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Original Article

Association Between Complementary Feeding Practices and Nutritional Status in Children Aged 6-24 Months Using the Complementary Feeding Index Score and WHO Indicators in Three Hospitals in Cameroon

Association entre les Pratiques d'Alimentation Complémentaire et le Statut Nutritionnel des Enfants Agés de 6 à24 Mois en Utilisant le Score de l'Indice d'Alimentation Complémentaire et les Indicateurs de l'OMS dans Trois Hôpitaux au Cameroun

Wandji Lontsi Y[1,2], Puepi Djike Y[1,3], Nyongseh Gabsa Y[1], Eposse Ekoube C[4,5], Mandeng Ma Linwa[1], Naiza Monono[1,6], Noukeu Njinkui D[7], Dominique Enyama[7], Ganni Wele W[1], Mah Mungyeh E[8]

Affiliations
1. Faculty of Health Sciences, University of Buea, Buea, Cameroon
2. Bonassama District Hospital, Douala, Cameroon[3]
3. Buea Regional Hospital, Buea, Cameroon
4. Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Cameroon
5. Paediatric unit, Douala Laquintinie Hospital, Douala, Cameroon
6. Limbe Regional Hospital, Limbe, Cameroon

Auteur correspondant
Yolande Puepi Djike Fokam, Buea, Cameroon
Email: yolandep2000@yahoo.fr ,

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Mots clés : Pratiques de diversification alimentaire, Malnutrition, Indice d'alimentation complémentaire

ABSTRACT

Introduction. Initiation of complementary feeding (CF) is recommended at the age of 6 months since milk alone cannot guarantee optimal growth from this age. This study aimed at evaluating CF practices carried out by caregivers of children aged 6-24 months and their association with the nutritional status of children at the Bonassama District, Limbe and Buea Regional Hospitals. **Methodology**. This was a hospital-based cross-sectional study conducted from January 2023- March 2023 at the Vaccination Units of these three hospitals. Caregivers were interviewed to determine the Complementary Feeding Index (CFI) score and evaluate the WHO Indicators of CF practices through dietary recall. **Results**. We included 325 caregiver-child pairs. CF was initiated at 5.7 ± 3.38SD months. Though many children attained minimum meal frequency (74.19%), only few children attained minimum dietary diversity (20.00%) and minimum acceptable diet (27.42%). Overall, 23.69% were malnourished: 9.35% underweight, 13.23% stunted and 6.77% wasted. Compared to low CFI scores, medium CFI scores (88%) were associated with normal WAZ scores (B=1.01, OR=2.74, 95% CI: 1.13-6.66, p=0.026). **Conclusion**. Most caregivers practiced timely initiation of complementary feeding. However, food choices were suboptimal and were associated with weight for age Z-score.

RÉSUMÉ

Introduction. L'introduction de la diversification alimentaire complémentaire (CF) est recommandée à l'âge de 6 mois car le lait seul ne peut garantir une croissance optimale à partir de cet âge. Cette étude visait à évaluer les pratiques de CF réalisées par les aidants des enfants âgés de 6 à 24 mois et leur association avec l'état nutritionnel des enfants aux hôpitaux régionaux de Bonassama, Limbe et Buea. **Méthodologie.** Il s'agissait d'une étude transversale basée sur les hôpitaux menée de janvier 2023 à mars 2023 dans les unités de vaccination de ces trois hôpitaux. Les aidants ont été interviewés pour déterminer le score de l'indice de diversification alimentaire complémentaire (CFI) et évaluer les indicateurs de l'O MS des pratiques de CF par le biais du rappel alimentaire. **Résultats.** Nous avons inclus 325 paires d'aidants-enfants. La CF a été initiée à l'âge de $5,7 \pm 3,38$ mois SD. Bien que de nombreux enfants aient atteint une fréquence minimale de repas (74,19%), seuls quelques enfants ont atteint une diversité alimentaire minimale (20,00%) et un régime accepté minimal (27,42%). Dans l'ensemble, 23,69% étaient malnutris : 9,35% étaient en sous-poids, 13,23% avaient un retard de croissance et 6,77% étaient émaciés. Comparés aux scores bas de CFI, les scores moyens de CFI (88%) étaient associés à des scores normaux de Z d'âge pour le poids (B=1,01, OR=2,74, IC à 95%:1,13-6,66, p=0,026). Conclusion. La plupart des aidants ont pratiqué l'introduction opportune de la diversification alimentaire complémentaire. Cependant, les choix alimentaires étaient suboptimaux et étaient associés au score Z d'âge pour le poids.

