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the number of stunted children is increasing in Africa and is still high by international standards. The number of stunted children in Africa increased from 49.7 million in 2000 to 57.5 million in 2019 [5]. The National Statistics Institute reported high rate and increasing prevalence of stunting (33%), underweight (15%) and wasting (6%) in children under 5 years. In Cameroon, despite a fairly large food production, malnutrition persists in children under 5 years old and prevalence of stunting is highest. According to the Demographic and Health Survey conducted by the National Statistics Institute in 2018, 29%, 11% and 4% of children under 5 years were suffering from stunting, underweight and wasting respectively [6]. The chronic malnutrition remained highest with 14% in the severe form and 15% in the moderate form. These proportions are much higher than those expected in a healthy and well-nourished population: 2.3% for chronic malnutrition (moderate or severe) and 0.1% for its severe form [6]. This national demographic and health survey data hide regional and cultural disparities. However, nutritional problems make it necessary to have regularly updated data in each region or even village of the country, in particular on food and health practices. The aim of this study was to determine the prevalence of nutritional status and associated risk factors among children aged 6 to 59 months in the locality of Ayos borders with the East Region of Cameroon which is one of the region most affected by chronic malnutrition (37%).

Material and Methods

Study site

This study was carried out in the locality of Ayos located in the Department of Nyong and Mfoumou, Central Region and bordering the Eastern Region, in Cameroon.

Study design

This is a cross-sectional and descriptive study that took place during the period from August to October 2019 in 19 neighborhoods in Ayos locality. About, 309 children of both sexes and their mothers were recruited.

Ethical approval

Before data collection, the study has been approved by the Institutional Research Ethics Committee for Human Health of Douala and ethical clearance was obtained (N° 2082 CEI-UDo/12/2019/M). After approval of this study by the Ethics Committee, the administrative health and community authorities have been met and informed of the objectives of our study in order to obtain their consent and assistance. Informed consent were then handed over and explained to parents.

Eligibility Criteria

Mothers and children aged 6 to 59 months who had resided in Ayos for at least 6 months at the time of the survey and who had voluntarily signed the informed consent form were included in the study. Any participant who was ill during the study was excluded.

Procedures

Prior to the study, sensitization was carried out among the entire population in order to present the interest of our study. Subsequently, a pre-test was carried out to assess the comprehension of the questionnaire. The final questionnaire was therefore developed, adjusted and validated before the survey. During the survey, the socio-demographic characteristics of mothers, the practices and knowledge of child nutrition, the eating habits and nutritional status of children (anthropometric parameters) were evaluated.

Socio-demographic parameters of mothers

The socio-demographic parameters of mothers were: level of education, marital status, occupation, time spent at work, number of children.

Practices and knowledge of the mothers on the child nutrition

To determine whether or not the child's nutrition was under control, mothers were asked about the type of breastfeeding, the age at which complementary foods were introduced and the reasons for which they introduced these foods into the diet of their children.

Children's eating habits

The children's eating habits were assessed using a food consumption frequency questionnaire. The mothers had listed all the foods and drinks consumed by their children for seven days. The consumption of a food in a group regardless of the amount in a child's diet is rated "1" and the absence is rated "0". Each food group was assigned a weight, so the score obtained was the product of the weight.

Anthropometric parameters

Weight measurement

The weight measurement was performed using an electronic scale (TEFAL, Germany) of 150 kg with 0.1 g precision for infants and electronic digital baby scale (ALECTO) of 20 kg for young children. The children were made stand or lying on the scale without touching anything. Shoes and heavy clothing were removed.

Size measurement

The size of children was performed using a vertical locally manufactured measuring board with a ruler graduated in centimeter. With their feet parallel, their heels, buttocks, shoulders and back of head were made to touch the upright part of the meter.

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Evaluation of nutritional status

Stunting is an indicator of linear growth retardation and cumulative growth deficits in children. The height-for-age Z-score (HAZ), as defined according to WHO growth reference, expresses a child's height in terms of the number of standard deviations (SD) above or below the median height of healthy children in the same age group or in a reference group [7]. This study focused on children with a height-for-age Z-score below minus two standard deviations (-2 SD) as moderate stunted and height-for-age Z-score below minus three standard deviations (-3 SD) as severely stunted [7].

