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Feeding Practices and Nutritional Parameters of Children Aged 6-14 Years from Cameroon

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FEEDING PRACTICES AND NUTRITIONAL PARAMETERS OF CHILDREN AGED 6-14 YEARS FROM CAMEROON

Strictly as per the compliance and regulations of:

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I. Introduction

Nutrition plays a key role in health and development of an individual. Good nutrition protects the infants, the children and the mother, strengthens the immune system and reduces the risk of non communicable diseases related to foods. It also enhances the productivity of the population and can help to get out gradually from the vicious circle of poverty and hunger (UNICEF, 2011). The nutritional needs of an individual require the consumption of balanced diet. However, not everyone has access to optimal feeding. Inappropriate food habits linked to poor nutrients intakes are unable to cover nutrients needs of the body, leading to malnutrition (Baneko, 2008).

Malnutrition is then a result of less or excess of one or more nutrients (FAO, 2003). In all its forms it has serious health consequences and now, there is a double burden of malnutrition especially in developing countries. According to FAO (2006), more than 3.5 billion people are suffering in the world, for malnutrition and hunger. Each year, almost 9 million deaths of children fewer than 5 years, estimated from 33 to 56% are attributable to malnutrition (UNICEF, 2011). Malnutrition if not control at the youngest age will lead to chronic diseases at adulthood. Schoolchildren are also one of groups severely affected by malnutrition, after infants and young children. Long term poor eating habits affect lifestyle and cause related chronic diseases including obesity, diabetes, cardiovascular diseases and some cancers (Kobayassi et al., 2010). In recent years, obesity has become prevalent not only among adults but also in children in Japan (Kouda et al., 2004). Those who are obese in childhood tend to remain obese as adults (Freedman et al., 2005; Guo et al., 2000; Fried et al., 2005; Whilhok et al., 2005). When children are overweight, they are more likely to develop metabolic syndrome later in life (Vanhaha et al., 1998). Furthermore, the longer individuals rae overweight, the greater their risk of cardiovascular diseases (Baker et al., 2005). Various factors contribute to obesity, including physical inactivity, an irregular and unbalanced diet, and over-eating (Sugiura et al., 2007). Dietary habits are formed during childhood (Mikkala et al., 2005). To prevent adult obesity, it is desirable that individuals acquire appropriate dietary habits in childhood. Habitual dietary intake among children should be assessed to evaluate childhood dietary problems, enabling the correction of any bad dietary habits malnutrition consequences comprising essentially, the impairment of cognitive, and learning capacities resulting in the quickly and early drop out from school (Alaimo et al., 2001; Sanokho, 2005, Victoria et al., 2008).

In Cameroon, despite the quantity and diversity of food resources, populations are not exempt to nutritionals problems (PAM, 2007). According to statistics from the Department of Public Health, the prevalence of stunting among children under five rose from 23% in 1991 to 32% in 2004. Malnutrition is implicated in more than 50% of infant mortality. Deficiencies in vitamin A and iron affect respectively 38% and 58% of children under 5 years (EDSCIII, 2004). Beyond the age of 5 years there is very little information on child malnutrition in Cameroon. Available data concerns preschool children nutritional status and feeding (Kana Sop et al., 2008, Kana Sop et al., 2011),

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very little work was carried on school age children (Ponka et al., 2006). This work was thus initiated to assess the nutritional status of the population of children in Makèpè Missokè in order to contribute to the optimization of food and nutrition security in this locality.

