

Evaluation of the nutritional status of children under 5 years old from farmers, fishermen and fish farmers in the northern areas of the Republic of Congo

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ABSTRACT: The objective of this study was to evaluate the nutritional status of children under 5 years old in the households of farmers, fishermen and fish farmers in the areas of Sangha, Cuvette, Cuvette-Ouest and Plateaux. The correlation between the nutritional status of the children and the main activities of the households was established by the anthropometric measurements of nutritional status from the weight/age/height indices. The results showed that the prevalence of the three types of malnutrition in children from 0 to 59 months were 9.8% for underweight, 19.2% for stunting and 8.9% for wasting. Nevertheless, they presented spatial variations in the studied areas. The malnutrition incidence was higher in girls in Cuvette, Cuvette-Ouest and Plateaux, compared to boys. In contrary to this, in Sangha the malnutrition incidence was detected higher in boys than in girls. The children of the households surveyed were victims of the three types of malnutrition. Overall, the main activity of the household surveyed had an influence on the nutritional status of the child. However, this influence varied according to the type of malnutrition.

Keywords: Children, Congo, malnutrition, nutritional status.

INTRODUCTION

Changes in the child's body dimensions give an idea about the health status of human body including the nutritional status. The improper or insufficient food intake affects the body's dimensions and leads to malnutrition which resulted in decreased supply of energy, protein and micronutrients for maintaining growth and development. As recommended by UNICEF (1998), there are three levels of causes of malnutrition:

1. The immediate causes (at the level of the individual) which relate to the insufficiency of the food and diseases.
2. The underlying causes (at the household level) which include food insecurity, insufficient care for vulnerable people and insufficient hygiene and environmental

health services;

3. The root causes (at the level of society) which are linked to food availability, management control of the organizational, financial and nutritional resources.

Nutritional status can be evaluated by diverse methods such as clinical, biological or anthropometric (WHO, 1986). The anthropometric method is an important tool in the monitoring and treatment of severely malnourished children (Pelletier, 1993; WHO, 1995). WHO therefore recommends raw data obtained on individual: age (A), weight (W), height (H) or brachial perimeter (BP) (WHO/FAO, 2003; FAO, 2007). Each of these variables provides information about a person because when putting together, they describe a person's nutritional status.

The following three indices commonly used weight/age (WAZ), length/age or height/age (HAZ) and weight/length or weight/height (WHZ) (De Onis and Habicht, 1996; WHO, 2006; Turk et al., 2013; Capon, 2018).

The weight/age indicator reflects both chronic and acute undernourishment hence the global malnutrition. The height/age indicator for chronic undernourishment or stunting while the weight/height indicator for acute undernourishment or emaciated persons (Cogill, 2003).

WHO (2010) estimates that 180 million children suffered from a stunting around the world and 20 million suffer every year in the severe form of wasting. Furthermore, every year, the malnutrition is responsible of at least one third of 8 million of children's death under 5 years old (Pivert, 2013). As matter of fact, several works on the evaluation of the nutritional status of children have been realized around the world and using anthropometric measurements (Li et al., 1999; Choudhury et al., 2000; Arnaud, 2004; Mbemba et al., 2006; Chowdhury et al., 2008; Elmotia, 2010; Dekkaki, 2014; Achouri et al., 2016a,b). Among these studies, there are those which established the relationship between the nutritional status of children and the parents' socioeconomic situation (Tee et al., 2002; Aranceta et al., 2003; Oninla et al., 2007; Bose et al., 2008; El Hioui et al., 2011). Other studies have put in evidence the major role of food and environmental factors in the growth gaps between the developed countries and the developing countries' children (Droomers et al., 1995; Quinn et al., 1995; Mei et al., 1998; Pelletier and Frongillo, 2003; Ergin et al., 2007). The child's nutritional situation may be influenced by certain exogenous factors as the main activity of the household (Mei et al., 1998). However, the scientific literature in our disposition has not related to the influence of the main activity of parents on the nutritional status of Congolese children.

Therefore, this study was undertaken to evaluate the nutritional status of children in the northern areas of the Republic of Congo. The correlation between the nutritional status of the children and the main activity of the household was established by anthropometric measurements from the weight/age/height indices.