INTRODUCTION

Malnutrition, which refers to both overnutrition and undernutrition (underweight, stunting and wasting), has been reported to cause 45% of deaths among children under 5 years of age worldwide **[1]**. In a study conducted in the Tole Health Area in the Southwest Region of Cameroon, the prevalence of global malnutrition was shown to be 36.5% **[2].**

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KEY RESULTS

Aim of this study

Malnutrition, which refers to both overnutrition and undernutrition (underweight, stunting and wasting), has been reported to cause 45% of deaths among children under 5 years of age worldwide. The aim of the study was to evaluate the complementary feeding (CF) practices carried out by caregivers of children aged 6-24 months and their association with the nutritional status of children at the Bonassama District, Limbe and Buea Regional Hospitals.

Key Results

1. Most caregivers practice timely initiation of CF in children aged 6-23 months (mean: 5.7±3.38 months).
2. Though 74.19% of children attained minimum meal frequency, only 20.00% attained minimum dietary diversity and only 27.42% minimum acceptable diet.
3. Overall, 23.69% were malnourished: 9.35% underweight, 13.23% stunted and 6.77% wasted.

How this is relevant to clinical practice policy or further research use in our setting

The CFI may be more appropriate than WHO indicators alone in evaluating adequacy of complementary feeds in relation to nutritional status. Further studies are needed.

The high prevalence of malnutrition in children between the ages of 6-24 months gives reason to suspect that there is a direct association between the feeding practices and the nutritional state of these children. Around the age of 6 months, milk alone is no longer sufficient to supply all of an infant's nutritional requirements, and complementary foods are needed to ensure adequate nutrition and proper growth [3]. Complementary feeding refers to the introduction of solid, semi-solid and soft foods into the diet of a baby who was drinking only breast or formula milk [4]. In order to classify complementary feeding methods as appropriate, it should be initiated timely, not before 6 months of age, feeds should contain sufficient energy, protein and micronutrients, should be prepared and stored in a hygienic manner and lastly given at an appropriate frequency [5]. Feeding practices in early life are therefore very crucial as they determine not only the child's health but also their lifelong development [6,7]. Despite this, many commonly used complementary foods are nutrient imbalanced, have a poor dietary diversity and very low micronutrient content and these are the main reasons why malnutrition is predominant in this age group [8]. Inadequate complementary feeding practices can be a major predisposing factor to malnutrition and consequently under-five mortality. Therefore, to reduce the burden of malnutrition, it is primordial to evaluate these practices and their association with the nutritional status of children in Cameroon.