II. Materials and Methods

a) Study Area

The study took place in Douala. Douala is the most popular city of Cameroon (with 14.4% of the Cameroonian's population, which is 2,510,283 inhabitants) (CRTV news, 2010)). Makèpè Missokè is one of the poorest sub-quarter or locality of Douala according to AFEF (2011).

b) Subjects Recruitment

All the children (6-14 years of age, n = 255) were registered at the Bilingual Confidence Primary School of Makèpè Missokè and enrolled in anthropometrics measurements. Ninety nine of them were randomly selected for serum albumin determination. A sub-sample of 25 children (8 females and 17 males), Representing about 10% of the sample size, were involved in 3 day Weighed food records. The study was approved by the Cameroon National Ethics committee. The study aim and methods were explained orally, and written informations were provided to all parents/guardians (i.e., the person whose prepared the child's were enrolled). Then, the parents/guardians provided their written informed consent.

c) Weight Measurements

Using Salter scale (1 - 120 Kg Cap, AMSUA at 0, 01 Kg), subjects were made to stand on the platform without touching anything. Shoes were removed. Readings were taken to the nearest 0.2Kg. Weighing was done when the stomach was virtually empty.

d) Height Measurements

The children were made to stand without shoes on the platform of the vertical toise. The head erect comfortably was held in the same vertical plane as the external auditory meatus. The head piece was then lowered gently, crushing the hair and making contact with the top of the head. Readings were taken to the nearest 0.5 cm.

e) Biochemical Analyses

Blood samples were collected only on children whose parents gave their consent and signed the inform consent form. Thus, blood samples of 99 children were taken on an empty stomach in the morning between 8 and 10 h. Approximately 2 ml of venous blood were collected from each child. The blood collected was introduced in dry tubes and sent to the biochemistry laboratory at the University of Douala. Centrifugation of the blood was performed using a Sigma 2-6 E centrifuge type at the speed of 3600 x g for 20 min. This technique allowed us to separate serum from whole blood. The serum (supernatant) was extracted using a micropipette "eppendorf" (1000 mL) and introduced into cryotubes (1.2 mL). The serum obtained was then used to determine the albumin content.

f) Food Intakes

Three days weighed food records were conducted during a week. Foods intakes of children was quantified by using household weighing measuring tools, such as standard measuring cups and spoons, ruler for Measuring dimensions. We help children parents and guardians to fill the form detailing each menu according to breakfast, lunch, dinner, or snack in each investigation day. We determined the child's daily intake of food items by weighing their meal before an after each meal. We then calculated the nutrient intake for each child using the nutrients composition of dishes consumed in Douala of Kana Sop et al., 2008 and other item present in Nutrisurvey software. We defined food as not only a single food item (e.g., banana) but also as a mixed dish (e.g., banana stew). We calculated the composition of nutrients in the food per 100 g. For even the coating data sheets, we had the help of investigators trained for the occasion.

g) Anthropometric Analyses

Data from anthropometric measurements were analyzed using WHO (2007) standard references. Nutritional state indicators used were Body Mass Indices (BMI) for age, weight for age, height for age Z-scores. By the use of the indicator's above Z-score results, percentages of stunted, wasted, overweight and normal children were calculated. The overall prevalence rates of malnutrition were obtained by setting the threshold of normality to -2 z-scores below the baseline average for indicators P/A and T/A and 2 z-scores above the average reference indicator for BMI/A. Serum albumin concentrations of the children were compared according to their nutritional status. Food composition tables published by Kana Sop et al. (2008) and Nutrisurvey 2007 software were used to calculate and estimate the energy and micronutrients intakes of dishes consumed by any of the enrolled subjects. The results then were compared with the requirement or daily recommended values. We used two methods to develop the list of food types. First, we used the method reported by Block et al., 1998 and modified by Kobayashi el al (2010) and ranked all of the reported food types according to the contribution analysis. We were especially interested in the total energy, protein and calcium, magnesium, phosphor, zinc, copper and iron. The percentages were calculated by dividing the nutrient contents of each food type by the total nutrient amounts. All of the food types that contributed at least 0.15% to the total energy and nutrients were combined. In addition, we excluded food types eaten by fewer than 15 subjects.

III. Statistical Analyses

Mean and standard deviation of the height and weight measurements and serum albumin concentration were determined using Graph pad prism version 5. Significance was considered with $p \leq 0.05$.