MATERIAL AND METHODS

Material

In the present study, survey sheets, children' stadiometers and scales were used. The stadiometers used were those of the UNICEF model, making it possible to measure the lying or standing position, a length of 130 cm with graduations of 0.1 cm. Two types of scales was used: SECA brand electronic scales and UNICEF salter hanging scales.

Type of study

It was a cross-sectional study which consisted in

evaluating the nutritional status of children under the age of 5 years old. It included various households of farmers, fishermen and fish farmers in the departments of Sangha, Cuvette, Cuvette-Ouest and Plateaux. The study was conducted from March 10 to August 29, 2019

Type of variables

The following anthropometric variables were determined such as age, sex, height and the weight of each child under 5 years old in the households selected for the study. The main activity of the parents and the nutritional status of the mother were also taken into account.

Samples

Samples were taken by the simple random selection method and the survey was carried out on 214 children under the age of 5 years, including 109 boys and 105 girls.

Field work

In each household that was included in this study, parents caring for children were interviewed to obtain information on their ages. Then, anthropometric data (height, weight) were collected for each child obeying the conditions of the study. Anthropometric measurements were analyzed according to the WHO (2006) standard and the various malnutrition conditions were defined for z-score below -2 (Gibson, 1990; Mabossy-Mobouna and Mokemiabeka, 2018).

Statistical data processing and analysis

Data processing was carried out with SPSS version 20, ENA for Smart 2011 and Excel 2013 software. The quantitative variables are expressed as an average (\bar{x}) \pm standard deviation (s) while indicating the extreme values (minimum and maximum). The qualitative variables are expressed in figures and percentages. The χ^2 test has been used for the comparison of variables by Student's law with (k-1) degree of freedom and a significance threshold of 5%. ANOVA test was used to determine the influence of the variables on nutritional status of the children.

RESULTS AND DISCUSSION

Sex of the children surveyed

In the entire sample of households surveyed, it appears overall that the ratio (in %) of boys / girls was 109/105 or 50.93% of boys against 49.07% of girls (Table 1). With values of 29/28 in Cuvette, 25/25 in Cuvette-Ouest, 11/7

Table 1. Number of children surveyed by sex and by department.

Sex	Department				Total
	Cuvette	Cuvette-Ouest	Sangha	Plateaux	
Male	29 (50.88%)	25 (50%)	11(61.11%)	44 (49.44%)	109 (50.93%)
Female	28 (49.12%)	25 (50%)	7 (38.89%)	45 (50.56%)	105 (49.07%)
Total	57 (100%)	50 (100%)	18 (100%)	89 (100%)	214

Table 2. Distribution of children surveyed by age group and sex.

Age groups (months)	Sex		Total
	Boys	Girls	
< 6	2 (1.83%)	3 (2.86%)	5 (2.34%)
6-9	7 (6.43%)	13 (12.38%)	20 (9.34%)
10-11	5 (4.58%)	5 (4.76%)	10 (4.67%)
12-23	17 (15.59%)	20 (19.05%)	37 (17.29%)
24-35	27 (24.78)	16 (15.24%)	43 (20.09%)
36-47	35 (32.11%)	30 (28.57%)	65 (30.37%)
48-59	16 (14.68%)	18 (17.14%)	34 (15.90%)
Total	109 (100%)	105 (100%)	214 (100%)

in Sangha and 44/45 in Plateaux. In the whole sample, the sex ratio conforms to normal (range 0.7 to 1.2) according to the ENA software. These results were different from those obtained by Ateillah et al. (2012) in a survey conducted in Morocco. However, the Sangha department remarkably showed an under-representation of girls compared to boys (38.89% compared to 6.11%). The χ^2 test showed that there was no significant difference between children of either sex in the entire sample studied ($p>0.05$).

Age groups of the children surveyed

In all the households surveyed, the proportions of children by age group fluctuated between the ages of 6 months and 59 months (Table 2), regardless of the areas studied. The largest numbers of children aged 36 to 47 months (30.37%), 24 to 35 months (20.09%), 12 to 23 months (17.29%) and 48 to 59 months (15.90%). On the other hand, the lowest children surveyed were those of ages less than 6 months (2.34%), 10 to 11 months (4.67%) and 6 to 9 months (9.34%). However, the χ^2 test showed that there was no significant difference between children of either sex in the different age groups of the entire sample studied ($p>0.05$).