PATIENTS AND METHODS

This study was a hospital based cross-sectional study, involving children aged 6 to 24 months and their caregivers attending Infant Welfare Clinics at the Bonassama District Hospital, Buea Regional Hospital and Limbe Regional Hospital. The Buea and Limbe Regional Hospitals were chosen as they are the 2 major hospitals in the Southwest Region. The Bonassama District Hospital was included as it is located in Douala, the economical capital of Cameroon and is the biggest health facility in that health district. This study was carried out from the 15th of February 2023 to the 31st of March 2023. The target population included all caregivers of children aged 6 to 24 months at the time of the study who attended the Infant Welfare Clinics in the aforementioned hospitals. We included all caregivers of children aged 6-24 months who attended the Infant Welfare Clinics during the study period. Children with chronic diseases, like Sickle Cell Disease, Congenital Heart Diseases, Malabsorptive Syndromes and Human Immunodeficiency Virus were excluded. Moreover, children with a history of multiple hospitalizations, that is, greater than or equal to 3 in the past year, were also excluded. For our study to have 80% power, significance of 5%, and 95% confidence interval, and based on the prevalence of malnourished children (15.87%) in a similar study done in the Dschang Health District of Cameroon [10], and a 10% non-response rate, the minimum sample size was calculated using openepi software [10] and yielded 226 child-caregiver pairs. We used a non-probability sampling method, specifically convenience sampling. The selection of the study areas and sites was convenient because they were physically and financially accessible, while permitting an inclusion of cultural diversities. Probability proportional to size sampling was used to divide the 226 participants among the 3 centers. Thus, for Buea Regional Hospital, Limbe Regional Hospital and Bonassama District Hospital, the minimum size required was 92, 58, 76 participants respectively. After research proposals were defended and submitted, ethical approval was sought from the Faculty of Health Sciences and the Institutional Review Board of the University of Buea No 2023/1942-01/UB/SG/IRB/FHS. Administrative authorizations were sought from the Regional Delegations of Public Health in the Southwest and Littoral Regions along with the Directors of the three hospitals involved. After approval, the head of all Infant Welfare Clinics were informed, and data collection started. All mothers of children aged 6-24 months who fit the inclusion criteria were approached at the various Vaccination Centers on main vaccination days and given a consent form. In BRH, recruitment was done on Wednesdays, LRH on Thursdays and BDH on Fridays. Recruitment was organised based on the vaccination days for children in our age range. After informed consent was granted, mothers were interviewed, data was collected using structured questionnaires which contained sociodemographic information, inquiries about the age of complementary feeding initiation, the type and frequency of feeding, the content of meals given to their children 24 hours prior to presentation and was concluded by a physical examination to obtain anthropometric measurements. After this, values were plotted on the WHO Z Scores to determine the children's nutritional status, and a brief interpretation of results were given to caregivers especially when there was a need for counselling.

Anthropometric measurements and indices: For weight measurements, we choose SH-8008 Electronic Baby Scales with the following features: sturdy and robust, electronic (digital readout), capacity of 20kg, and precision of 0.1kg (100g) to weigh the children completely undressed. For height/length measurement, this was performed while the child was lying down with Narang Medical WS026 Height Measuring Rods. For children under 2 years old who refused to lie down to have their lying height measured, we measured their standing height and added 0.7cm to convert this to lying height. Height-for-age reflects the size growth attained by children of the same age during a specific visit. This metric is used to detect growth retardation (stunting), which is defined by a z-score of <- 2. When this z-score is <-3, this refers to severe stunting. Weight-for-age refers to the child's body weight in relation to his or her age on a specific day. This indication determines whether a child is underweight. We refer to underweight or low weight when the z-score is <-2. When this z-score is <-3, this refers to severe underweight. Weight-for-height is a growth indicator that compares weight and height in a lying posture and suggests wasting (z score <-2). It may also be used to diagnose overweight (z score > +2) and obesity (z score > +3). Complementary Feeding Scoring Index (CFI): This score has been used in previous studies in Cameroon and Latin America [6,11]. The CFI was designed for babies aged 6 to 12 months, based on current CF guidelines for this age group [12]. A score was assigned based on six variables: continued breastfeeding, avoiding bottle-feeding, timely initiation of CF, dietary diversity (the total number of food-groups consumed by the infant in the previous 24 hours), meal-frequency (past 24 hours), and food-frequency (the frequency of food-groups consumed by the infant in the previous seven days). Cereals and tubers; pulses (like beans, chickpeas, lentils); milk and milk products; meat and egg; vitamin A-rich fruits and vegetables; other fruits and vegetables; and meals produced with oil, fat, and butter were all evaluated. Minimum CFI score=3; Maximum CFI score=23; CFI score range: Low: ≤6; Medium: 7–16; High: 17–23. The detailed score is found in Annex 1. We further classified food as solid foods, which included home cooked food like fufu corn, okro and rice; semi-solid foods, which were home-made paps, soups, or porridges; and soft foods comprised of commercially prepared baby food. WHO indicators of adequate complementary feeding practices: The indicators are minimum daily meal frequency, dietary diversity, and minimum acceptable diet [13]. Minimum meal frequency refers to eating at least twice for breastfed infants aged 6-8 months, three times for breastfed children aged 9-23 months and four times for non-breastfed children aged 6-23 months. Minimum dietary diversity (MDD) is present when the diet contained four or more of the following food groups: breastmilk, grains/roots/tubers, legumes and nuts, dairy products (e.g milk, yoghurt, and cheese), flesh foods (e.g meat. fish, poultry, liver, or other organs), eggs, vitamin A-rich fruits and vegetables, other fruits and vegetables. Minimum acceptable diet is calculated from:

- the proportion of breastfed children aged 6-23 months who had at least the MDD and minimum meal frequency during the previous day; and
- the proportion of non-breastfed children aged 6-23 months who received at least two milk feedings and had at least the MDD, not including milk feeds, and minimum meal frequency during the previous day.

