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ASSESSMENT OF FEEDING PRACTICES AND NUTRITIONAL STATUS OF INFANT AND YOUNG CHILD IN RURAL HEALTH ZONES OF SOUTH KIVU PROVINCE (DEMOCRATIC REPUBLIC OF THE CONGO)

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Abstract: Optimal infant and young child feeding (IYCF) practices are crucial to improving the health and nutritional status of children: a public health intervention to prevent child morbidity, mortality and malnutrition. The main purpose of this study was to assess the feeding practices and nutritional status of infant and young child (IYC) from 0 to 36 months of age in rural health zones of South Kivu province, as well as the coexistence between the children's eating behavior and nutritional status. A cross-sectional study was conducted from March-May 2018 on 210 children. Data collection included socio-economic and demographic characteristics, anthropometric measurements and assessment of IYCF practices by using the 24-hour dietary recall. A total of 210 (121 females and 89 males) children were included in the study. Colostrum is most often given (77%). All children are breastfed; 92% are breastfed on demand. The median age of cessation of breastfeeding (BF) is 27.7 months. Only 20% of children are breastfed immediately after delivery. About 37% receive pre-milk fluids. Only 21% of those aged 0-3 months are exclusively breastfed. Only 30% of those aged 6-8 months receive complementary foods. The median age of introduction of the first food is 9.5 months. About 30% of children never receive porridge. Majority of mothers gave children 3 types of food according to their classification, including starch and cereals, meat and alternatives, and fruits and vegetables with a total diversity score of 0.75 (¾). Porridges consumed are of low nutritional quality, 60% consisting only of a cereal and water. Among children who take a complementary food, the frequency is at least 3 times a day for 49% of children aged 6-8 months, 57% of those aged 9-11 months and 68% of those aged 12-17 months. Their MUACs were below 125 mm and the vast majority did not show edema and their weight-for-height ratio was less than minus to standard deviations. The rates of stunting, underweight and emaciation are 43%, 46% and 13% respectively (*Z*-score <-2σ). The late introduction of complementary foods and their insufficient quality (the daily ration, eating meat, consumption of milk and milk products and weight of the child) are statistically significant factors that affect the nutritional status of children ($p<0.05$). These results provide a base information for intervention programs. They call for further research on the influence of IYCF practices on nutritional status. Four recommendations are issued.

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Keywords: Breastfeeding, weaning food, complementary food, nutritional status, infant and young child, South Kivu

Introduction

The level of child and maternal under nutrition remains unacceptable throughout the world, with 90 per cent of the developing world's chronically undernourished (stunted) children living in Asia and Africa (Brundtland and Bellamy, 2003; FAO, 2009; UNICEF, 2016). Malnutrition in IYC is a public health concern in developing nations. Over 33% of all infant deaths globally can be indirectly linked to malnutrition, even though it is hardly registered as a direct cause (Bain *et al.*, 2013). In 2001 it was observed that malnutrition in developing countries accounted for 54% of all infant mortalities; in addition, impoverishment of households remains the primary contributing factor to this public health problem (Bain *et al.*, 2013).

Improving IYCF practices has been identified as a fundamental intervention to deal with the suboptimal nutritional status of children under five years of age in resource-limited countries (WHO, 2009; UNICEF, 2012). Feeding practices in young children relate to a series of behaviors that the mother develops. They include how and for how long she breastfeeds, the choice of different types of complementary foods, the ages at which the various practices are introduced or discontinued, and the amounts served. These practices are of fundamental importance for the survival and harmonious development of children (WHO/UNICEF, 2008; WHO, 2016; 2017b).

In many countries, nutritional problems in infants and young children are closely linked to complementary feeding practices; as shown by way of example by Brou-Tanoh, (2010) for Ivory Coast; Mabossy-Mobouna and Mokemiabeka (2018) for Congo-Brazzaville; Nlend *et al.* (1997) for Cameroon; Sawadogo *et al.* (2004) for Burkina-Faso; Mekhancha-Dahel, (2005) for Algeria; Salim *et al.* (2014); Muhammad Hanif (2013) for Bangladesh; Bhandari and Chowdhury (2016); Puri (2016); Budimelli and Chebrolu (2015) for India; Ergin *et al.* (2007) in Western city of Turkey.

Countless international efforts are being made to ensure sufficient and healthy food for all humanity. However, despite all efforts, it is worth noting that this challenge has not yet been met. Inadequate feeding practices put children at risk of malnutrition (WHO, 1998; Mekhancha-Dahel, 2005; FAO, 2009). Malnutrition is one of the main causes of morbidity and mortality of children under 5 years of age in the world in general and in developing countries specifically (Ergin *et al.,* 2007; UNICEF, 2016). It is responsible for the deaths of more than 6 million children under the age of five worldwide. It is also responsible for serious physical failures among young children, as well as significant cognitive disorders that will more or less considerably hinder their educational and professional future (Pelletier and Frongillo, 2002).

