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Research Article

Nutritional Status of Children Aged 6 to 59 Months of the Baka Pygmy Population in the East Region of Cameroon

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Abstract

Background: Malnutrition is a public health problem in the world and particularly in sub-Saharan Africa. The Baka tribe in Cameroon is a group of short stature people, living in the rain forests of the East region. The Baka children are at an increased risk of malnutrition due to their low level of education and the forest setting in which they live.

Objectives: To assess the prevalence, associated factors of malnutrition, and feeding habits in Baka children less than 5 years old.

Methods: A cross sectional study done from 1st January to 31st May 2018 in 9 villages in the Lomie sub-division in the East region of Cameroon. Anthropometric assessment (weight- to- height Z scores, weight- to- age Z scores and height - to - age Z scores, and the mid upper arm circumference) food consumption scores were assessed in 357 children enrolled in the Study.

Results: The sex ratio was 0. 96 with most children (83%) between the age range of 24 to 59 months. The prevalence of malnutrition was 82.1% (with at least one anthropometric Z score less than -2). We noted wasting in 17.4% of children, underweight and stunting in 40.1% and 75.6% respectively. The proportion of households with a poor food consumption score was 5.9% and 40.6% had a borderline score. Risk factors for wasting were a poor food consumption score for wasting, a household size of more than 9 persons for underweight and the presence of infectious diseases as diarrhoea and respiratory tract infections within the last 3 months for stunting.

Conclusion: The prevalence of malnutrition is very high in Baka children, in Cameroon. Efforts should be taken to reinforce information, education of the families on good nutritional practices. Measures to appropriately prevent and treat infectious diseases which significantly influence malnutrition in this population should be taken.

Keywords: *Anthropometry; Baka Children; Food Consumption Score; Malnutrition; Risk Factors*

Background

Malnutrition is a public health problem in the world with 159 million children less than 5 years old affected by growth retardation and 50 million suffering from acute malnutrition [1]. In sub-Saharan Africa, 39% of children less than 5 years old have growth retardation,

25% underweight, and 10% wasted [2]. In Cameroon, according to the MICS 2014 survey, 31.7% of children less than 5 years old had growth retardation, 14.8% underweight and 5.2% emaciated [3].

The immediate causes of malnutrition in children are either inadequate food intake, or infections; underlying causes are household food insecurity, inadequate care and unhealthy household environment and inadequate health services; and basic causes as household access to adequate quantity and quality of resources, inadequate human and material resources and sociocultural, economic and political context [4]. It has many consequences on the child (infections, death, learning difficulties, growth retardation, and low productivity at adult age) [5,6].

The Baka are a people of short stature, of the equatorial forest who live on hunting and artisanal farming. The decline in forest resources and the low literacy level increases the risk of malnutrition in Baka children. Few studies have been on the nutritional status in this population in Cameroon. We thus undertook this study to determine the prevalence of malnutrition, and identify the factors associated with malnutrition in Baka children aged 6 to 59 months in the East region of Cameroon.

Methods

Study setting and population

A cross sectional analytical study was conducted from 1st January to 31st May 2018 in 9 Baka villages in the Lomie sub-division in the East region of Cameroon.

In the municipalities where the Baka population is found, we randomly sorted the Lomie municipality where the study was done. The Lomié municipality is found in the Haut Nyong division situated 126 km from Abong Mbang, the head quarter. It has a surface area of 13 000 km^2 and a population of 19000 inhabitants with 64 villages, with the Baka as one of the four main tribes.

The climate is equatorial, with two rainy and two dry seasons within the year. The revenue activities of the population are mostly farming and small commercial activities.

Study design

After a written informed consent from the parents, the children were enrolled in the study and anthropometric parameters, socio-demographic data, past medical history of the children and feeding habits were noted on a questionnaire.

A local community agent helped in the translation into the local dialect.

Included in the study were children aged 6 to 59 months living in the study setting with at least one Baka parent, and children with chronic diseases, as well as those with congenital malformations which could have an impact on the nutritional status were excluded.

Sampling was consecutive and was done in all the households and in all the villages of the Lomie municipality.

Collection of data

Socio-demographic: Age of the child (months), sex, mother's age (years), mother's educational level, and household size.

Child's past history: Occurrence of diarrhoea/respiratory tract infections within the last 3 months.