Statistical analyses

Data from anthropometric measurement were standardized using ENA software and analyzes were done using SPSS Version 16 software. Descriptive statistics were used to determine the means and percentages of the various parameters. Chi 2 test was used to compare the values of different parameters. The results were given as mean ± standard deviation and differences were considered significant from $p<0.05$.

Results

About 309 children 6 to 59 months aged in both sexes took part in the study almost equally in the surveyed population with a sex ratio of 1.02 in favor of girls. The average of age, weight and height were 24.61 ± 1.13 months, 10.49 ± 0.25 kg and 78.86 ± 1.04 cm respectively. Table 1 also shows that the least and the high represented age groups of children were 48-59 months (9.71%) and 12-24 months (28.16%) respectively.

Assessment of the nutritional status of children

In table 2, 9.06% of children suffer from wasting with 3.56% in the severe form and girls were more affected (5.18%) than boys (3.88%). The prevalence of underweight was 26.54% with 10.03% in the severe form and boys were the most affected (13.92%) compared to girls (12.62%). Stunting was the most common form of malnutrition among these children. Its prevalence was 53.07% with 34.96% in the severe form and predominance in boys (31.72%) against (21.36%) in girls.

Impact of socio-demographic factors of mothers on child malnutrition

Table 4 shows that underweight, wasting and stunted growth predominated in children from families of cohabiting mothers (17.52%; 6.94%; 27.74% respectively) and single mothers (7.3%; 2.18%; 20.07% respectively). The prevalence of malnourished children was highest among mothers in the

Table 1: Distribution of children according to age group, sex, weight and height

Age group (months)	Boys N (%)	Girls N (%)	Total N (%)
[6-9[	19 (6.15)	13 (4.21)	32 (10.36)
[9-12[	22 (7.12)	21 (6.8)	43 (13.92)
[12-24[	46 (14.89)	41 (13.27)	87 (28.16)
[24-36[	33 (10.68)	39 (12.62)	72 (23.30)
[36-48[	23 (7.44)	22 (7.12)	45 (14.56)
[48-59[	11 (3.56)	19 (6.15)	30 (9.71)
Total	154 (49.84)	155 (50,16)	309 (100)
Weight (kg)	10.39 ± 0.25	10.59 ± 0.25	10.49 ± 0.25
Height (cm)	77.29 ± 1,07	80.43 ± 1.03	78.86 ± 1.04

Table 2: Nutritional status of children according to the sex and forms of malnutrition

Variables	Boys (n=154)	Girls (n=155)	Total N (%)
Stunting (n=309)			
Normal (HAZ ≥ -2)	56 (18.12)	89 (28.8)	145 (46.92)
Moderate (-3 ≤ HAZ < -2)	30 (9.71)	26 (8.41)	56 (18.12)
Severe (HAZ < -3)	68 (22.01)	40 (12.95)	108 (34.96)
Underweight (n=309)			
Normal (WAZ ≥ -2)	111 (35.92)	116 (37.54)	227 (73.46)
Moderate (-3 ≤ WAZ < -2)	26 (8.42)	25 (8.09)	51 (16.51)
Severe (WAZ < -3)	17 (5.5)	14 (4.53)	31 (10.03)
Wasting (n= 309)			
Normal (WHZ ≥ -2)	142 (45.96)	139 (44.98)	281(90.94)
Moderate (-3 ≤ WHZ < -2)	7 (2.26)	10 (3.24)	17 (5.50)
Severe (WHZ < -3)	5 (1.62)	6 (1.94)	11 (3.56)

Citation: Angèle Eveline Tchapda, Serge Berlin Dzeukou, Christine Biyegue Nyangono, Nicolas Policarpe Nolla, Inocent Gouado, Ekoe Tetanye. Assessment of Nutritional Status and Associated Factors in Children Aged 6 to 59 Months in Ayos Locality, Cameroon. Journal of Food Science and Nutrition Research 5 (2022): 651-657.