Prevalence of the different types of malnutrition in children from 0 to 59 months

Underweight (weight/age ratio)

The results in Table 3 showed that for the all four areas

surveyed, the prevalence of underweight among children 0 to 59 months was 9.8%. Where, one child out of ten were underweight with 6.1% in the moderate form and 3.7% in its severe form. In addition, the prevalence of global malnutrition was roughly the same among children of both sexes. These results were different from those obtained by Bose et al. (2008) and Achouri et al. (2016a,b) who noted more malnourished girls than boys. However, girls were more affected by moderate underweight, while boys were more affected by severe underweight. However, the χ^2 test showed no significant association between the sex of the children and the degree of underweight ($p>0.05$). The results in this study significantly different from those of the Congo Demographic and Health Survey (EDSC-II, 2012), which showed that 7% of children under the age of 5 were underweight.

Stunting of children (height/age ratio)

The prevalence of stunting in children aged from 0 to 59 months was 19.2%, either one child out of five suffered from stunting with 12.1% in the moderate form and 7.1% in its severe form. According to WHO health indicators, this level of stunting was very high (WHO, 1995; WHO, 2006). Furthermore, the prevalence of chronic malnutrition was higher in boys than in girls. The results in this study were similar to those reported by Tee et al. (2002), Oninla et al. (2007) and El Hioui et al. (2011). But they were different from those obtained by Chowdhury et al. (2008) and Achouri et al. (2016a,b). However, the χ^2 test showed no significant association between the children's sex and the degree of stunting ($p>0.05$). The results obtained were

Table 3. Prevalence of malnutrition by sex.

Parameters	Male (n=109)	Female (n=105)	Total (n=214)
Underweight (%)			
Overall (<-2 z-score)	10.1	9.5	9.8
Moderate (<-2 z-score and \geq -3z-score)	4.6	7.6	6.1
Severe (<-3z-score)	5.5	1.9	3.7
Stunting (%)			
Overall (<-2 z-score)	22.1	16.2	19.2
Moderate (<-2 z-score and \geq -3z-score)	13.8	10.5	12.1
Severe (<-3z-score)	8.3	5.7	7.1
Wasting (%)			
Overall (<-2 z-score)	8.3	9.5	8.9
Moderate (<-2 z-score and \geq -3z-score)	5.5	9.5	7.5
Severe (<-3z-score)	2.8	0.0	1.4

similar to those of the Congo Demographic and Health Survey (EDSC-II, 2012), which showed that 19% of children under the age of 5 years old suffered from chronic malnutrition.

Wasting of children (weight/height ratio)

The prevalence average level of wasting was 8.9% (about one child out of eleven suffered from wasting), with the prevalence of 7.5% in moderate form and 1.4% in severe form. These results were similar to those obtained by several doctors of Africa Congo in 2012. But here is an almost perfect parity between the girls and boys on the level of global wasting in the sample. However, no girl suffering from this severe malnutrition during the surveys and the rate of moderate wasting in girls was almost the double of boys. However, the χ^2 test showed no significant association between children's sex and the type of wasting ($p>0.05$). The results in this study were significantly different from those of the Congo Demographic and Health Survey (EDSC-II, 2012), which showed that 6% of children under the age of 5 years old suffered from wasting. In all type of malnutrition, the results differ from those obtained in 2015 by Gnimi and Kibangou in children aged 6 to 59 months from the departments of Brazzaville, Plateaux and Lékoumou.

Curves of the anthropometric indices compared to the normal curve

The anthropometric indices for height/age and for weight/age (Figures 2 and 3) showed that the problem of malnutrition in children was very serious and indicated a nutritional deficit. For these two types of malnutrition, the results in this study were similar to those of Mariko et al. (2009) in Mali. However, the emaciation curve (weight/height) displayed a position closer to the normal

curve (Figure 1). This indicated that the wasting situation was almost normal and confirmed the low prevalence of this type of malnutrition. Overall results obtained in this study are similar to those obtained by Gnimi and Kibangou (2015).