Dietary survey: We assessed the frequency of consumption of different foodstuffs, food consumption score (FCS) adapted to the local foods [7].

	Food item (examples)	Food group	Weight
1	Maize, millet, rice, cassava, bread, roots and tubers, plantain	Cereals, tubers	2
2	Pulses, beans and nuts	Pulses	3
3	Vegetables, leaves	Vegetables	1
4	Fruits	Fruits	1
5	Fish, poultry, red meat and bush meat	Meat and fish	4
6	Milk and milk products	Milk	4
7	Sugar, honey and sweets	Sugar	0.5
8	Oil, butter and shea butter	Oil	0.5
9	Spices, tea, coffee, salt,	condiments	0

***Table 1**: Food consumption score.*

Score < 21: poor; 21.5 - 35: borderline; >35: Acceptable.

Anthropometry: Mid upper arm circumference, weight, height, weight/height Z score, weight/age Z score, height/age Z score.

Age: The age of the child was determined in months from the birth certificate or from a predefined calendar of local events, in case the birth certificate was not available, and the mother's age was calculated from that in the national identity card.

Weight: Each child was undressed and their shoes taken off, then put on a calibrated scale; the cursors were then adjusted until the equilibrium point was attained and the corresponding measurement read. The measurement was done to the nearest 0.1 kilogram.

Height: The height gauge was placed on a flat surface against a wall and the child's height taken; the child always bare-footed and the feet placed flat, and we made sure that the legs were straight and the calves, buttocks, scapulae and head were against the gauge; the sliding part of the gauge was then lowered to the child's head and the reading was done. The measurement was done to the nearest 0.1 cm.

Mid upper arm circumference: The left arm was relaxed along the body and the metre was put loosely around the arm, passing through the point equidistant from the shoulder to the elbow.

Data analysis

The data was keyed into Epi info and the analysis was done with the help of Epi info and WHO Anthro 3.2.2. Weight/Height, Weight/Age and Height/Age were used as indicators for the diagnosis of emaciation, underweight and growth retardation respectively (Z score <-2). We noted as malnutrition a Z score <-2; moderate malnutrition if the Z score was between -2 and -3 and severe if the Z score was less than <-3.

The Chi-square and Fisher statistical tests were used with a significant level of 0.05.

Ethical clearance

Written informed consent was obtained before enrolment in the study, and we had authorizations from the local administrative and traditional authorities of the Lomie municipality. Ethical clearance was obtained from the Institutional Ethical Review Board of the Faculty of Medicine and Biomedical Sciences, University of Yaounde I.

Results

Socio-demographic characteristics of the population

Out of 357 children, 298 (83%) were aged 24 to 59 months and the mean age of the children was 39.2 +/- 16.1 months. The ages ranged from 6 to 59 months, 175 (49.1%) were of the males and 182 (50.9%) were females giving a sex ratio of 0.96.

We noted that 29 (8.1%) had respiratory tract infections and/or diarrhoea in the past three months; 207 (58%) mothers were in the 20 - 30 age range, with an age range of 14 to 59 years and a mean age of 29.2 +/- 6.5 years.

We also observed that 262 (73.4%) mothers had primary education, and 324 (90.8%) lived in a couple; 353 (98.9%) had liberal professions, and 230 (64.4%) lived in a household size of 5 to 9 people.

Prevalence of malnutrition

Among the 357 children, 62 (17.4%) had a Weight/Height ratio <-2 Z score; 270 (75.6%) had a height/age index <-2 Z score; 143 (40.1%) had a weight/age index <-2 Z score and 293 had at least one of the three indices <-2 Z score, giving a global rate of malnutrition of 82.1%.

Anthropometry

Wasting

We noted that 62 (17.4%) children were wasted with 9% severe and 8.4% moderate. 42 (11.8%) were overweight and 21 (5.9%) obese. The weight/height Z score curve was dispersed symmetrically on either side of the WHO reference curve, respectively indicating equal proportions of wasting and overweight/obesity (Figure 1).