IV. Results and Discussions

In this study, male sex was the most represented with 136 boys against 119 girls. Sixty seven percent (67%) of children live in families with at least five individuals. In addition, nearly 78.6% of mothers of investigated children had primary level of education against only 21.4% for secondary school level and beyond (table 1). Table 2 shows mean weights and heights of the children ranged from 19.2 ± 3.1 to 36.5 ± 8.0 kg and 108.7 ± 5.3 to 143.6 ± 7.8 cm respectively. Evolution of height and weight of these children shows that there growth faltering in many cases (table 2).

Prevalences of various nutritional disorders encountered in the study population were 18.0 % for stunting, 5.1 % for underweight and 1.6 % for overweight (table 3). These prevalences were much lower than those of children under 5 years in Cameroon according to the ESDCIII (2004). These results showed a decrease of nutritional disorders with age in Cameroon. No significant difference ($p > 0.05$) between age of children suffering from stunting (9.5 ± 1.8 years), low weight (10.2 ± 2.4 years) and overweight (9.0 ± 1.4 years) were observed. From the children suffering from nutritionals disorders, height and weight were lower than that of normal children. On the number of children with wasting and overweight, girls were most affected with respectively 53.84 and 75% of cases (Table 4). The content of serum albumin of children who are underweight was the lowest (31.2 ± 2.9 g / l) and below standard (35-55 g/l) recommended by the assay method (table 4). Serum albumin levels of all children except of those suffering of wasting were in the normal range (table 4). Boys took between 89.5% and 100.6% of their daily energy requirement and girls between 100.9% and 114.1%. Mean daily protein intake of the Children was above 50% for all the children. However their daily calcium, magnesium, potassium, zinc, and iron intakes were below the daily requirement values. Copper intakes of 10-12 years children were above requirement for all the two sexes. The food type intake frequencies were classified into many levels linking consumption mode. For example, we used seven (i.e., everyday, 5-6 times per week, 3-4 times per week, 1-2 times per week, 2-3 times per month, 1 time per month, or never); eight ("2-3 times per day" was added to seven categories); nine ("4-5 times per day" was added to eight categories) and eleven ("8-10 times per day", "6-7 times per day" were added to nine categories) according to general intake frequency of each food type. The estimation of portion size was classified into six categories referring to the photographs in full-scale size; that is, one-third, one-half, the same amount, 1.5 times, twice, and other.

Table 1 : Characteristics of the study population

Parameters	Effective	Frequency (%)
Sex		
Male	136	53.3
Female	119	46.7
Age (years)		
6-10	163	63.9
10-14 years	92	3.1
Size of household		
< 5 persons	84	33
≥ 5 persons	168	67
Mothers instruction level	252	
Primary	198	78.6
Secondary and beyong	54	21.4
M= Male; F= female, SD= Standard Deviation		

Table 2 : Mean weights, heights and Body Mass Indices (BMI) of the 6-14 years old children

Age (years)	Sex	Number	Mean weight (± SD) (Kg)	Mean height (± SD) (cm)	BMI (± SD) (Kg/m²)
6	M	11	19.2 ± 3.1	110.2 ± 6.3	15.7 ± 1.9
	F	9	18.3 ± 2.6	108.7 ± 5.3	15.2 ± 2.6
7	M	14	22.5 ± 3.0	118.4± 5.5	16.5 ± 1.2
	F	18	21.3 ± 3.5	116.5 ± 5.3	15.3 ± 1.8
8	M	20	25.4 ± 4.5	121.7 ±10.6	16.8 ± 2.7
	F	21	25.8 ± 3.2	123.9 ± 4.5	16.9 ± 1.3
9	M	39	26.6 ± 3.2	126.3 ± 6.9	17.0 ± 1.9
	F	31	27.4 ± 5.2	128.6 ± 7.2	16.2 ± 2.2