Factors influencing the prevalence of the different types of malnutrition

Prevalence of malnutrition in children under 5 by age group

The results presented in Table 4 indicate that the prevalence of global malnutrition (underweight) and stunting were zero in children less than 6 months. This finding may be due to the exclusive breastfeeding of these children. However, the limit of underweight to -1 z-score equals to 20% of children who can be easily switched to wasting. In addition, 20% of children in this age group suffered from moderate wasting, one in five reflecting a recent drop in food intake. Furthermore, 40% of children in this age group were on the verge of wasting despite their apparently normal condition.

The prevalence of severe and overall stunting increased sharply between 6 to 9 months due to chronic nutritional deficiencies or repeated exposure to infections. Other causes included, an unsuitable diet or a recent illness (diarrhea for example). This may be due to a change in the children's diet as they reach ages when they start receiving complementary foods (Mariko et al., 2009).

The malnutrition was very high in children aged 10 to 11 months, hence more than one in two children suffered from stunting or underweight and more than one in three children suffered from wasting. According to WHO health indicators, this level of malnutrition was very high (WHO, 2006; Mariko et al., 2009). Children from 12 to 23 months of age were more exposed to wasting (27%), about one in four children suffered from this malnutrition compared to

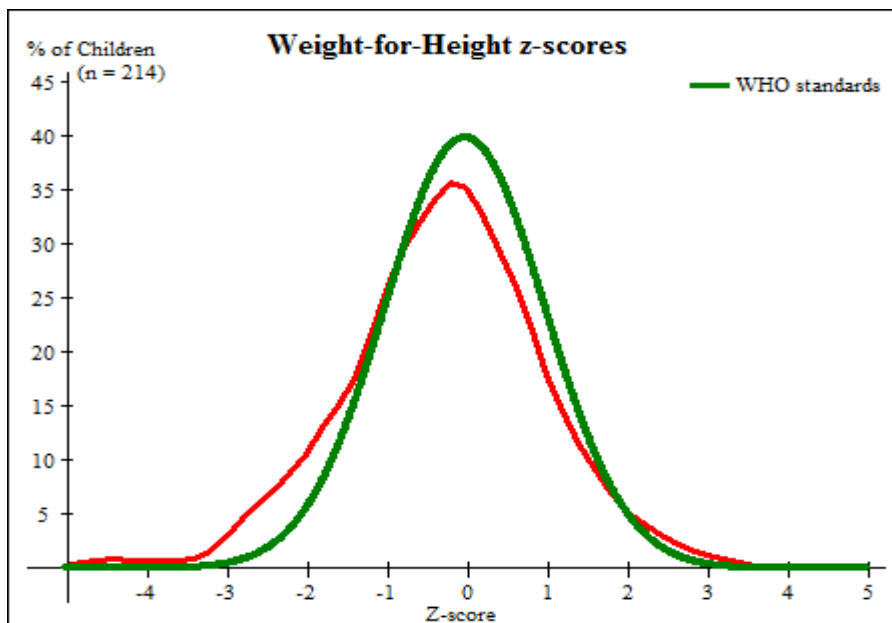


Figure 1. Distribution of standard deviation scores for weight –for- height of children under 5.

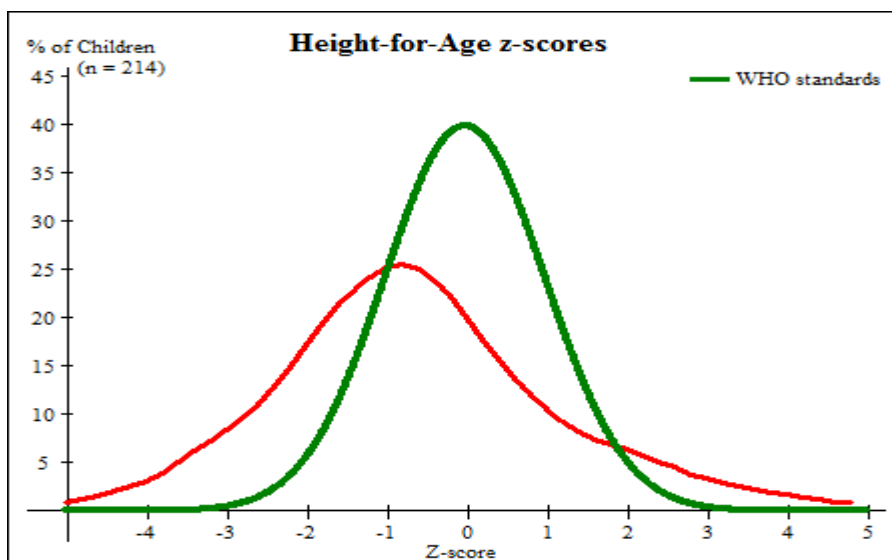


Figure 2. Distribution of standard deviation scores for height –for- age of children under 5.