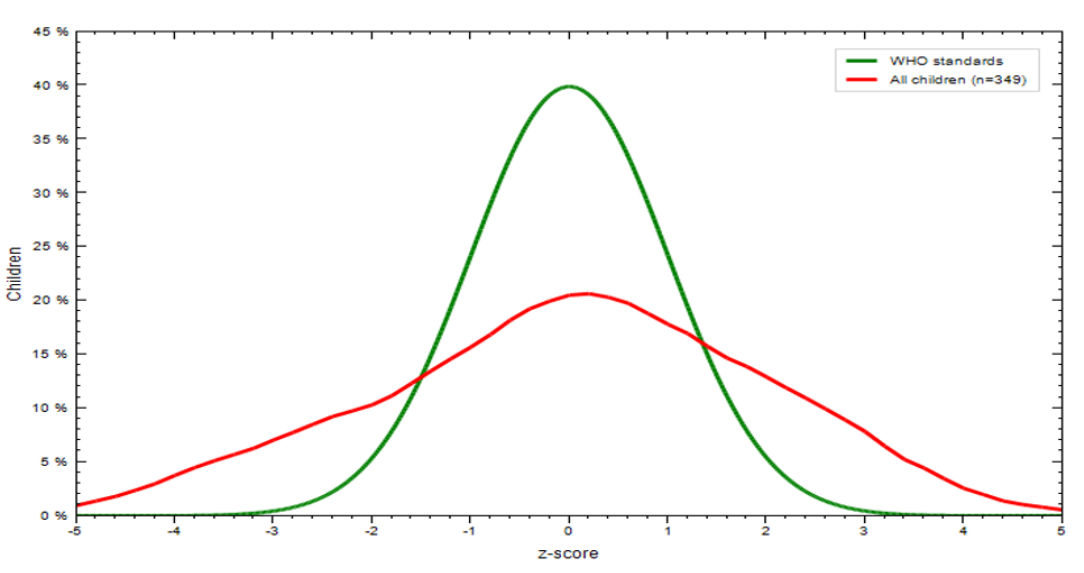

Figure 1: *Weight/Height Z score curve.*

The mean Weight/Height Z score was 0.047 +/- 2.08, with 274 (64.9%) children having Z scores between -2 and +2.

The dispersion from the WHO growth standard was more for boys than girls indicating a greater propensity for boys to be wasted and obese than girls.

Underweight

143 (40.1%) children were underweight with 69 (19.3%) severe and 74 (20.8%) moderate. Our weight/age Z score curve was shifted to the left of the WHO curve, with the median of our curve was inferior to that of the reference curve, with 40.1% of children having a Z score less than -2 (Figure 2).

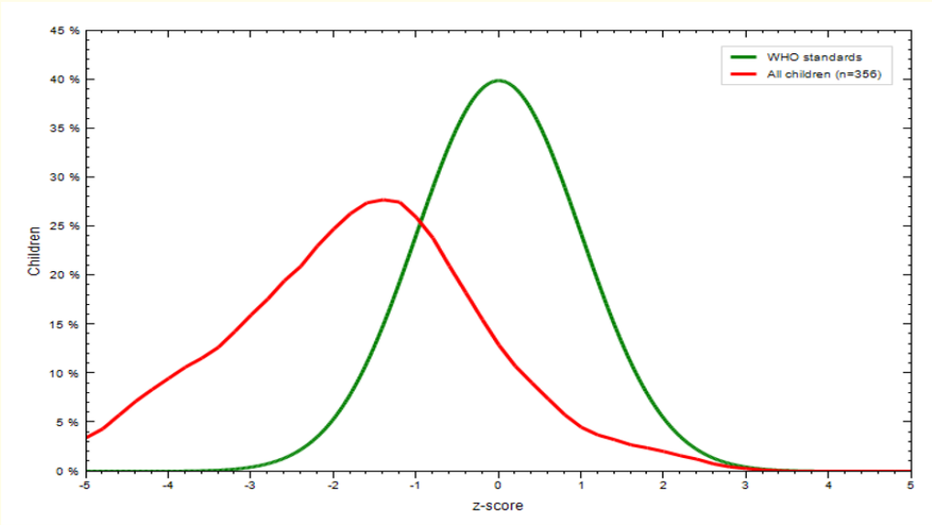

Figure 2: *Weight/Age Z score curve.*

The mean weight/age Z score was -1.73 +/- 1.53 and 59.1% of the children had a Z-score between -2 and +2.

The dispersion from the WHO growth standard was more to the left, and lower for boys than for girls indicating that boys were more underweight than girls.

Stunting

270 (75.6%) had a growth retardation, with 164 (45.9%) severe and 106 (29.7%) moderate. The height/age Z score curve was shifted to the left of the WHO reference curve and the median of our curve was inferior to that of the reference (Figure 3).