A research proposal was deposited at the Faculty of Health Sciences, University of Buea. Ethical clearance was obtained from the Institutional Review Board of the University of Buea. Administrative authorization was obtained from the Regional Delegates of the Southwest and Littoral Regions along with the Directors of the Buea Regional, Limbe Regional and Bonassama District Hospitals. Only participants who gave consent were recruited, and all participants were made aware that they can withdraw from the study at any moment of their choice. Interviews were conducted in a non-judgmental manner and recommended feeding practices were shared with the mothers and all children with abnormalities were directed to appropriate care. The principles of respect for persons, beneficence and non -maleficence, and justice were respected. Data was collected anonymously with no identifiable information gathered.

Data was grouped and compiled on a Microsoft Excel Spreadsheet diligently to avoid any error and stored in a laptop and external storage device both with restricted access to promote confidentiality and hinder any breach in privacy of our participant. Analysis was performed using the Statistical Package for Social Sciences Version 25.0. Continuous variables were summarized as means and standard deviations while categorical variables as frequencies and percentages. Chi Square Test was used to compare categorical variables. Analysis of variance was used to compare mean CFI score between patients with normal, moderate, and severe anthropometric indices. Logistic regression analysis was conducted to identify factors that are independently associated with the CFI score. Statistical significance was set at $p<0.05$ with a 95% confidence level.

RESULTS

A total of 325 caregiver-child pairs were recruited at the Infant Welfare Clinics as shown in Figure 1. Of this sample, 105 were from the Bonassama.
District Hospital, 108 from the Buea Regional Hospital and 112 from the Limbe Regional Hospital.
Characteristics of the infants and caregivers: Most study infants were females (50.97%) with an age range between 6-24 months. The predominant age range was infants aged 9-11 months (54.46%) followed by 12-24 months (27.69%) and lastly 6-8 months (17.85%). Most primary caregivers were the mothers of the children (96.31%) followed by grandmothers (2.20%). The age of primary caregivers ranged between 18 and 60 years with a mean age of 28.31±6.49SD years. Most of the primary caregivers were from the Grassfield regions of Cameroon (64.31%).
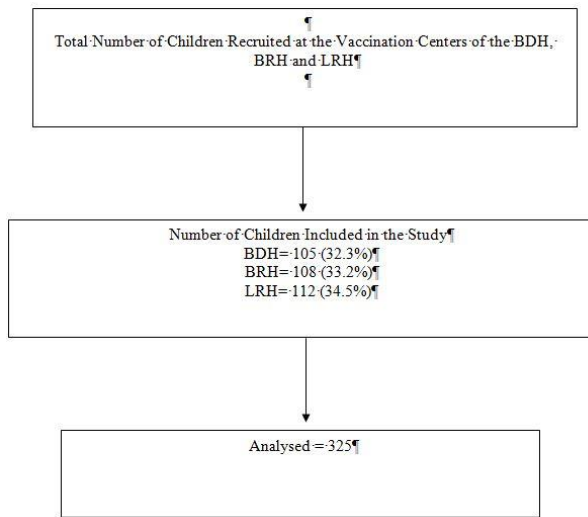
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Fig 1: Recruitment flowchart

Complementary foods, Complementary Feeding Index (CFI) score and WHO indicators: The majority, (n=118, 36.3%) of the caregivers reported initiating complementary feeding with semi-solid homemade foods like paps and porridges and this even for 50% of <3-month-old infants. Continued breastfeeding was practiced by 60% (n=195) of caregivers, bottled feeding in 67.74% (n=210) and timely initiation of complementary feeding in 48.71% (n=151/310) of children. Food included at least 4 food classes in the past 24 hours in 70.65% (n=219/310) of children. Children ate at least twice a day in 91.69% (n=298/309) of the sample, and food frequency per food class in the past 7 days was four or more times of cereals/grains/tubers in 53.87%, of pulses in 16.13%, milk and dairy products in 19.03%, meat/eggs/flesh in 31.94%, vitamin A rich fruits and vegetables in 7.74%, and other fruits and vegetables in 30.65% of children. The mean CFI

score was 10.63± 3.12SD with a minimum of 3 and a maximum of 19. Medium CFI score was present in 88.06% (n=273/310), low score in 9.33% (n=28/310) and high score in 2.90% (n=9/310) of children.