one in six children for underweight (16.2%) and one in seven children for stunting (13.5%). These results also showed that beyond 11 months, the prevalence of chronic and wasting decreases as the child becomes older.

Overall, the rate of the different types of malnutrition goes up and down as the child's age increases. This observation was also made by Gnimi and Kibangou during a study on the nutritional status of children under 5 in the departments of Brazzaville, Plateaux and Lékoumou in 2015. The statistical analysis of these results showed that the

prevalence of each type of malnutrition was significantly associated with the age groups of children from 0 to 59 months ($p < 0.05$), except for underweight ($p > 0.05$).

Prevalence of malnutrition in children under 5 years of age by department and sex

As shown in Table 5, the results observed the prevalence of each type of malnutrition by department surveyed and

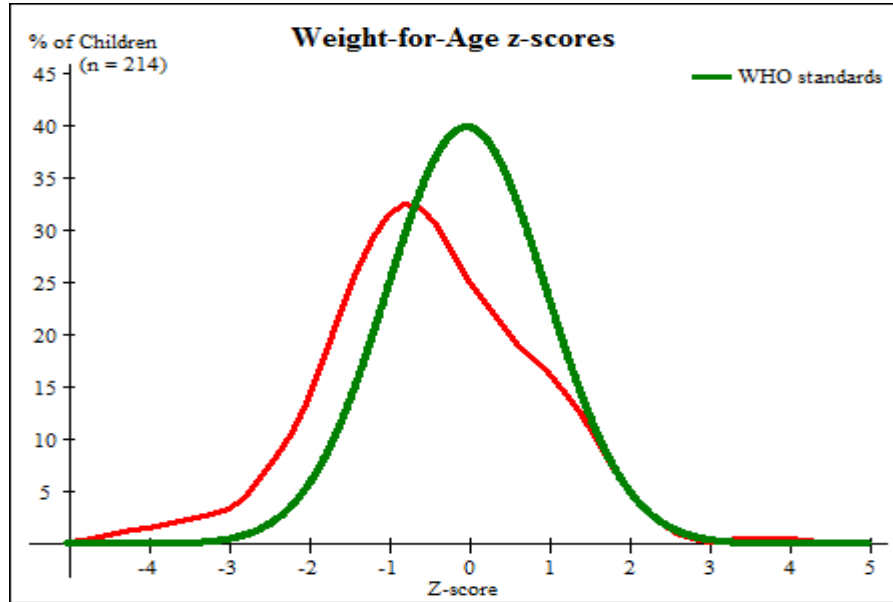


Figure 3. Distribution of standard deviation scores for weight-for-age of children under 5.

Table 4. Prevalence of malnutrition by age group of children 0-59 months (%).

Age (months)	Stunting (HAZ)			Wasting (WHZ)			Underweight (WAZ))		
	<-3 z-score	<-2 z-score and ≥-3 z-score	<-1z-score	<-3 z-score	<-2 z-score and ≥-3 z-score	<-1z-score	<-3 z-score	<-2 z-score and ≥-3 z-score	<-1z-score
< 6	0	0	0	0	20	40	0	0	20
6-9	10	0	10	0	0	15	5	5	0
10-11	10	30	30	0	30	10	10	30	20
12-23	8.1	5.4	21.7	2.7	24.3	8.1	10.8	5.4	24.5
24-35	7	16.3	32.6	2.3	4.7	11.6	2.3	9.3	30.2
36-47	6.2	15.4	20	0	1.5	24.6	1.5	3.1	29.2
48-59	2.9	14.7	35.3	2.9	0	11.8	2.9	0	35.3

by children’s sex.