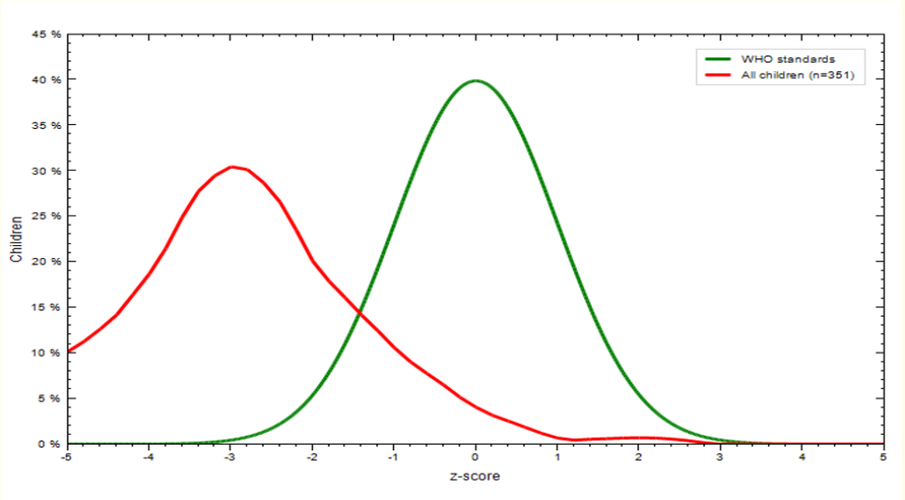

Figure 3: *Height/Age Z score curve.*

The mean height/age Z score was -2.94 +/- 1.51 and 75.6% of children had a height/age Z score less than -2. The curve of our population was dispersed more to the left of the WHO curve, with 75.6% of the children had a Height/Age Z score less than -2.

The curve for the boys was more shifted to the left than that of the girls, also the median for boys was lower than that for girls indicating that boys were more stunted than girls.

Mid upper arm circumference

120 (33.6%) children had a mid-upper arm circumference < 125 mm, with 46 (12.9%) < 11.5% indicating severe malnutrition.

Mid upper arm circumference	Number (N)	Percentage (%)
< 115 mm	46	12.9
115 mm - 125 mm	74	20.7
> 125 mm	237	66.4
Total	357	100

Dietary survey

Food groups	Frequency	Number (n)	Percentage (%)
Tubers and cereals	Poor*	0	0
	Borderline**	0	0
	Acceptable***	357	100
	Total	357	100
Vegetables	Poor	124	34.7
	Borderline	174	48.7
	Acceptable	59	16.6
	Total	357	100
Pulses	Poor	88	24.6
	Borderline	127	52.4
	Acceptable	82	23
	Total	357	100
Fruits	Poor	293	82
	Borderline	57	16
	Acceptable	7	2
	Total	357	100
Meat and fish	Poor	308	86.3
	Borderline	41	11.5
	Acceptable	8	2.2
	Total	357	100
Milk	Poor	356	99.7
	Borderline	1	0.3
	Acceptable	0	0
	Total	357	100
Sugar	Poor	351	98.3
	Borderline	6	1.7
	Acceptable	0	0
	Total	357	100
Oil	Poor	140	39.2
	Borderline	153	42.9
	Acceptable	64	17.9
	Total	357	100

Table 2: *Distribution of the households according to the weekly consumption of food stuffs.*
**Poor = 1 - 2 days/7; ** Borderline = 3 - 4 days/7; ***Acceptable = ≥ 5 days/7.*

All the households had a high consumption of tubers and cereals, 16.6% (59) had a high consumption in vegetables, 23% (82) high a high consumption of dried vegetables (beans, soya), 2% (7) high consumption of fruits, 2.2% (8) high consumption in animal proteins, and no household high consumption in milk and sugar products, and 17.9% (64) had a high consumption in oils.

Food consumption score rating according to the food consumption score

21 (5.9%) children had a poor food consumption score < 21; 145 (40.6) borderline between 21 - 35; and 191 (52.5%) acceptable.

The score ranged from 16.5 to 65. The mean score was 35.68 +/- 8.5 and 191 (53.5%) had an acceptable score.

