accepted voluntarily to participate to this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Azzaoui F-Z, Ahami AOT, Khadmaoui A. Relationship between socioeconomic. Environmental factors and malnutrition: Cases of children aged 6 to 8 years from the Gharb plain (North West Morocco). *Antropo*. 2008;17:1-5.
2. WHO. Global data base on child growth and malnutrition. World Health Organization; 2012.
3. ACF. WASH 'Nutrition. Practical guide for a better nutritional impact thanks to the integrated WASH and Nutrition programs. Attention Humanitarian and Development Practitioners. 2017;164.
4. FAO. Regional overview of food security and nutrition. The link between conflict and food security and nutrition: building resilience for food security. *Nutrition and Peace*. 2017;116.
5. UNICEF / WHO / World Bank Group. Joint Child Malnutrition Estimates. Levels and Trends in Child Malnutrition: 2017 Key findings of the 2017 edition 6.
6. NEPAD. Nutrition assessment sheet for Africa. Actions and responsibility to promote nutrition. Sustainable Development. 2015;28.
7. Ocha-Tchad. Food security and malnutrition - humanitarian overview (as of October 31. 2015) OCHA. GAUL Comments; 2015.
8. SMART –TCHAD. Final Report of the National Nutrition and Retrospective Mortality Survey. Period: August - September. 2016;86.
9. EDST-MICS Demographic and Health Survey and with Multiple Indicators in Chad. 2015;53-77.
10. DHS (Demographic Health Surveys) Measure DHS Statcompiler; 2012.
11. UNDP. The education situation in Chad. 2014;23-34
12. Hanane Benhima. Assessment of the nutritional status of children in the city of Safi. 2008;116.
13. Dillon JC. Prevention of iron deficiency and iron deficiency anemia in the tropics. *Tropical Medicine*. 2000;60:83-91.
14. UNICEF. The Right to Healthy And Adequate Food For All! From Madagascar to Belgium. Nyhq-1229 / Pirozz. 2014;25.
15. Salanave B, De Launay C, Guerrisi C, Castetbon K. Breastfeeding rate at maternity and first month of the child. Results of the Epifane study. *Weekly epidemiological bulletin*. 2012;4:34-45.
16. Barros AF, Martorell R. Count down to 2015: a retrospective review of survey data from 54 countries: equity in maternal, newborn and child health interventions. *The Lancet*. 2012;379:201-212.
17. Begum K, Dewey K, Alive And Thrive. Insight. Impact of early initiation of exclusive breastfeeding on newborn deaths. 2010;6.

18. UNICEF. Monitoring progress in the area of mother and child nutrition: A priority in terms of survival and development. New York. United Nations Children's Fund. 2009;124.
19. Glover M, Waldon J, Manaena-Biddle H, Holdaway M, Cunningham C. Barriers to best outcomes in breastfeeding for Māori: Mothers' perceptions. *Whānauperceptions and services. Journal of Human Lactation.* 2009;25(3):307-316.
20. Tiwari R, mahajan PC, lahariya C. The determinants of exclusive breast feeding in urban slums: A community based study. *Journal of Tropical Pediatrics.* 2009;55(1): 49-54.
21. Otoo GE, Lartey AA, Pérez-Escamilla R. Perceived incentives and barriers to exclusive breastfeeding among periurban Ghanaian women. *Journal of Human Lactation.* 2009;25(1):34-41.
22. Alexander A, Dowling D, Furman L. What do pregnant low- income women say about breastfeeding. *Breast Feeding Medicine.* 2010;5(1):17-23.
23. Kamudoni PR, Maleta K, Shi Z, De Paoli MM, Holmboe-Ottesen G. Breastfeeding perceptions in communities in Mangochi district in Malawi. *Acta Paediatrica.* 2010; 99(3):367-372.
24. Goro A. Study of knowledge, attitudes and practices of mothers of children 0-24 months on exclusive breastfeeding in the city of Koro (Mopti) Mali; 2013.
25. Bondevik GT, Eskeland B, Ulvik R. Anaemia in pregnancy: possible causes and risk factors in Nepali women. *European Journal of Clinical Nutrition.* 2000;54(1):3-8.
26. Laingo R. Nutritional status of lactating women in the rural commune of Iarinarivo (Madagascar). 2007;2007:12-34.

© 2020 Aziz-Mahamat et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/61924>