Nutritional status of children in Cuvette: In Cuvette, the prevalence of different types of malnutrition was (3.5%) for wasting, (10.6%) for stunting and (5.3%) for underweight. So, one child in nine suffered from stunting against more than one child in twenty-eight for the wasting and one child in nineteen for underweight. However, 32.1% of children were on the verge of underweight and 17.9% were on the verge of wasting. The children were therefore given a diet that was inadequate for their nutritional needs or exposed to infections or inadequate living conditions. Girls were more affected by the moderate form and boys by the severe form.

Nutritional status of children in Cuvette-Ouest: In Cuvette-Ouest, the two most common types of malnutrition are stunting (16%) and wasting (18%) (one in six children

suffered from stunting and one in five children suffered from wasting). The prevalence of underweight was 10%, or one in ten children suffered from this malnutrition. However, 36% of children were on the verge of underweight and could be easily switched to wasting if these children’s food intake became insufficient or if these children had intestinal nutrient absorption problems. The prevalence was higher among many girls in Cuvette-Ouest, 12% versus 8% for underweight and 32% versus 4% for wasting compared to boys. Regarding chronic malnutrition, the prevalence was the same in both sexes regardless of its form, moderate or severe.

Nutritional status of children in Plateaux: In Plateaux, the three types of malnutrition were observed in all their forms in the households surveyed. Stunting was the most common (25.9%) (one in four children). Followed by underweight (10.1%) (one in ten children) and the wasting

Table 5. Prevalence of malnutrition among children from 0 to 59 months by department and by sex.

Parameters	Sex	Cuvette	Cuvette-Ouest	Plateaux	Sangha	Total
Underweight (%)						
Limit (<-1 z-score)	Girls	32.1	40	15.6	42.9	27.6
	Boys	27.6	32	18.2	27.3	24.8
	Together	29.8	36	16.9	33.3	26.20
Moderate (<-2 z-score and \geq -3z-score)	Girls	7.1	8	6,7	14,3	7,6
	Boys	0	4	6.8	0	3.7
	Together	3.5	6	6.7	5.6	5.6
Severe (<-3z-score)	Girls	0	4	2.2	0	1.9
	Boys	3.4	4	4.5	27.3	6.4
	Together	1.8	4	3.4	16.7	4.2
Stunting (%)						
Limit (<-1 z-score)	Girls	32.1	8	15.6	28.6	19
	Boys	34.5	40	18.2	36.4	29.4
	Together	33.3	24.0	16.9	33.3	24.3
Moderate (<-2 z-score et \geq -3z-score)	Girls	7.1	12	11.1	14.3	10.5
	Boys	3.4	12	22.7	18.2	14.7
	Together	5.3	12	16.9	16.7	12.6
Severe <-3z-score)	Girls	3.6	4	6.7	14.3	5.7
	Boys	6.9	4	11.4	0	7.3
	Together	5.3	4	9	5.6	6.5
Wasting (%)						
Limit (<-1 z-score)	Girls	17.9	20	11.1	42.9	17.1
	Boys	10.3	24	13.6	9.1	14.7
	Together	14.0	22.0	12.4	22.2	15.9
Moderate (<-2 z-score and \geq -3z-score)	Girls	3.6	32	2.2	0	9.5
	Boys	3.4	4	4.5	18.2	5.5
	Together	3.5	18.0	3.4	11.1	7.5
Severe (<-3z-score)	Girls	0	0	0	0	0
	Boys	0	0	2.3	18.2	2.8
	Together	0	0	1.1	11.1	1.4

had a low prevalence (4.5%) (one in twenty-two children). According to WHO health indicators, this level of stunting was very high. The prevalence levels were higher in girls in Plateaux (11.2% against 8.4% for underweight and 29.4% against 22.5% for stunting) in comparison with boys. However, the prevalence of wasting was higher in boys than in girls (6.8% compared to 2.2%).

Nutritional status of children in Sangha: In Sangha, the prevalence of the three types of malnutrition was very high. Regarding wasting, the prevalence level was 22.2% (one child in four). While, the rate of stunting was 22.3%, or one

in four children suffering from stunting. Finally, the prevalence of underweight was also 22.3%. In addition, children at the limit of each malnutrition rate was very high (22.2% for wasting and 33.3% respectively for underweight and stunting). The prevalence of underweight was higher in many boys than in girls.