10	M F	24 14	29.2 ± 4.3 27.4 ± 2.5	130.8 ± 4.8 129.7 ± 4.3	16.9 ± 0.9 16.0 ± 0.7
11	M F	24 19	32.0 ± 5.1 33.0 ± 7.4	134.0 ± 4.7 134.1 ±11.8	17.8 ± 1.3 18.3 ± 2.1
12	M F	3 6	36.3 ± 5.0 36.5 ± 8.0	138.6 ± 10.9 143.6±7.8	19.2 ± 1.4 17.8 ± 1.7
13	M F	1 1	30.0 ± 0.0 36.0 ± 0.0	131.0± 0.0 143.0 ± 0.0	17.5 ± 0.0 17.6 ± 0.0
Total		255			

Figures are means ± standard deviation (SD); SD=Standard Deviation F= Famale; M= Male; BMI= Body Mass Indices.

Table 3 : Percentage of children classified as normal, wasted, stunted, underweight and overweight

Indicators	Normal <-2 SD, >+2SD	Wasting ≤- 2SD	Stunting ≤- 2SD	Underweight ≤- 2SD	overweight ≥ + 2SD	Total
Weight for age	94.5 (241)	51 (13)	-		0.4 (1)	100 (255)
Height for age	81.6 (208)	-	18 (46)		0.4 (1)	100 (255)
BMI for age	96.47 (246)	-	-	1.96 (5)	1.6 (4)	100 (255)

The numbers in brackets represent the number of subjects. SD= Standard Deviation

Table 4 : Characteristics of children according to their nutritional status

Parameters	Group				
	Normal (n=192)	Stunting (n=46)	Wasting (n=13)	Overweight (n=4)	P
Individuals factors					
Mean age (years)	8.8 ± 1.5 [a]	9.5 ± 1.8 [a]	10.2 ± 2.4 [ab]	9.0 ± 1.4 [a]	*
Mean weight (Kg)	28.0 ± 9.3[ab]	24.7 ± 5.9[a]	21.4 ± 5.6[a]	34.0 ± 7.8 b	**
Mean height (cm)	127.9 ± 9.3 [b]	118.5 ± 10.8 [ab]	117.0 ± 12.4 [ab]	129.0 ± 7.7 [b]	*
Sex distribution					
Female % Male %	45.4 54.6	43.47 5.53	53.84 46.16	75 25	NR
Serum albumin levels (g/l)	48.7 ± 11.1[b]	38.1 ± 7.7[a]	31.2 ± 2.9 [a]	46.2 ± 2.1[ab]	***

n= number of subjects.

* = Significant at P <0.05

** = Significant at P <0.01,

*** =Significant at P <0.001, NR = not relevant.

Figures in the same line carrying the same superscript letters are not significantly different at least at p≤0.05.

Table 5 : Estimated daily energy and nutrient intakes of 6 - 14 years old children compared with FAO/WHO (1990) daily needs

Sex	Nutrients/Age	Age (yrs)	Energy (kcal)	Protein (g)	Ca (mg)	Mg (mg)	P (mg)	Zn (mg)	Cu (mg)	Fe (mg)
Female	Mean daily intake	6-9	1916.6±241.4	38.6±11.3	275.7±45.9	103.3±9.7	320.6±25.4	3.7±0.9	1.16±0.3	3.74±0.7
	FAO/WHO daily needs		1900	34	800	200	3800	9	0.75	8
	% of coverage		100.9	113.3	34.5	51.6	8.4	41.1	154.6	37.4
	Average daily intake	10-12	2172.9±308.1	40.2±84	194.9±18.4	108.0±13.7	274.2±29.2	4.7±1.1	2.5±0.6	4.1±0.9
	FAO/WHO daily needs		1905	49	1200	280	4500	12	0,77	10
	% of coverage		114.1	82.0	16.2	38,.5	6.0	39.2	324.6	51.2
Male	Average daily intake	6-9	1700.9±129.3	31.2±10.5	355.3±54.2	106.3±19.3	324.7±47.5	2.9±0.6	0.4±0.03	3.8±0.09
	FAO/WHO daily needs		1900	34	800	200	3800	9	0,75	8
	% of coverage		89.5	91.7	44.4	53.2	8.5	32.2	53.3	38
	Average daily intake	10-12	2133±419.6	42.2±10.5	196±33.4	100.3±22.1	316.6±50.4	4.6±1.3	1.9±0.02	3.7±0.04
	FAO/WHO daily needs		2120	48	1200	280	4500	12	0,73	10
	% of coverage		100.6	87.9	16.3	35.8	7.0	38.3	260.2	46.2
Macronutrients and micronutrients intake levels were estimated from Kana Sop *et al.* (2008)										