In the Democratic Republic of Congo, DRCongo the 2013-2014 Demographic and Health Survey (EDS) and the 2010 Multiple Indicator Cluster Surveys (MICS4) provide an overall description of observed practices (EDS, 2014); however, these national data conceal regional, provincial, or cultural disparities. Yet, the implementation of appropriate intervention strategies

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to effectively address nutritional problems requires disaggregated data in each region or province countrywide, particularly on food and health practices. Infants and young children have special needs that require appropriate feeding and intakes (Anon, 2017; Syed and Das, 2017). However, no national survey exists on the IYCF practices and their nutritional status and especially children in the 3 first months of life (i.e., from 0 to 36 months of age). Partly in response to this need, we proposed to conduct a descriptive survey on feeding practices and nutritional status of infants and young children aged 0-36 months in the deprived rural health zone of eastern DRCongo, South Kivu province. This communication focuses on BF practices, feeding habits, complementary feeding and the nutritional status of infants and young children in the studied area.

The present survey aimed to assess the feeding practices in infants and young children in the age group of 0 to 36 months and study its association with nutritional status of children. The objective of present study was to assess the feeding practices and nutritional status of infants and young children of age group from 0 to 36 months; in a deprived rural health zone, the field practice area of Kalehe rural health zone, South Kivu province (DR Congo) and explore the IYCF practices among children under 36 months of age. Lastly, the coexistence between feeding practice and nutritional status was assessed.

Materials and Methods

Study design

To achieve the objectives of the present study, villages in each health area (HA) of Kalehe rural health zone in South Kivu province were selected (Table 1). Infants and young children in the age group of 0-36 months were selected since the nutritional status and child care/feeding practices are more important in this age group for the child to be healthy and prevent them from malnutrition.

A cross-sectional study was carried out to assess the dietary intake and nutritional status of infants and young children, data collected from March 3 to May 30, 2018. Interview schedule was formulated to elicit the information on their socio-demographic and economic background, children care and feeding practices to their children from their mothers.

Anthropometric measurements like height, weight, mid-upper arm circumference (MUAC) and weight-for-height were derived for analysis to determine infants and young children's nutritional status. The standard electronic weighing scales precise to 0.1 kg (UNICEF Electric Scale: UNIscale) was used to measure the weight and height of each children (double weighing method). The mother was asked to remove child's shoes, socks and heavy clothes. Also, a manual infant meter/stadiometer, a portable rigid length board with a head and a sliding foot piece with precision of 0.01 mm (UNICEF-Child Pediatric Wooden Mobile Wall Mounted Stadiometer), was used to measure supine length of infants and heights of older children were measured using standard techniques recommended by (UN, 1986). The height of children under 87 cm was taken in lying position, while for those of 87 cm or more in the standing position.

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To measure the arm circumference, MUAC ribbon was used for this indice used as an alternative method to weight-for-height for measuring leanness. Mothers were asked to remove the clothes covering the child's left arm. A mark halfway between the left shoulder and elbow (middle of the left arm) was made by placing the 0 of the MUAC on top of the shoulder and bringing the other end toward elbow. The number at the elbow to the nearest centimeter was tied. The resulting number was then divided by two to get an estimate of the midpoint between the shoulder and elbow. A mark on the arm was made with a pen at this value. The child's arm was relaxed and the MUAC placed around the arm at the marked point. The researcher made sure that the numbers were right side up, the MUAC was touching the child's skin, and that the tension applied was correct, that the MUAC was not too tight (arm compressed) or too loose (MUAC was not touching the skin all around the arm). Each step was repeated as necessary.

When the MUAC was correctly placed and the applied tension was correct, the researcher read and spoke aloud the measurement to the nearest 0.1cm and immediately recorded the resulting measurement (UN, 1986).

The weight and height measurements were converted into one summary indices of nutritional status: weight-for-height W/H (standard deviation SD), determined using a WHO-recommended weight-for-height Unisex table, 2006 (WHO, 2006).

According to WHO criterion based on percentiles, children who were below the 3rd percentile below the reference median on the basis of indices were considered respectively to be underweight, stunted and wasted. Indeed, the anthropometric nutritional assessment is a universally applicable technique; fast; simple; reliable; inexpensive and able to detect malnutrition (De Onis and Habicht, 1996) because the size is a very faithful measure of the phenomenon of growth and the weight increases with age.

Bilateral pitting edema (kwashiorkor) was verified by applying pressure using the thumb on top of both feet for three seconds and if it leaves an indentation on the foot after the thumb is lifted, then the child presents nutritional edema. In most evaluated cases, anthropometric measurements and/or the presence of bilateral pitting edema confirmed a clinical diagnosis of edematous malnutrition (WHO/UNICEF, 2009; PCIMA-RDC, 2016).