Balance sheet: There were significantly high rates of stunting in children residing in Sangha (22.23%), Plateaux (25.9%), and Cuvette-Ouest (16%). On the other hand, the situation of the Cuvette department seemed relatively better, even if the prevalence was still high (10.6%). The

Table 6. Prevalence of malnutrition in children 0-59 months by parents' sector of activity (%).

sector of activity	Stunting (HAZ)			Wasting (WHZ)			Underweight (WAZ)		
	<-3 z-score	<-2 z-score à ≥-3 z-score	<-1z-score	<-3 z-score	<-2 z-score à ≥-3 z-score	<-1z-score	<-3 z-score	<-2 z-score à ≥-3 z-score	<-1z-score
Farmers (%)	8.1	15.3	20.7	0	8.1	19.8	4.5	8.1	24.3
Fishermen (%)	7.2	10.1	31.9	4.3	5.8	13.0	4.3	4.3	31.9
Fish farmers (%)	0	8.8	20.6	0	8.8	8.8	2.9	0	20.6

profile of global wasting varies slightly from one department to another. However, the high rates were observed in Sangha and Cuvette-Ouest, with 22.22% and 10.53% respectively. These rates remain high, as the severity of overall wasting was at a higher rate. The rate of malnutrition was higher in many girls in Cuvette, Cuvette-Ouest and Plateaux, compared to boys. In Sangha it was the opposite of that (more boys than girls). Overall, the rate of malnutrition was higher in Sangha and Plateaux than in Cuvette and Cuvette-Ouest. Concerning the three types of malnutrition, more boys suffered than girls (40,36% versus 35,23%). These results were different from those obtained by Baali (2012) and Dekkaki (2014) in Morocco. Overall, the χ^2 test showed that there was no significant association between the prevalence of malnutrition and the department of residence of the parents' children surveyed ($p>0.05$), nor with the children's sex ($p>0.05$). However, the ANOVA test indicated that the department of residence had an influence on the prevalence of underweight and wasting ($p<0.05$). Besides, the child's sex had a significant influence on the prevalence of stunting ($p<0.05$).

Prevalence of malnutrition in children under 5 by main activity sector of parents

Nutritional status of children from 0 to 59 months and main activity of parents: The results in Table 6 showed that the main activity of the household surveyed such as agriculture, fishing or fish farming had an influence on the nutritional status of children. However, the proportion of stunted children was very high among children of farmers (23.4%), of fishermen (17.1%) and of fish farmers (8.8%). So, stunting was greater among children of farmers and fishermen than those of fish farmers. In addition, the rate of children on the verge of stunting was very high in all the three types of households. Furthermore, the χ^2 test showed no significant association between the prevalence of stunting in children and the main activity performed by their parents ($p>0.05$).

The rate of wasting was quite high among fishermen's children (10.1%) compared to that of the farmers and fish farmers children. The χ^2 test showed no significant association between the wasting in children and the main activity performed by their parents ($p>0.05$).

Regarding underweight, the prevalence of children of farmers suffering from this malnutrition was (12.6%) higher than among fishermen's children (8.3%) and fish farmers' children (2.94%). The χ^2 test showed no significant association between the prevalence of underweight children and the main activity of their parents ($p>0.05$).

The ANOVA test indicated that the main activity of parents had no influence on the prevalence of the three types of malnutrition.

Nutritional status of children from 0 to 59 months by area and main activity of parents:

The results in Table 7 showed that underweight affected children of fishermen more (23.1%) and fish farmers of Sangha, farmers of Cuvette-Ouest (16.3%). Stunting was more common among children of farmers in Plateaux (29%) and Cuvette-Ouest (19%). It was also common among children of fishermen (13.1%) and fish farmers (20%) of Sangha, and fishermen of Plateaux (18.7%). Wasting was widespread among children of Plateaux farmers (22.6%), fishermen (23.1%) and fish farmers (20%) of Sangha. In addition, the high prevalence of severe wasting among children of Sangha fishermen could be in the origin of a high risk of mortality if treatment was not immediate. The χ^2 test showed that there was no significant association between the prevalence of different types of malnutrition in the children of farmers, fishermen and fish farmers, and the parents' department of residence ($p>0.05$).