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15-24 age group (54.74%), followed by the 25-34 age group (35.77%). The prevalence of malnourished children was higher among women farmers (19.71%) and the unemployed (58.76%). The higher number of malnourished children came from families where mothers had primary (38.32%) and secondary 1st cycle (33.94%) education level. From this study, it emerges a significant influence of the mother's level of education ($\chi 2 = 18.33$; p=0.001), marital status ($\chi 2 = 11.61$; p=0.009) and occupation ($\chi 2 = 11, 61$; p=0.046) on the prevalence of stunting in children.

Table 5 shows that 13.92% of infants received exclusive breastfeeding, 82.53% mixed breastfeeding and 3.55% artificial breastfeeding. The prevalence of underweight, stunting and wasting was higher among mixed breastfeeding mothers (22.98%, 47.57% and 7.12% respectively). These results also show that 86.1% of mothers practiced dietary diversification early (before 6 months) and only 4.53% of mothers gave exclusively breast milk during 6 months. Similarly, out of 86.1% of children who received the first food early, 24.28%, 48.87% and 8.09% were underweight,

Table 3: Forms of malnutrition according to age groups

Age groups (months)	Stunting N (%)	Underweight N (%)	Wasting N (%)	Malnourished children N (%)
[6-9]	22 (7.12)	5 (1.62)	1 (0.32)	28 (9.06)
[9-12]	27 (8.74)	14 (4.53)	3 (0.97)	44 (14.24)
[12-24]	60 (19.41)	33 (10.68)	13 (4.21)	106 (34.3)
[24-36]	27 (8.74)	15 (4.85)	5 (1.62)	47 (15.21)
[36-48]	15 (4.85)	10 (3.24)	3 (0.97)	28 (9.06)
[48-59]	13 (4.21)	5 (1.62)	3 (0.97)	21(6.8)
Total	164 (53.07)	82 (26.54)	28 (9.06)	274 (88.67)

Table 4: Distribution of malnourished children according to socio-demographic factors of mothers

Variables	Socio-demographic factors	Number of malnourished children (N=274)			Total
		Stunting n (%)	Underweight n (%)	Wasting n (%)	n (%)
Age group of mothers (years)	15-24	83 (30.29)	49 (17.88)	18 (6.57)	150 (54.74)
	25-34	64 (23.36)	26 (9.49)	8 (2.92)	98 (35.77)
	35-44	17 (6.2)	7 (2.56)	2 (0.73)	26 (9.49)
	45-54	0 (0)	0 (0)	0 (0)	0 (0)
	Total	164 (59.85)	82 (29.93)	28 (10.22)	274 (100)
Marital status	Monogamous	33 (12.04)	13 (4.75)	3 (1.09)	49 (17.88)
	Polygamous	0 (0)	1 (0.36)	0 (0)	1 (0.36)
	Cohabitation	76 (27.74)	48 (17.52)	19 (6.94)	143 (52.2)
	Single	55 (20.07)	20 (7.3)	6 (2.18)	81 (29.56)
	Total	164 (59.85)	82 (29.93)	28 (10.22)	274 (100)
Level of education	No Formal education	26 (9.49)	16 (5.84)	3 (1.09)	45 (16.42)
	Primary	65 (23.72)	29 (10.58)	11 (4.02)	105 (38.32)
	Secondary 1st cycle	52 (18.98)	30 (10.95)	11 (4.02)	93 (33.94)
	Secondary 2nd cycle	12 (4.38)	5 (1.82)	3 (1.09)	20 (7.3)
	Higher	9 (3.28)	2 (0.74)	0 (0)	11 (4.02)
	Total	164 (59.85)	82 (29.93)	28 (10.22)	274 (100)
Employment status	Work at home	8 (2.92)	5 (1.82)	5 (1.82)	18 (6.56)
	Farmer	32 (11.68)	17 (6.21)	5 (1.82)	54 (19.71)
	Employee	9 (3.28)	2 (0.74)	0 (0)	11 (4.02)
	Trader	11 (4.02)	9 (3.28)	1 (0.37)	21 (7.67)
	Unemployed	99 (36.13)	46 (16.79)	16 (5.84)	161 (58.76)
	Others	5 (1.82)	3 (1.09)	1 (0.37)	9 (3.28)
	Total	164 (59.85)	82 (29.93)	28 (10.22)	274 (100)