All studied parameters were crossed by the nutritional status. Depending on the value of Z-score obtained, children is: obese > + 2σ; pre-obese or overweight > + 1σ; normal: between - 2σ and +1σ; moderate weight deficit < -2σ; severe weight loss < - 3σ. (De Onis *et al.,* 2007) OR: good status (normal): SD or W/H Z-score indices ≥ 1.5 SD or -1 or 0 and/or MUAC ≥ 12.5 cm and <13 cm and malnutrition: SD or W/H Z-score indices < -3 SD and/or MUAC < 11.5 cm (WHO, 2006; PCIMA-RDC, 2016).

The Unisex Table recommended by (WHO, 2006) which provides a summary of the nutritional status of children (boys and girls) based on the child's height (cm) and weight (kg) was used in this study as reference to evaluate the nutritional status of our target population by weight-for-height ratio (Z-score).

Children were in severe acute malnutrition (SAM) when noticed the presence of bilateral pitting edema (nutritional edema) or MUAC <11.5 cm or weight-for-height *Z*-score (WHZ) < -3 SD

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(standard deviation) or weight-for-height <70% of growth reference (WHO and UNICEF, 2009; Desormeaux, 2015; PCIMA-RDC, 2016).

Sampling and techniques

Sampling was done using the simple random selection to two-stage cluster survey method. A total of 210 mothers with children in the age group of 0-36 months (couple mother-child) in the study area comprising both male and female child were randomly selected for the study. To achieve the two-stage cluster survey, children were selected within the 30 clusters above in Table 2. In each selected village in the cluster, a direction drew at random by rotating a bottle, the direction indicated by the neck of the bottle was chosen and go to the end of the village in this indicated direction by counting the number of dwellings. The first house was chosen by a random draw among all the houses met. The following houses was chosen step by step until the number of children needed. Always we chose the house whose front door is closer to the last house visited.

According to WHO, the couple mother-child of 0 to 36 months residing in a health zone, representing 12% of the total population. Thus, for the studied health zone was (181592*12/100) = 21790 children from 0-36 months old. To carry out this operation, Fisher's formula was our guide:

$$n = \frac{\varepsilon^2 x\ p\ x\ q\ x\ d}{a^2}; n = \frac{(1.96)^2 \text{ x } 0.072 \text{ x } (1-0.072)}{(0.05)^2} = \frac{3.8416 \text{ x } 0.072 \text{ x } 0{,}928}{0.0025} \text{ x } 2 = 205.34 \approx 206 \text{ respondents}$$

with:

Ɛ = risk of error, Ɛ = 1.96 to 95% of confidence

p = Prevalence of the studied phenomenon: 0.72% (0.072)

q = Complement of p from where q = 1-p

α = The desired precision or (margin of error, α = 0.05)

d = Cluster effect = 2

To find the number of respondents per HA in each unit, the total number of participants in this study (210) has been multiplied by the total population in the HA, divided by the total target population of the health zone (21790) (Table 2). The following formula was used:

$$n = \frac{\text{total respondents x pop/HA}}{\text{pop.total of ZH}}$$

The total population cumulative was calculated by adding the population of each unit (target population in a HA) to the total population of the previous units. This amount ordering the population by assigning each unit a certain number of fictitious numbers, proportionally to the population of these units (MSF, 1998). The number of respondents per cluster, was calculated using the formula below:

Number of respondents per cluster = $\frac{n}{30} = \frac{206}{30}$ = 6.8 = **7** respondents/cluster, from which we have a total of 210 respondents/30 clusters.

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Distribution of the population by HA in 2018

Table 1. Kalehe health zone population distribution by HA 2018

Health area (HA)	Total population
Bushaku	9281
Bushushu	20751
Cigera	11229
Ishovu	8568
Kasheke	11737
Kalehe	19553
Lemera	15031
Lushebere	13201
Luzira	8371
Muhongoza	12311
Mushenyi	6513
Nyabibwe	17461
Nyamukubi	9775
Tchofi	1475
Mweha	6335
Total	**181592**

To determine the probing pitch (K), we used the following formula: K= $\frac{N}{30} = \frac{21790}{30} = 726$

K = no probing or sample interval

N = total population estimated from 0 to 36 months old

30 = number of clusters (PRONANUT-DRC, 2013). To pull the clusters, we used the ALEA-ENTRE-BORNES function of the Ms. Excel software, which helped us find a number between 1 and K= 319. We pulled the first cluster between 1 and K and the following clusters by gradually adding K to S. Clusters were considered as villages in different HAs (Table 2). The distribution of sample by HA is shown in Table 2 below.