Factors associated with malnutrition

Factors associated with stunting

	Stunting				
	Yes	**No**	**Total**	**OR (IC 95%)**	**P-value**
Variables	**n (%)**	**n (%)**	**n (%)**		
Age of child					
[6 - 23]	43 (72.9)	16 (27.1)	59 (16.5)		
[24 - 59]	227 (76.2)	71 (23.8)	298 (83.5)	1.19 (0.62-2.22)	0.350
Sex					
Males	137 (78.7)	37 (21.3)	174 (48.7)	1.39 (0.85-2.28)	0.110
Females	133 (72.7)	50 (27.3)	183 (51.3)		
Age of mother					
< 20	13 (72.2)	5 (27.8)	18 (5)		
≥ 20	257 (75.8)	82 (24.2)	339 (95)	1.21 (0.38-3.4)	0.460
Mother's educational level					
literate	72 (79.1)	19 (20.9)	91 (25.5)	1.3 (0.74-2.36)	0.230
Illiterate	198 (74.4)	68 (25.6)	266 (74.5)		
Mother's matrimonial status					
Lives alone	26 (78.8)	7 (21.2)	33 (9.2)	1.22 (0.52-3.13)	0.420
In a couple	244 (75.3)	80 (24.7)	324 (90.8)		
***FCS**					
Low	17 (77.3)	5 (22.7)	22 (6.2)	1.1 (0.41-3.43)	0.540
Borderline/acceptable	253 (75.5)	82 (24.5)	335 (93.8)		
Mother's profession					
Liberal**	267 (75.6)	86 (24.4)	353 (98.9)	1.03 (0.04-9.83)	0.670
Non liberal ***	3 (75)	1 (25)	4 (1.1)		
Associated Illness**					
Yes	27 (93.1)	2 (6.9)	29 (8.1)	4.72 (1.28-29.95)	0.010
No	243 (74.1)	85 (25.9)	328 (91.9)		
Household size					
≤ 9	237 (74.5)	81 (25.5)	318 (89.1)		
> 9	33 (84.6)	6 (15.4)	39 (10.9)	1.88 (0.79-5.09)	0.110

Table 3: *Factors associated with stunting: Bivariate analysis.*

**Household food consumption score, **Liberal professions: farmer, trader, informal sector, ***Non liberal professions: civil servant, ****Respiratory tract infections and/or diarrhea in the past 3 months.*

The children who had suffered from infectious diseases in the past 3 months were 4 times more at risk of growth retardation. This result was significant (OR = 4.72; IC95% 1.28 - 29.95); P = 0.010) (Table 3).

The presence of infectious diseases persisted as a statistically significant factor for stunting after multivariate analysis (OR = 4.7222; IC95% (1.0995 - 20.2808); P = 0.0368).

Factors associated with underweight

	Underweight				
	Yes	**No**	**Total**	**OR (IC 95%)**	**P-value**
Variables	**n (%)**	**n (%)**	**n (%)**		
Age of child					
[6 - 23]	20 (33.9)	39 (66.1)	59 (16.5)		
[24 - 59]	123 (41.3)	175 (58.7)	298 (83.5)	1.37 (0.77-2.5)	0.180
Sex of the child					
Males	72 (41.4)	102 (58.6)	174 (48.7)	1.11 (0.73-1.7)	0.350
Females	71 (38.8)	112 (61.2)	183 (51.3)		
Age of mother					
< 20	4 (22.2)	14 (77.8)	18 (5)		
≥ 20	139 (41)	200 (59)	339 (95)	2.43 (0.82-8.73)	0.090
Mother's educational level					
Literate	107 (40.2)	159 (59.8)	266 (74.5)	1.03 (0.63-1.68)	0.510
Illiterate	36 (39.6)	55 (60.4)	91 (25.5)		
Mother's matrimonial status					
Lives alone	15 (45.5)	18 (54.5)	33 (9.2)	1.28 (0.61-2.64)	0.310
In a couple	128 (39.5)	196 (60.5)	324 (90.8)		
FCS					
Low	12 (54.5)	10 (45.5)	22 (6.2)	1.87 (0.77-4.58)	0.110
Intermediate - acceptable	131 (39.1)	204 (60.9)	335 (93.8)		
Mother's profession					
Liberal	142 (40.2)	211 (59.8)	353 (98.9)	2.02 (0.21-53.51)	0.470
Non liberal	1 (25)	3 (75)	4 (1.1)		
Associated illness					
Yes	14 (48.3)	15 (51.7)	29 (8.1)	1.44 (0.66-3.12)	0.230
No	129 (39.3)	199 (60.7)	328 (91.9)		
Household size					
≤ 9	121 (38.1)	197 (61.9)	318 (89.1)		
>9	22 (56.4)	17 (43.6)	39 (10.9)	2.11 (1.07-4.18)	0.020