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Table 5: Influence of mothers' dietary practices on the nutritional status of children

Variables	Dietary practices	Number of children (309)			
		Underweight n (%)	Stunting n (%)	Wasting n (%)	Normal n (%)
Type of breastfeeding	Exclusive breast milk	7 (2.27)	13 (4.21)	3 (0.97)	20 (6.47)
	Artificial breastfeeding	4 (1.29)	4 (1.29)	3 (0.97)	0 (0)
	Mixed breastfeeding	71 (22.98)	147 (47.57)	22 (7.12)	15 (4.86)
	Total	82 (26.54)	164 (53.07)	28 (9.06)	35 (11.33)
Age of introduction of complementary feed	Before 6 months	75 (24.28)	151 (48.87)	25 (8.09)	15 (4.86)
	During 6 months	3 (0.97)	3 (0.97)	0 (0)	8 (2.59)
	After 6 months	4 (1.29)	10 (3.23)	3 (0.97)	12 (3.88)
	Total	82 (26.54)	164 (53.07)	28 (9.06)	35 (11.33)
Reason for introducing foods early	Did not introduce early	7 (2.27)	13 (4.21)	3 (0.97)	20 (6.47)
	Mother's choice	54 (17.47)	107 (34.62)	16 (5.18)	2 (0.65)
	Other reasons	21 (6.8)	44 (14.24)	9 (2.91)	13 (4.21)
	Total	82 (26.54)	164 (53.07)	28 (9.06)	35 (11.33)
First food introduced	Infant cereals	6 (1.94)	14 (4.53)	1 (0.32)	12 (3.89)
	Local porridge	32 (10.36)	65 (21.04)	11 (3.57)	19 (6.15)
	Soup / broth	0 (0)	1 (0.32)	0 (0)	0 (0)
	Vegetables	0 (0)	1 (0.32)	0 (0)	0 (0)
	Yoghurt pots	1 (0.32)	0 (0)	1 (0.32)	1 (0.32)
	Pre-cured foods	5 (1.62)	14 (4.53)	0 (0)	1 (0.32)
	Family meal	37 (11.98)	68 (22.01)	14 (4.53)	0 (0)
	Other	1 (0.32)	1 (0.32)	1 (0.32)	2 (0.65)
	Total	82 (26.54)	164 (53.07)	28 (9.06)	35 (11.33)

stunted and wasting respectively. The first complementary food introduced was the poorly enriched local porridge used by 41.12% of the mothers, followed by the family meal (38.52%).

Type of breastfeeding ($\chi2$ = 10.616; p=0.005), age of introduction of complementary foods ($\chi2$ = 11.110; p=0.004), reason for introduction ($\chi2$ = 27.442; p=0.002), have a significant impact on the prevalence of stunting. There is a significant influence between the type of breastfeeding ($\chi2$ = 8.168; p=0.017) and the first food introduced ($\chi2$ = 16.367; p=0.022) on the prevalence of wasting. Likewise, it emerges that the mother's level of education ($\chi2$ = 14.696; p=0.005) has a significant relationship on the prevalence of underweight. The low consumption of dairy products and other fruits and vegetables are associated with underweight and stunting respectively.

Discussion

The present study investigated the nutritional status and associated factors in children 6 to 59 months of age in the locality of Ayos. Almost 309 children were included in the study, ie 155 (50.16%) girls and 154 (49.84%) boys (Table 1). The female gender predominated with a ratio of 1.02. The results obtained indicate that the prevalence of underweight, stunting and wasting was 26.54%, 53.07% and 9.06% respectively. These prevalences were similar to those obtained in the rural community of Bangang, Cameroon for children aged 0-24 months [8]. The high prevalence rate of stunting could be explained by inadequate dietary practices and health care, culture and/or relatively chronic or recurrent infectious diseases. Also most households live in precarious conditions, characterized by a limited or undiversified quantity of available food. This could lead to a prolonged micronutrient deficiency, thus weakening the nutritional status of children [9]. The mothers gave the family meal and porridge to the children at the age of one month, this according to their culture which say we should always give eat to the child when we eat. Our survey showed that the prevalence of underweight and stunting is higher in boys than girls (Table 2). This predominance in male children could perhaps be explained by the biological difference between the sexes from the start of pregnancy, the length of the rump to the crown is greater in male fetuses than in female fetuses in early pregnancy. The male gender is significantly associated with stunting (p=0.026) as reported by the study in Indonesia [10]. Boys are more susceptible to malnutrition than girls. This result is also similar to that of the work of Alur et al. 2019 [11]. This association between male sex and nutritional status could be