Minimum daily meal frequency was achieved in 74.19% (n=230) of children while minimum acceptable diet and dietary diversity was achieved in 27.42% (n=85) and 20.00% (n=62) of children respectively as shown in **Table I.**

Anthropometric indices: Overall, 23.69% were malnourished. The proportion of underweight was 9.35% (n=29): 0.92% severely underweight while 8.31% had mild to moderate underweight. A total of 13.23% (n=41) patients were stunted: 3.38% were severely stunted while 10.15% had mild to moderate stunting. For wasting, this related to 6.77% (n=22): 2.46% were severely wasted while 4.31% had mild to moderate wasting and 4.92% (n=16) were overweight/obese as shown in Table II.

Stunting was therefore the most prevalent form of malnutrition. There were similar trends in all forms of malnutrition within different age ranges.

Association between CFI score, WHO indicators and anthropometric measures: Age of the child in months (p=0.014), underweight (p=0.011) and wasting (p=0.040) were associated with CFI score categories. The WHO indicators: minimum acceptable diet (p <0.001) and dietary diversity (p <0.001) were also associated with CFI score. The three WHO indicators in our study were not associated with WAZ, LAZ or WLZ scores (p >0.05).

Nonetheless, compared to low CFI scores, medium CFI scores were associated with normal WAZ scores (B=1.01, OR=2.74, 95% CI: 1.13-6.66, p=0.026). The other anthropometric measures were not influenced by the CFI score categories as shown in Table III. No other variables were significantly associated with WAZ score as shown in **Table IV.**

Table I Comparing CFI items and WHO indicators in three age groups of children.					
Variables	**Age groups of the children**			**Total**	**p value**
	6-8 months (n=58)	**9-11 months (n=177)**	**12-24 months (n=90)**		
Continued breastfeeding	29	109	57	195	0.771
Bottled feeding	29	118	63	210	0.858
Food type consumed last 24hours					
Cereals/grains/tubers	36	160	90	286	0.002
Pulses	10	42	25	77	0.758
Milk/Dairy products	11	55	30	96	0.711
Meat/eggs/flesh	12	95	46	153	0.009
Vitamin A-rich fruits and vegetables	2	23	12	37	0.300
Other fruits/vegetables	11	90	51	152	0.003
Number of solid meals per day	2.98	3.33	3.51	3.33	0.004
Timely initiation of complementary feeding	15	91	45	151	0.145
Food type consumed at least 4 times in last 7 days					
Cereals/grains/tubers	15	92	60	167	0.00
Pulses	5	26	19	50	0.53
Milk	5	33	21	59	0.10
Meat/eggs/flesh	7	55	37	99	0.00
Vitamin A-rich fruits and vegetables	0 (0)	15	9	24	0.33
Other fruits/vegetables	6	54	35	95	0.01
Minimum acceptable diet	8	49	28	85	0.32
Minimum daily meal frequency	33	128	69	230	0.68
Dietary diversity	8	32	22	62	0.46

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Table II Comparison of selected caregiver's and child's characteristics with complementary feeding index score categories

Variables	Complementary feeding index score			Total	P
	Low score (n=28)	Medium score (n=273)	High score (n=9)		
Centre (LRH)	12	86	4	102	0.64
Carer's characteristics					
Age of the carer in years	27.21	28.31	30.78	26.25	0.34
Number of children at home	2.26	2.45	2.89	2.47	0.63
Married caregiver	15	177	7	199	0.34
Grassfield origin	21	172	6	199	0.45
50 or less monthly income	14	117	5	136	0.56
Tertiary education	11	124	3	138	0.64
Child's characteristics					
Age in months	9.32	10.45	13	10.22	**0.02**
Age 6-8 months	8	35	0	43	**0.03**
Female gender	15	141	2	158	0.21
Underweight (W/A Z score <-2)	7	21	1	29	**0.01**
Wasting (W/L Z score <-2)	5	15	1	21	**0.04**
Stunting (L/A Z score <-2)	6	35	0	41	0.21
Overweight/obesity	1	14	0 (0)	15	0.74
Minimum acceptable diet	0 (0)	76	9	85	**<0.0**
Minimum daily meal frequency	21	200)	9	230	0.2
Dietary diversity	4	49	9	62	**<0.001**