The criteria for non-inclusion were: be a couple mother-child who is not in the age range of 0 to 36 months, not residing in one of the HAs of Kalehe health zone, refusal to participate in the study and absence on the day of the survey. This study was conducted in three phases: the preparatory phase, the field data collection phase and finally the data entry, processing, analysis and publication phase.

Data collection

The data on food consumption was assessed using the food record method: pre-established 24-hour dietary recall data sheet endorsed by (FAO, 2018), which consists of noting food and beverages divided into three meals per day including snacks: breakfast, lunch and snack consumed 24-hours before the investigation. The questionnaire (survey starting tool) was pretested on some mothers for a week to ensure clarity of the questions. After validation, this

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retrospective questionnaire was based on a collection of answers to set of questions to obtain information on social characteristics data, the eating behavior and dietary intakes of each IYC. To find the food diversity score, the daily food consumption based on four-star diet including: milk and dairy products, meats and substitutes, cereals and starchy foods, fruits and vegetables were evaluated. The generalizations achieved through the present study were discussed in the present article with some of the important findings.

Table 2. Sample distribution by HA
The coverage of the studied health zone and HA is as follows:

HA	Total pop.	Target pop. 0-36 months old	n=210	Cumulative pop.	Assigned Number	Number of clusters/HA
Bushaku	9281	1114	11	1114	1-1114	1
Bushushu	20751	2490	24	3604	1115-3604	3
Cigera	11229	1347	13	4951	3605-4951	2
Ishovu	8568	1028	10	5979	4952-5979	1
Kasheke	11737	1408	13	7387	5980-7387	3
Kalehe	19553	2346	23	9733	7388-9733	3
Lemera	15031	1804	17	11537	9734-11537	2
Lushebere	13201	1584	15	13121	11538-13121	2
Luzira	8371	1005	11	14126	13122-14126	2
Muhongoza	12311	1477	15	15603	14127-15603	2
Mushenyi	6513	782	7	16385	15604-16385	1
Nyabibwe	17461	2095	20	18480	16386-18480	3
Nyamukubi	9775	1173	11	19653	18481-19653	1
Tchofi	1475	1377	13	21030	19654-21030	2
Mweha	6335	760	8	21790	21031-21790	1
Total	**181592**	**21790**	**210**			**30**

Data processing and analysis

Collected data were entered in Excel 2007 table, imported into Epi-Info 1.3.5 software for their analysis. The Weight-for-height table recommended by the WHO allowed us to determine the standard deviation or the weight-for-height (Z-score) ratio. The numbers and percentages were calculated for qualitative variables. Different statistical tests were used to carry out this analysis, among others the Pearson Chi-square test and Fisher exact, at the significance level of $p<0.05$ for possible association. As for the feeding practice, eating habits and reminder of 24 hours of children was assessed through their weekly food consumption and the previous day. To do so, foods consumed regularly and those consumed yesterday by children were noted.

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Ethical considerations

Approval for the study was obtained from institutional review board IRB under the auspices of the Ministry of Health. Mothers of children selected by random sampling; who were willing to be part of the study were interviewed to obtain desired information. The interview was conducted in Kiswahili, Mashi and Kihavu local languages according to the consent of the respondents. Information was obtained on selected socio demographic characteristics: age of children, religion, etc. socio-economic status (SES), current feeding practices of infants and children were assessed using pretested questionnaires. The questions were constructed based on the standard IYCF module adjusted to the local context.

Results and discussion

Descriptive data

Sociodemographic characteristics of mothers

Mothers participant in this survey were between the age of 18 and 30 years (60.5%) with predominance of the protestant religion (51.9%), the great majority were married (90.5%). 41.9% mothers presented a level of primary education, a high rate of illiteracy (34.80%), the profession devoted to agriculture (61.90%) with a predominance of the Havu tribe (80%) on a household size of up to 7 people and an estimated daily ration of less than USD$ 3 (Table 3). These results are different to those found by Diallo in 2004 on the situation of women with IYC between 0-36 months old in Mali were in the age group between 25 and 34 years, most represented with 46% (Diallo, 2004). Similar to those of (Camara, 2009), who founds predominance in the age group of 20-29 years with a rate of 61.4%; and an illiteracy rate of 78.4%, 95.5% of married women, 78.4% of housewives. For children, the largest age group was between 0 and 6 months with a rate of 24.6%; the male sex was predominant with a rate of 59.1%. (Diallo, 2004) founds the rates of 53% for children aged 0 to 4 months and 52.5% for men. Therefore, the awareness and understanding of the BF support program caused a dramatic increase in the practice of EBF by nearly 6 times; educational levels of caregivers also demonstrated similar tendency: The higher the educational levels, the higher the percentage of EBF uptake (Basrowi *et al.*, 2015).