It was observed that children diet was very monotonous. Stunting and falter growth observed may be due to poor knowledge on optimal feeding. Intakes of nutrients estimated by weighed foods dairy record (WDR) showed very insufficient coverage of daily needs apart for energy. We used weighed foods dairy record (WDR) for easy estimation of nutrients intakes.

WDR is quantified either by weighing or determining volumes using a household measuring tool, such as standard measuring cups and spoons, and a ruler for measuring dimensions. Usually, general WDR performers weigh the raw ingredients (Buzzard, 1998), but we were interested by the weight of eaten portions of the meals. We used a digital cooking scale as an index of the size of the dish. Energy, protein, was calculated directly. To obtain the necessary open-ended data from children, we conducted our WDR personally. Even if energy needs were meeting globally, the recipes were imbalanced in tem of macronutrients contribution to energy intakes. The fact that in this study, male group was the most represented with 136 boys against 119 girls may be linked to ignorance. Girls are always in high number than boys in our society. However, girls drop out from school earlier to help household activities. In poor families, when funds lack, parent preferred to send boys at school (ESDCIII, 2004). Sixty seven percent (67%) of children live in families with at least five individuals and this condition was linked to poor growth. The number of children and the family size was inversely correlated malnutrition indicators. According to Emel et al., (2005) household size has a very big influence on young children nutritional state. There is therefore competition on the household's financial resources which could affect the nutritional status of children living in poorest families were also most malnourished. According to Madginzira et al., (1995), the educational level of mothers is very important especially when living conditions are difficult. Poverty and malnutrition form a vicious cycle. Poverty prevents individuals to access good nutrients sources. For example, meat, fishes and animal foods sources are very rich in bioavailable minerals, but it is very inaccessible to poor population. They are forced to consume mainly vegetal foods that contain many antinutritional substances that inhibit micronutrients bioavailability and sometimes micronutrients digestibility. Illiteracy is another underlying factor of poor feeding. Individuals in these cases are limited in knowledge and cannot master optimal feeding.

It is well known that those stunted children would have poor school result as they may be usually ill. Malnourished children tend to start school later, progress less rapidly, have lower attainments, and perform less well on cognitive achievement tests, even into adulthood. These indirect effects of malnutrition on productivity are substantially more than the direct effects of height on schooling and hiring. Malnourished children may receive less education than their well-nourished peers for a number of reasons. Caregivers may invest less in their education or schools may use physical size as a rough indicator of school readiness, and thus bar children of short stature from entering school at the appropriate age. Malnourished children are also sick more often and so absent more often, and learn less well when they are in school. Studies showed that delayed entry to school leads to lower expected lifetime earnings because of fewer years in the workforce (Behrman et al., 2004). In addition to its impact on adult productivity through less schooling, severe malnutrition also affects learning capacity or cognitive development directly, with consequent impact on schooling productivity and labor productivity. Birth weight and breast-feeding both correlate with cognitive development; malnourished children perform poorly on cognitive tests, have poorer psychomotor development and fine motor skills, have lower activity levels, interact less frequently with their environments and fail to acquire skills at normal rates (Grantham-McGregor et al., 1999).