Table III Prediction of anthropometric parameters based on WHO indicators and CFI score

Variables	W/A Z-score*		L/A Z-score*		W/L Z-score*	
	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
WHO indicators						
Minimum daily meal frequency	0.95 (0.39-2.34)	0.919	0.66 (0.29-1.5)	0.325	1.51 (0.72-3.19)	0.275
Dietary diversity	1.17 (0.42-3.2)	0.766	0.87 (0.39-1.94)	0.325	1.28 (0.51-3.24)	0.596
Minimum acceptable diet	1.43 (0.56-3.65)	0.458	0.9 (0.44-1.86)	0.776	1.65 (0.69-3.92)	0.258
CFI score						
CFI Total score	1.12 (1-1.29)	0.053	1.06 (0.95-1.17)	0.313	1.12 (1-1.25)	0.058
CFI Low score (REF)	1	-	-	-	1	-
CFI Medium score	2.74 (1.13-6.66)	**0.026**	1.8 (0.8-4.07)	0.158	1.92 (0.81-4.54)	0.136
CFI High score	1.83 (0.2-16.77)	0.594	593429698.12 (0-infinity)	0.998	1.83 (0.2-16.77)	0.594

Prediction of normal Z score (-2 < z < +2). **REF:** Reference category is low score on CFI :(Complementary Feeding Index) Score. **OR**:Odd's ratio. CI:Confidence interval. **W/AZ score**:Weight for age Z-score. **L/A Z-score**:Length for age Z-score. **W/L Zscore**:Weight for length Z-score.

Table IV Comparing selected characteristics with Weight for Age Z score status.

Variables	W/A Z-score*			p value
	Normal	Underweight	Severely underweight	
Centre (LRH)	105 (35.59)	6 (22.22)	1 (33.33)	0.307
Carer's characteristics				
Age of the carer in years	28.34±6.58	28.11±5.77	28.33±6.81	0.985
Number of children at home	2.51±1.72	2.12±1.72	2±1	0.498
Married caregiver	193 (65.42)	17 (62.96)	2 (66.67)	0.966
Grassfield origin	188 (63.73)	18 (66.67)	3 (100)	0.412
50K FCFA or less monthly income	130 (44.2)	13 (48.15)	0 (0)	0.280
Tertiary education	137 (46.6)	7 (25.93)	2 (66.67)	0.089
Child's characteristics				
Age in months	10.19±3.36	10.74±3.74	8.33±2.08	0.452
Age 6-8 months	52 (17.63)	5 (18.52)	1 (33.33)	0.762
Female gender	152 (51.33)	14 (51.85)	1 (33.33)	0.820
Overweight/obesity	16 (100)	0 (0)	0 (0)	0.425

W/AZ score: Weight for age Z-score.

DISCUSSION

This hospital-based cross-sectional study aimed at assessing Complementary Feeding (CF) Practices implemented by caregivers of children aged 6-24 months who attended Vaccination Centres of three healthcare facilities in Cameroon. The mean age of initiation of CF was 5.7 ± 3.38 months which was later than the age according to Laadjel *et al* **[14]** in Eastern Algeria where the mean age was 4.79 ± 1,79 months; and 4 months