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linked to a greater vulnerability in boys than girls in a socio-economically disadvantaged environment such as that in Ayos locality where our study has been conducted [11]. In addition, the results showed that malnutrition is higher in children of the age group 12-24 months with the prevalence of 10.68% for underweight, 19.41% for stunting and 4.21% for wasting (Table 3). This could be explained by the fact that mothers introduced complementary foods in the infant's diet early (before 6 months) or the complementary foods associated with breast milk were insufficient to cover the nutritional needs of the children. Most of the consequences are irreversible and negatively influence the physical, psychomotor and intellectual growth of children into adulthood, thus leading to the deterioration of their intellectual performance and their economic productivity. This result is similar to that obtained in a study in Douala [12]. As the work in Cameroon [13], we noted that underweight, stunting and wasting were higher in children of mothers aged between 15-24 years with an increased risk in children 12-24 months (Table 4). This could be explained by the fact that most mothers who are young at childbirth can have inappropriate feeding behaviors. In Ayos, almost 16.42% of children whose mothers were not go to school were malnourished, while the prevalence of malnourished children was 38.32% among those of mothers with primary education. Children of the mothers whose were in first cycle of secondary education (7.3%) or above (4.02%) had the lowest prevalence. Our study found that low education is significantly associated with underweight (p=0.005) and stunted growth in children (p=0.001). The same observation was reported in Cameroon [13] and in Indonesia [10]. These results could be explained by the fact that the more educated mothers have the capacity to make the best use of the information provided to them in order to improve hygiene and child care, to make better use of services health. In contrast, out-of-school mothers often tend to attribute malnutrition to the action of witchcraft, which overshadows their own responsibility. They are the most numerous to live in precarious socio-economic conditions characterized by available food which is sometimes limited and of low quality. It is therefore this set of factors that explain this association between the mother's level of education and malnutrition. The prevalence of underweight (7.3%), stunting (20.07%) and wasting (2.18%) were higher among children of single mothers. This could be explained by the fact that mothers did not have the financial possibility to take care for their children, which led them to adopt inadequate nutritional behaviors. Most of them were unemployed and from poor families. There was a significant association between marital status and stunting (p=0.009). Our study showed that the proportions of malnourished children were high among farmers and low among salaried mothers. Maternal occupation is significantly associated with stunting (p=0.046). This prevalence gap between different types of occupation could be attributed to the generally lower educational level and low income level among women in the agricultural sector and housewives, thus limiting access to health care and better health food choices for their children.

The prevalence of wasting (7.12%), underweight (22.98%) and stunting (47.57%) were higher among children whose mothers gave the mixed breastfeeding and early complementary foods (Table 5). This could be explained by the fact that mothers do not put into practice the recommendations of the WHO (exclusive breastfeeding up to 6 months). Both artificial and mixed breastfeeding were significantly associated with underweight (p=0.040), stunting (p=0.005), and wasting (p=0.017). A significant relationship was observed between the age at which complementary foods were introduced and underweight (p=0.046), as was stunting (p=0.004). This could be explained by the type of breastfeeding and the early introduction of foods in children under five years of age [14].

Conclusion

At the end of this study, the main objective was to assess the nutritional status and associated factors in children aged 6-59 months in the locality of Ayos. It appears that these children suffered from all forms of malnutrition with a higher prevalence of stunting. The prevalence of malnutrition was accentuated in children who received inadequate breastfeeding and feeding. The socio-demographic characteristics of the mothers significantly influenced the nutritional status of the children. Nutrition education for mothers could improve the nutritional status and health of these children.

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Conflict of interest

The authors declare they have no financial interests.

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