Stunting prevalences were still high in these group affecting mostly boys. Similar results were found by Wamani et al. (2007) in Congo, in children less than 5 years. In fact, malnutrition that start during preschool age is usually not corrected among affected children that are exposed to the same food habits. However, the stunting rate is lower than those found in preschool infant (ESDC, 2004). As indicated earlier, growth deficits in the first 2 to 3 years of life are only partially regained during childhood and adolescence, particularly when children remain in poor environments. Stature at age 3 is strongly correlated with attained body size in adulthood in several countries (Martorell et al., 1994; Simondon et al., 1998).

Actions need to be taken because affected children may have poor scores in school and are more exposed to diseases. The synergy between malnutrition and infectious diseases is well established (Schrimshaw et al., 1968). In a widely quoted study, Pelletier et al. (1995) estimated that 56% of child deaths can be attributed to the potentiating effect of malnutrition (including low birth weight), with most of those deaths linked to mild or moderate malnutrition, rather than severe malnutrition. Although severely malnourished children are more likely to die, they are far fewer in number. Children with mild, moderate or severe malnutrition would be, respectively, 2.5, 4.6 and 8.4 times more likely to die than children whose weights are within the normal range for their ages. Not only a significant proportion of child can deaths from common infectious diseases be attributed to malnutrition (measles, 44.8 %; malaria, 7.3 %; diarrhea, 60.7 %; and pneumonia, 52.3 %) but malnutrition also increases the likelihood of having an attack of malaria, diarrhea or pneumonia (but not measles) (Caulfield et al., 2004). There is also increasing evidence that fetal malnutrition predisposes to the metabolic syndrome later in life (Barker, 1998). This result suggests that boys recover less of their growth retardation with age.

The contents of serum albumin of children who were underweight were low (31.2 ± 2.9 g / l) and below standard (35-55 g / l) (table 4). Serum albumin levels of

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all children except those affected by wasting were in the normal range. However, the children suffering from nutritionals disorders have their heights and weights lower than those of normal children. This decrease was also reported by Diouf et al., 2000; Simpore et al., 2009 in children suffering from severe malnutrition, and Yapi et al., (2010) among children under 5 years suffering from moderate or minor malnutrition.

Coverage of energy by boys ranging between 89.5% and 100.6% of their daily energy requirement where lower than those of girls, ranging between 100.9% and 114.1%. This may be explained by the fact that girls eat more frequently than boys. No matter the age group considered, girls energy intake was above WHO (1985) and FAO (1990) standard. This observation could be due to the high number of snack found in their diaries. Most of their proteins intakes were from plant foods but there are some good nutritionally combinations they make in the area that can help in improving the quality of their protein intake. For example, plant foods like beans were being prepared with animal foods like dried fish. Vegetables and cereals were usually blended together in their meals and this combination gives protein of very high quality. Calcium, magnesium, potassium, zinc and iron intakes were low in the diet of these children. The problem with micronutrients like calcium, iron, zinc, magnesium and copper from plant sources is poor bioavailability because of phytates and fibres contains of plants (Kana Sop et al., 2008 Kana Sop et al., 2012). Another explanation of the low intake of minerals was poor consumption of vegetables and fruits, poor consumption of animal foods and practices in preparations process in the area (these include, reheating of vegetables in meals several times before consumption, fruits and vegetables of exposure to some degree of sun-drying before eating).

This study highlights types and causes of nutritional problems in the area of Makèpè Missokè. Stunting, wasting and overweight were the physical forms of malnutrition identified in that area. Besides macronutrients, there were poor intakes of micronutrients due to inappropriate feeding linked to poor knowledge of available foods and poverty. The solution therefore remains the intensification of nutrition education, dietary diversification and fortification, optimal processing, post harvest improvement in storage and handling techniques.

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