Data on infants and young children feeding practices

Mothers weaned their children at the age of 6 months and over, the mothers considered plus the quantity of food consumed by their children, the most widely used source of drinking water is tap water, the most consumed foods by the majority of children were cereal flours, starchy and tuberous, the frequency of feed was less than 8 times per day while the number of meals was less than or equal to three per day (Table 4). Compared to Benin results, complementary foods consist mainly of maize flour, millet or sorghum (46%) and mixtures or recipes often poorly made of cereals and legumes (42%) (INSAE, 2015).

The traditional corn-based porridges given to children have a very low energy density which is of the order of 36 to 60 kcal/100 ml for millet and sorghum-based porridges in Burkina-Faso, 44

to 64 kcal/100 ml in Gabon and 60 kcal/100 ml in Congo (Kouton et *al.,* 2017). Micronutrient densities are also low. The porridges are poorly enriched with proteinaceous materials and the daily consumption frequency is low. Children are accustomed to eating carbohydrate-based foodspro exclusively like corn stew with sauce or crushed chili without meat or fish (Kouton et *al.,* 2017). By these practices, the use of low-quality complementary foods and the inadequate conduct of the complementary feeding process may partly account for the 34% prevalence of stunting observed in Beninese children at preschool age (Kouton et *al.,* 2017).

The frequency of children feeding was below 8 times a day while the number of meals was less than or equal to three meals a day. Comparing these results with those of Mali, supplemental feeding was given less than 5 times in 87.3% of children (Diallo, 2004).

Brown (2017) conducted a narrative evaluation to synthesize subjects in relevant literature using PubMed, Science Direct and Web of Science, to determine hurdles to BF at the societal rather than at the level of the individual caregiver, were economic influences, health policy and service issues were all recognized. BF had more hurdles at the societal level compared to the individual level, and these effects are usually outside the control of the caregivers; therefore, BF is a public health problem that demands substantial investment at a societal level (Brown, 2017).

In this study, the age of dietary diversification was 6 months for 99.5% of children. 98.3% of mothers breastfed their child each time they claimed it. Indeed, BF was the most common feeding method with 83.3% compared to other forms of feeding used. Nevertheless, efforts still need to be made, especially with regard to EBF. In fact, 69.9% of children did not benefit from EBF. Of the 83 who benefited from it, only 16.3% lasted up to 6 months (Table 4). Workplace barriers are among one of the various factors which contribute to discontinuation of BF practices; this is more pervasive in workplaces where there are no provisions for nursing mothers and caregivers to bring their children (Ajibade *et al.*, 2013). Agunbiade and Ogunleye (2012) argued that conflicting positions on feeding practices, as well as having a spouse who offered little or no support, are known to influence infant feeding behaviors. In developing counries, according to the studied lessons from Ethiopia, the introduction of complementary feeding at about the 6th month is considered as good timing, and the periods between 6 and 23 months is the highest point where growth falters. The study concluded that BF along can only guarantee optimal nutritional needs for the first 6 months, beyond that time if complementary feeding is not introduced there will be a shortfall in the total sum of energy and micronutrients essential for most favorable growth and development of the IYC (Abeshu *et al.*, 2016). Studies have demonstrated that about 13 billion United States dollars could possibly be saved in terms of morbidity cost, if 90% of IYC in North America were breastfed, this will reduce the volume of biodegradable and non-biodegradable materials from infant formula and bottles pile up which is a treat to the environment (Bomer-Norton, 2013).

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Table 3. Sociodemographic characteristics of mothers surveyed

Variables	Effective (n= 210)	%
Age (year)		
< 18	10	4.8
18-30	127	60.5
≥ 31	73	34.8
Mean (± SD)	28.11(±6.16)	
Religion		
Adventist	9	4.3
Catholic	76	36.2
Muslim	9	4.3
Protestant	109	51.9
Jehovah witnesses	7	3.3
Marital status		
Single	17	8.1
Married	190	90.5
Separate	3	1.4
Study level		
Primary	88	41.9
None	73	34.8
Secondary	45	21.4
University	4	1.9
Profession		
State Agent	4	1.9
Agriculture	130	61.9
Trade	30	14.3
Seamstress	3	1.4
Teacher	11	5.2
Household	32	15.2
Tribe		
Batembo	16	7.6
Bembe	3	1.4
Havu	168	80.0
Hutu	12	5.7
Lega	5	2.4
Shi	6	2.9
Household size		
< 7	136	64.8
≥ 7	74	35.2
Daily ration (USD$)		
< 3	142	67.6
≥ 3	68	32.4

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Table 4. Infant and young child feeding (IYCF) practices