***Table 4**: Factors associated with underweight.*

A household size > 9 increased the risk of underweight by 2. This result was statistically significant (OR = 2.11; IC95% (1.07 - 4.18); P=0.020) and persisted after multivariate analysis (OR = 2.1070; IC95% (1.0758 - 4.1265); P = 0.0298).

Factors associated with wasting

	Wasting				
	Yes	No	Total	OR (IC 95%)	P-value
Variables	**n (%)**	**n (%)**	**n (%)**		
Age of child					
[6 - 23]	10 (16.9)	49 (83.1)	59 (16.5)		
[24 - 59]	52 (17.4)	246 (82.6)	298 (83.5)	1.04 (0.5-2.28)	0.550
Sex of the child					
Males	32 (18.4)	142 (81.6)	174 (48.7)	1.15 (0.66-2)	0.360
Females	30 (16.4)	153 (83.6)	183 (51.3)		
Age of Mother					
< 20	4 (22.2)	14 (77.8)	18 (5)	1.38 (0.38-4.18)	0.380
≥ 20	58 (17.1)	281 (82.9)	339 (95)		
Mother's educational level					
Illiterate	17 (18.7)	74 (81.3)	91 (25.5)	1.13 (0.6-2.07)	0.410
Literate	45 (16.9)	221 (83.1)	266 (74.5)		
Mother's matrimonial status					
Lives alone	10 (30.3)	23 (69.7)	33 (9.2)	2.27 (0.98-5)	0.040
In a couple	52 (16)	272 (84)	324 (90.8)		
FCS					
Low	8 (36.4)	14 (63.6)	22 (6.2)	2.97 (1.13-7.39)	0.020
Intermediate-acceptable	54 (16.1)	281 (83.9)	335 (93.8)		
Mother's profession					
Non liberal	0 (0)	4 (100)	4 (1.1)	0 (0-5.33)	0.460
Liberal	62 (17.6)	291 (82.4)	353 (98.9)		
Associated illness					
Yes	2 (6.9)	27 (93.1)	29 (8.1)	0.33 (0.05-1.23)	0.090
No	60 (18.3)	268 (81.7)	328 (91.9)		
Household size					
≤9	52 (16.4)	266 (83.6)	318 (89.1)		
>9	10 (25.6)	29 (74.4)	39 (10.9)	1.76 (0.78-3.78)	0.110

Table 5: *Factors associated with emaciation: Bivariate analysis.*

Having a mother who lives alone multiplied the risk of wasting by 2 and the result was significant (OR = 2.27; IC 95% (0.98 - 5); P = 0.040). A low food consumption score increased the risk of emaciation by 3. This result was statistically significant (OR = 2.97; IC95% (1.13 - 7.39); P = 0.020).

After multivariate analysis, only a low food consumption score persisted as a statistically significant factor for wasting (OR = 2.8967; IC95% (1.1490 - 7.3024); P = 0.0242).

Discussion

The global prevalence of malnutrition was 82.1%. This result was superior to that of Pondy., *et al*. [8] in 2016 at Salapoumbe (67.8%). This difference could be explained by the differences between the two study populations. Pondy., *et al*. [8] studied a heterogeneous population composed of 63.9% Baka and the rest were Bangando (Bantu). This high prevalence of malnutrition in the Baka children could be due to socio-cultural and genetic differences.

We had a prevalence of wasting of 17.4%, which was superior than found by Hagino., *et al*. [9] (8.4%) at Moloundou in the Baka in 2014. This gap between the two studies would be explained by the fact that Hagino., *et al.* [9] used the CDC (Centre for Disease Control) curves, and older children were included in the study. Pondy., *et al.* [8] had found a prevalence of 4.6%. This could equally be explained by the heterogenic ethnicity of the population. Foster., *et al*. in 2007 in the Tsimanes (Amerindians) in Bolivia found a prevalence of 5% [10]. It should be noted that they used the CDC curves, but the socio-cultural differences despite their similarities could explain this difference. Al-Mekhlafi., *et al.* in 2005 in the Orang Asli in Malaysia, found a 15.1% wasting in short stature children, a result close to ours [11]. We equally note a prevalence of emaciation in our study which was largely superior to the national rate (5.2%).