Prevalence of malnutrition in children under 5 and the frequency of food consumption

The frequency of daily food consumption by children in the sample of fishermen, farmers and fish farmers in this study was 2.7 ± 0.64 . Analyzes had shown that among children who ate three times per day suffered from chronic malnutrition (15.1%), underweight (5.7%) and wasting (13.2%). So, this malnutrition had other causes such as quantity of the consumed food and their nutritional value. In addition, the χ^2 test showed that there was no significant association between the prevalence of malnutrition in the children of farmers, fishermen and fish farmers and the frequency of daily food consumption ($p>0.05$). The ANOVA test confirmed that the frequency of food consumption had no influence on the prevalence of the three types of malnutrition.

Table 7. Prevalence of malnutrition among children aged 0-59 months by parents' sector of activity and by department (%).

Parameters	sector of activity	Cuvette	Cuvette-Ouest	Plateaux	Sangha
Underweight (%)					
Limit (<-1 z-score)	Fishermen	41.4	50	12	46.2
	Fish farmers	12.5	35.3	0	0
	Farmers	12.0	35.5	20.0	-
Moderate (<-2 z-score et ≥-3z-score)	Fishermen	3.4	0	4	7.7
	Fish farmers	0	0	0	0
	Farmers	5	9.7	8.3	-
Severe (<-3z-score)	Fishermen	0	0	4	15.4
	Fish farmers	0	0	0	20.0
	Farmers	5	6.5	3.3	-
Stunting (%)					
Limit (<-1 z-score)	Fishermen	44.8	50	8	46.2
	Fish farmers	25.0	29.4	0	0
	Farmers	20.0	19.4	21.7	-
Moderate (<-2 z-score et ≥-3z-score)	Fishermen	6.9	0	12	15.4
	Fish farmers	0	11.8	0	20
	Farmers	5	12.5	20	-
Severe (<-3z-score)	Fishermen	3.4	0	6,7	7.7
	Fish farmers	0	0	11.4	0
	Farmers	10	6.5	9	-
Wasting (%)					
Limit (<-1 z-score)	Fishermen	6.9	50	12	23.1
	Fish farmers	0	11.8	0	20
	Farmers	30	25.8	13.3	-
Moderate (<-2 z-score et ≥-3z-score)	Fishermen	6.9	0	4	7.7
	Fish farmers	0	11.8	0	20.0
	Farmers	0	22.6	3.3	-
Severe (<-3z-score)	Fishermen	0	0	4	15.4
	Fish farmers	0	0	0	0
	Farmers	0	0	0	-

Other factors influencing the nutritional status of children

The age of the mother had a significant influence on the prevalence of stunting ($p < 0.05$). In addition, the Pearson test showed a negative weak correlation between the prevalence of stunting and the age of the mother. The ANOVA test showed that BMI (Body Mass Index) of the mother had an influence on the prevalence of wasting. Thus, the occurrence of wasting was strongly associated with the place of residence of the child's parents or the

nutritional status of the mother ($p < 0.05$). The relationship between the occurrence of wasting and the locality of residence could be due either to the availability and/or accessibility of food in the locality resulting in an insufficient food intake, or to children with problems of absorption of nutrients linked certain pathologies.

Conclusion

This study was undertaken to evaluate the nutritional

status of children in the northern areas of the Republic of Congo. The correlation between the nutritional status of the children and the main activities of the households was established by anthropometric measurements from the weight/age/height indices. In the present study, the three types of malnutrition in children from 0 to 59 months were observed. From the results, it was deduced that the households surveyed were victims of the nutritional problems relating to undernutrition to quite significant proportions. The rate of malnutrition was higher in many girls in Cuvette, Cuvette-Ouest and Plateaux, compared to boys. In Sangha it was the opposite of that. As matter of fact, living in a locality or a department seemed to have an influence on the level of underweight or wasting. The age of the mother had a significant influence on the prevalence of chronic malnutrition. The influence of the main activities of the households surveyed such as agriculture, fishing or fish farming was observed on the three types of malnutrition. However, no significant association has been observed between the nutritional status of children and the main activities of the households.

More in-depth research and on larger samples would be necessary in order to know the underlying causes of this nutritional situation and to be able to take concrete actions to resolve these nutritional problems.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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