Variables	Effective (n=210)	%
Age of weaning of the child (months)		
< 6	92	43.8
≥ 6	118	56.2
Consideration on diet		
Hygiene condition	6	2.9
Quality	14	6.7
Amount	190	90.5
Source of drinking water		
Tap	204	97.1
Source	6	2.9
Cereal consumption		
No	128	61.2
Yes	82	38.8
Vegetable consumption		
No	106	50.7
Yes	104	49.3
Consumption of milk and milk product		
No	182	86.7
Yes	28	13.7
Consumption of meat		
No	170	81.0
Yes	40	19.0
Fish consumption		
No	158	75.2
Yes	52	24.8
Fry consumption		
No	46	21.9
Yes	164	78.1
Fruit consumption		
No	162	77.1
Yes	48	22.9
Starch and tuber consumption		
No	17	8.1
Yes	193	91.9
Sugar consumption		
No	125	59.5
Yes	85	40.5
Frequency of BF per day		
≤ 8	130	93.5
> 8	80	6.5
Number of meals per day		
≤ 3	141	67.0
> 4	69	33.0

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In view of these results, majority of mothers gave children breakfast, lunch, dinner but the snack was served by the minority (Table 5). Comparing these results with those of Burkina-Faso by (Sawadogo *et al.*, 2004), study focused on a qualitative 24-hour dietary recall of BF on the eve of the investigation, as well as the consumption of complementary foods or liquids other than breast milk (water, herbal tea, etc.). According to the study conducted in Bamako (Korotimi, 2011), for children who received complementary foods, the complete list of foods and ingredients was developed with the help of mothers. Data from this 24-hour dietary recall, or current status data, as a function of age, was then used to estimate the median ages at the onset or cessation of feeding practices, using modeling (probit regression). It is simply a question of estimating the probability of observing the practice studied (BF, consumption of mush, etc.) as a function of age method already used by (Ferreira *et al.*, 1991). Al-Binali (2012) maintained that there is important benefits of exclusive breastfeeding (EBF) and the incidences of otitis media, gastroenteritis, respiratory diseases, sudden infant death syndrome (SIDS), and necrotizing enterocolitis (NEC) are lower in exclusively breastfed IYC. There is improved mother-infant bonding when EBF is practiced, and these exclusively breastfed IYC have also demonstrated improved cognitive ability when neurodevelopmental assessed (Rempel & Moore, 2012). EBF practice has shown to be directly responsible in reducing occurrences or severity of bacterial infections such as meningitis, diarrheal disease, and neonatal sepsis; lymphoma, leukemia, Hodgkin's disease, and asthma are also reduced (Kramer and Kakuma, 2012).
Basrowi *et al.*, (2015) argued that the working environment of the caregiver was a determining factor for the practice of EBF, this was demonstrated in a cross-sectional research study carried out in five workplace environments. Data elicited from 186 participants showed 52% of the caregivers' age ranged 20−46 years of age, 75.3% of the participants' educational levels were high, 12.9% of the subjects had 2 or more children, and 36.0% had their own homes (Basrowi *et al.*, 2015). The prevalence of EBF in the first 6 months postnatal was 32.3%, the researcher also noted that a suitable devoted BF center was accessible for 21.5% of the caregivers, but only 7.5% of the participants are in touch with a BF support program (Basrowi *et al.*, 2015). Despite the small study sampling size, which is the study limitation because of its ability to decrease the statistical power, the authors concluded that dedicating a BF center increases the adoption and practice of EBF by nearly 3 times.

Anthropometric measurements for infants and young children

Majority of children in this study were under 24 months of age, most were female, the weight was 8kg and over, the dominant size was less than 80cm, their MUACs were less than 125mm, and the vast majority did not have the same size. edema and their weight-for-height ratio was less than minus two standard deviations SD (Table 6). Akombi *et al.* (2017) argued that stunting is one risk factor for the poor mental and physical development of young children 5-years-old and below. Results in Brazil, indicate that during the four years of the intervention, stunting girls and boys, as well as underweight.

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Table 5. 24-hour dietary recall of food consumed

Variables	Effective (n=210)	%
Breakfast		
No	69	32.9
Yes	141	67.1
Lunch		
No	39	18.6
Yes	171	81.4
Dinner		
No	5	2.4
Yes	205	97.6
Snacks		
No	129	61.4
Yes	81	38.6

For the combined sexes, the reduction was 11.4 and 9 percentage points for stunting and underweight, respectively. The decline in stunting was very marked, whereas emaciation (Weight/Height) was virtually unchanged. Wasting should not be used for evaluation because it is a relatively rare condition and highly susceptible to seasonal influences. Note the different age groups for stunting and wasting for some of the children measured for stunting were older than the children in the intervention (Ferreira, 2020).