Only the low FCS was associated to emaciation in the multi-variate analysis after logistic regression. A low FCS is usually associated to the low consumption of highly weighting foodstuff such as animal proteins and dairy products [12]. The latter are principal sources of type 2 nutrients (nitrogen products and essential amino acids) and micronutrients that they contain are easily absorbable due to the absence of phytates [12]. As type 2 nutrients are not stored in the organism, we will have muscle wasting to level off their deficiency, therefore leading to emaciation in the short term [13]. So, a low FCS leads to emaciation by reduction of consumption of type 2 nutrient sources. We could not compare this result because we could not find data in the literature on FCS and emaciation in short stature populations.

The prevalence of underweight (40.1%) in our study was superior to that of the multiple indicator sample study in Cameroon (14.8%) [3]. Hagino., *et al.* obtained a prevalence of 80% which was superior to ours, but they used CDC curves [9]. Al-Mekhlafi., *et al*. in Orang Asli (Malaysia) had a higher rate (56.5%) [11], whereas Pondy and al in Salapoumbe, in East-Cameroon found a lower value (31.4%) [8]. The differences in these two study populations were incriminated for this difference. Foster., *et al*. used the CDC curves and equally found an inferior prevalence to ours (22%) in the Amerindians [10].

As concerns underweight, only household size > 9 people was statistically significant in the multivariate analysis. This could be explained by the fact that, the greater the household size, the smaller the meal sizes per person. We did not have studies to compare our results with.

The prevalence of stunting was 75.6%, lower than that of Hagino., *et al*. who had 95% [9]. This difference could be explained by the fact that their study included children more than 5 years as opposed to our study which was limited to children less than 5 years old. Other studies had lower values, Pondy., *et al.* (63.9%) [8], Foster., *et al*. (47%) [10], Al-Mekhlafi., *et al*. (61.3%) [11] and Benefice., *et al*. (41%) [14].

The occurrence of infectious diseases (respiratory tract infections and diarrhoea) in the past 3 months statistically predisposed to stunting. Infectious states are characterised by high catabolism with diversion of nutrients to the immune system for the production of antibodies and the functioning of the immune cells, leading to stunting in the long term [15]. Growth retardation could be a consequence of a reduction of the transport of nutrients towards tissue, a situation encountered in infectious states [16]. During the acute phase of inflammation, cytokines could affect bone remodelling and hence prevent growth of long bones [16].

On 357 children, 120 (33.6%) had a mid-upper arm circumference less than 125mm indicating acute malnutrition. This high prevalence of acute malnutrition according to the mid upper arm circumference shows the magnitude of malnutrition in the Baka population; a low mid upper arm circumference has been shown to be correlated with increased mortality in the population [17].

About half of the households had an acceptable food consumption score (FCS). This result is similar to that found by Benefice., *et al*. in the Amerindians [14]. Tubers were the most consumed foodstuffs, and animal proteins were least consumed. Yamauchi., *et al*. [18] in 2000 in Moloundou in Cameroon, also noted that starch was most consumed (80% of the foodstuffs) and animal proteins were least consumed. This finding could be explained by the reduction of forest resources, the commercialisation of hunting products to the Bantu population, and the national regulations in terms of protection of species. Low consumption of fruits could be explained by their scarcity, as our study was done in the dry season.

Nevertheless, our study had several limitations. There are growth references for children with short stature, so we were obliged to use the WHO growth curves and this could have had had some influence in our results. The absence of birth certificates for some children made us to estimate the ages from the calendar of local public events. These difficulties could have overestimated or underestimated the nutritional status of in our study.

Conclusion

The prevalence of malnutrition in Baka children was very high and this could be explained by genetic and nutritional factors, promiscuity and infectious diseases. In light of our conclusions, we propose that a study on a greater scale should be carried out to determine the growth curves specific to children of short stature on a global and national level. Information, education and communication on proper dietary and feeding habits of a child and proper management of infectious diseases in the Baka communities should be conducted and reinforced.

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Volume 9 Issue 3 March 2020