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according to Mbusa *et al* [15] in the Democratic Republic of Congo. We also found that in 48.71% of children, there was a timely initiation of CF at the age of 6 months. This is lower than the 72.6% reported by Ngo Um-Sap *et al* in Yaounde, Cameroon [11] and 68% according to the 2018 Cameroon Demographic and Health Survey [16]. In addition, the first type of complementary food predominantly introduced according to our study was semi-solid homemade soups, pap or porridge (36.3%), mostly made of cereals/grains/tubers (55.7%), This probably relates to the availability and cost-effectiveness of these foods/ingredients, despite their weak nutritional value. This is in line with Ngo Um-Sap *et al*, who reported pap (55.8%) with main ingredient being corn (85.3%). Udoh et al also reported that the main complementary food in Nigeria was guinea corn pap (37.3%) and the most consumed foods were starchy foods [11,17]. On the other hand, the first food introduced in Eastern Algeria was described to be olive oil, where 100% of children had received it as first complementary food [14]. These differences may relate to sociocultural norms which are seldom evaluated in these practice and need to be explored in further studies. Grains/cereals/tubers, were consumed by 92.26% of children while protein-rich pulses/beans/nuts were consumed by 24.92% of the children. This is similar to the findings of Korir *et al* in a focus group discussion carried out in 2013 in Kenya where 94.4% of children had consumed grains, roots and tubers and 18.2% had consumed legumes/nuts [18]. As similarly reported in our study, Lencha *et al* in Sodo Town, Ethiopia in 2021 reported that dairy, flesh food and eggs were included into the meals of 58.1%. 15.8% and 31.8% children respectively [19]. The consumption of vitamin-A rich fruits and vegetables in our study was lower than that of Kimiywe *et al* in Kenya where Vitamin-A rich fruits and vegetables were consumed by 47.8% [20]. In this study, 74.19% of participants met the minimum meal frequency, which is much higher than the MMF obtained by Udoh et al which was 36.7% [17] and even higher than global trends i.e. 50% according to UNICEF Global Databases. Nonetheless, because of the high prevalence of abnormal nutritional status in our study, it is safe to say that quality of complementary feeding should be prioritized over quantity [25] This hypothesis is comforted by the fact that only few children (20.0%) met the minimum dietary diversity. This was very low compared to the MDD derived from a hospital based cross-sectional study in Addis Ababa, Ethiopia by Solomon *et al* which was 59.9% [21]. This is also significantly lower than the MDD estimated during the 2014 Cameroon Multi Indicator Cluster Survey which was 32.9% and higher than results obtained in Oromia, Ethiopia by Agize *et al* where the MDD was 16% [22,23]. MDD has been proven to be an adequate indicator of diet adequacy, thus our results provide evidence that there is a gap to bridge with nutritional counselling of caregivers of children aged 6-24 months [24]. Stunting was the most common form of malnutrition, which was similar in other relevant studies [15,20,26]. The hospital-based design in our study probably explains why our study's prevalence was lower than that reported by the 2018 Cameroon

Demographic and Health Survey (CDHS) report (29%) which employed a community-based design. The prevalence of wasting in this study (6.77%) was slightly lower than that derived by Njigang et al in the Tole Health Area (7%) [2] but higher than national prevalence according to the CDHS (4%). The prevalence of underweight (9.35%) was higher than that obtained by Ngo Um-Sap et al, which was 4.6% which could be explained by the fact that this study is multicentric, and included children living in rural communities [11]. CFI scores have been previously associated to L/A Z-scores [6], however, in our study this was not the case. Our findings were rather similar to those reported by Ahmad et al who found no association between LAZ score, WLZ score and complementary feeding index or even WHO indicators [7]. Nonetheless, compared to low CFI scores, medium CFI scores were associated with normal WAZ scores. Since CFI principally evaluates quantity and quality of caloric intake, it was expected that the main anthropometric parameter it affects will be weight for age, which is a marker of early caloric deficit [27]. When a child consistently consumes fewer calories than their body requires for growth and development, it can lead to insufficient energy availability, resulting in weight loss or the inability to gain weight appropriately. The CFI may be more appropriate than WHO indicators alone in evaluating adequacy of complementary feeds in relation to nutritional status. Further studies need to be conducted to explore their use in our setting.

This study was based on dietary recall, and therefore carries the potential of significant recall bias, hindering the reliability of the collected data. Nonetheless, because of the multicentric nature of the study, cutting across a variety of backgrounds and cultures, in addition to our relatively high sample size makes us consider our results as useful evidence.

CONCLUSION

Most caregivers practice timely initiation of complementary feeding in children aged 6-23 months. However, these practices are inappropriate and are associated with weight for age Z-score.

DECLARATIONS

Competing interests
The authors declare no potential conflicts of interest.

Funding
No funding was received for this study.

Consent for publication
 Not applicable

Ethical approval and informed consent
Ethical clearance was obtained from the Institutional Ethics Committee of the University of Douala. Informed consent was obtained from all participants prior to inclusion.

Data availability statement

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