Analytical data

Factors influencing the nutritional status of infants and young children aged 0-36 months in the studied health zone

Only the daily ration, eating the meat and the weight of the child were statistically significant influence with the nutrition status ($p<0.05$, Table 9, 10). Concerning the diversity score, majority of mothers (≥59.5%) gave the children 3 kinds of foods according to their classification, including starchy foods and cereals, meat and alternatives (fish and local edible insects), and fruits and vegetables (Table 8). We find that most (184 participants either 87%) achieve a total diversity score of 0.75 or ¾ (Table 9). In comparison with the Mali study by (Diallo, 2004), the Food Diversity Score the minimum Daily Allowance of 6-23 months also varies by age class as the minimum acceptable diet. He adds that the consumption of eggs was observed only in children aged 24 to 59 months (0.2%), while 1.7% of this age group consume milk and produce dairy. Level of children from 6 to 23 months: No remarkable variation in average Score of the Daily Allowance SDA was observed according to the periods.

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Table 6. Anthropometric measurements

Variables	Effective (n=210)	%
Age of the child (month)		
<24	117	55.7
≥24	93	44.3
Gender		
Female	121	57 .6
Male	89	42.3
Weight (kg)		
<8	51	24.3
≥8	159	75.7
Height (cm)		
<80	117	55.7
≥80	93	44.3
MUAC (mm)		
<125	106	50.5
≥125	104	49.5
Presence of edema		
No	182	86.7
Yes	28	13.3
Z-Score		
<-2	173	82.4
≥-2	37	17.6

According to the study of (Diallo, 2004), the average is 2.82 in the initial period against 2.80 in the final period. Level of children aged 24 to 59 months: As in children aged 6 to 23 months, the average SDA of children aged 24 to 59 months did not change significantly. An average of 4.5 with a minimum of 1 and a maximum of 7 during both periods. The decrease in the SDA of end-line mothers compared to Baseline is justified by the fact that the 2012-2013 crop year was better than that of 2013-2014 in the Banamba circle on the one hand; On the other hand, the circle has seen many interventions like that of ACF-E through its project of resilience and distribution of M'isola and many others like that of MAP implemented by CSPEEDA, adds (Bruce, 2003).

In this study, a bi-varied analysis, shows that milk and milk products influence child malnutrition in the studied health zone at a 95% confidence interval The median age of introduction of the first food is 9.5 months. About 30% of children never get porridge. The porridges consumed are of low nutritional quality, 60% consisting of only one cereal and water. Among children who take a complementary food, the frequency is at least 3/day for 49% of children 6-8 months, 57% of those 9-11 months and 68% of those 12-17 months (Table 9). According to (PADABA, 2015), the nutritional practices in infants and young children are not also the best in Niger and, together

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with morbidity, constitute one of the determining factors in the nutritional status of children. Although BF is the general rule, it is very common and it is extended on average up to 22 months, it is not generally exclusive: before the age of 6 months, 13.5% only children under 6 months of age are exclusively breastfed. Most often, from birth, the newborn receives sweet water or holy water.

Table 7. Influence of Dietary Patterns on the nutritional status of children from 0 to 36 months in Kalehe Health Zone

Factors	**Effective (n=210)**	**%Malnutrition**	**OR (95% CI)**	***p-value***
Mother's age (year)				
<30	127	81.9	1.0	
≥30	83	83.1	1.09(0.52-2.26)	0.82
Marital status				
Married	190	83.2	0.61(0.21-1.79)	0.36
Not married	20	75.0	1.0	
Study level				
Illiterate	73	86.3	1.55(0.71-3.41)	0.28
Educated	137	80.3	1.0	
Profession				
Without occupation	32	81.3	1.0	
With occupation	178	82.6	1.09 (0.42-2.88)	0.86
Household size				
<7	100	82.0	1.0	
≥7	110	82.7	1.05 (0.52-2.14)	0.89
Daily ration (USD$)				
<3	142	89.7	0.43 (0.18-1.03)	0.04*
≥3	68	82.4	1.0	

*significant (p<0.05); OR: Odd Ratio

According to the study in Burkina-Faso, only 28.3% of babies are breastfed within one hour of birth. Then, until the milky rise, the baby is fed with goat or cow's milk, not boiled (UFR-SVT/CRSBAN). Supplementary feeding starts very early or very late depending on the region. If in the East of the country (Magaria), the foufou (a local staple food made from cassava flour) can be given to a child from the first week of life, in the West (Loga, Ouallam) no food is given to him before he knows how to go to four legs (8 to 10 months). From a general point of view, 62.1% of children aged 6 to 10 months receive complementary nutrition. However, the child does not benefit from a special complementary diet, he is directly initiated to share the family dish (Brundtland and Bellamy, 2003). The usual consumption of meat and the weight of the child

have a statistically significant influence with the nutrition status ($p<0.05$) (Table 8). These study findings are consistent with Ahmad *et al.*, (2018), who concluded that IYC with a high prevalence of underweight were known to have experienced suboptimal complementary feeding practices; therefore, the need to improve complementary feeding practices for a better nutritional status outcome is important. Poor nutritional status of infants has become a public health problem of concern in Eastern DRCongo; the occurrence of growth faltering is highly prevalent where there is inadequacy of complementary feeding in terms of the quality, quantity, and frequency of diets. In this study, the bi-varied analysis shows that milk and milk products influence child malnutrition in the Kalehe health zone at a 95% confidence interval (Table 9).

Table 8. Influence of dietary habits of the infants and young children on their weights and nutritional status

Factors	Effective	%Malnutrition	OR (95% CI)	*p-value*
Age of weaning (months)				
<6	91	84.6	1.32 (0.64-2.73)	0.46
≥6	119	80.7	1.0	
Meat consumption				
No	170	85.3	2.49 (1.12-5.52)	0.02*
Yes	40	70.0	1.0	
Fish consumption				
Yes	52	86.5	0.66 (0.27-1.62)	0.36
No	158	81.0	1.0	
Fruit consumption				
Yes	48	80.2	1.0	
No	162	89.6	0.47 (0.17-1.29)	0.14
Sugar consumption				
Yes	125	85.9	0.66 (0.31-1.39)	0.27
No	85	80,0	1.0	
Weight of the child (kg)				
<8	51	85,5	0.45(0.21-0.95)	0,03*
≥8	159	72,5	1.0	

Multi-varied logistic regression analysis of the determinants of malnutrition among children aged 0 to 36 months

Multi-model analysis in logistic regression model shows that eating meat and child weight were significantly associated with nutritional status ($p<0.05$, Table 10). Universally, IYC are faced with growth challenges such as stunting, wasting, overweight, and obesity. Developing healthy eating behavioral habits is influenced by responsive parenting behaviors and the consumption of healthy foods (Black and Aboud, 2011).

This study does not allow us to establish a precise relationship between the described feeding practices and nutritional status. However, the practices observed clearly deviate from the recommendations for ensuring better nutritional status for IYC from 0-36 months of age and, as

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such, could help to explain the high rates of malnutrition (under-nutrition) recorded in the province by the National Program of Nutrition (PRONANUT).

Table 9. Influence of food consumed on the nutritional status of IYC

Variables		**Effective**			**%**	**OR (95% CI)**	**p**
Diversity score		**Malnutrition**	**Good condition**	**Effective**			
	0.5	19	68	87	41.4	1.0	
	0.75	31	66	97	46.2	0.69 (0.02-0.15)	0.45
	1	6	20	26	12.4		
Milk and dairy products							
		SAM	**Good condition**	**MAM**	**%**		
Yes		5	21	2	13.3	1.0	
No		9	133	40	86.7	0.35 (0.25-0.49)	0.01*

Table 10. Logistic Regression Analysis of the determinants of malnutrition of children from 0-36 months in the Kalehe Health Zone

Variables	**Adjusted OR**	**95% CI**	***p-value***
Eating meat	2.10	(1.29-6.97)	0.01*
Weight	0.39	(0.17-0.88)	0.02*
Food ration	0.4678	(0.19-1.15)	0.10

OR: Odd Ratio; SAM: Severe Acute Malnutrition; MAM: Moderate Acute Malnutrition

Conclusion and recommendations

IYCF practices in the rural health zones of South Kivu province in eastern DR Congo pose mainly problems at two levels: during the neonatal period, when BF initiation practices are far from optimal, and after the age of 6 months, when breast milk becomes insufficient to cover their nutritional needs. Late introduction and insufficient quality and quantity of complementary foods can have a significant impact on nutritional status. It is therefore essential that mothers receive education on BF and complementary feeding. IYC most affected by undernutrition (Z-score <-2σ) are those who rarely consume meat, milk and milk products and whose households have an insufficient daily ration.

In view of the results found in this study, it is advisable to recommend:

(i) To the mothers of the children from 0 to 36 months of age: to apply the diversification and the balanced diet, to envisage the consumption of milk and dairy products for an adequate intake of

calcium in order to improve the nutritional state of the children. Participate in nutrition education sessions to learn about child nutrition.

(2i) To the Central Bureau of Health Zone (BCZS): to ensure better training of health workers so that they can provide mothers with quality information on appropriate child feeding practices. At the place of health workers; Give birthing mothers and mothers who come with their infants a monthly consultation with all the necessary information on proper early childhood feeding practices so that they can put them into practice and in turn sensitize other mothers; Multiply practical education sessions on infant feeding for mothers.

(3i) To the researchers: to deepen this subject by conducting more surveys to acquire much more information that can be used to strengthen the implementation of the issue.

(4i) To the Congolese government: to strengthen anti-poverty policies; disseminate information on good food practices in children through the media, health centers and billboards.

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