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Prevalence and Risk Factors of Malnutrition in Children Zero-Five Years in Tole Health Area, South West Region of Cameroon

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Abstract Childhood malnutrition is a multi-dimensional problem, and it adversely affects the productivity of nations as well as creating economic and social challenges among vulnerable groups. It remains a major challenge to public health in developing countries and Cameroon is not an exception. The aim of this study was to assess the prevalence of malnutrition in children 0-5years and contributing factors in the Tole health area. A cross-sectional study was carried out in eight quarters in Tole including 301parent/ children. Data was collected through the administration of questionnaire to children's parents/caregivers to obtain socio-demographic and socio-economic information. In addition, measurement of anthropometric indices such as weight, height, and mid upper arm circumference (MUAC) were obtained. Data was entered into excel version 13 and analyzed using SPSS 22. Descriptive analysis was carried out to investigate the spread of scores. A chi square test was carried out to test for an association between sociodemographic/ socioeconomic characteristics and nutritional status of children. The Odds Ratio was used to measure the strength of association between potential predictive factors and nutritional status with significant levels measured at 95 % confidence interval (CI) and significant differences set at $P<0.05$. Interpretation was done using Z-scores (mild malnutrition≤1SD, moderate malnutrition≤2SD and severe malnutrition≤3SD). The overall prevalence of malnutrition was 36.5% with Stunting being the most common form of malnutrition (20.9%), underweight (8.6%) of the children and wasting (7%). Risk factors associated with malnutrition were age more than12 years (p= 0.030), lack of vaccination (p=0.028), poor feeding habits (p=0.041), household size (p=0.023). This study showed a high prevalence of malnutrition in the Tole health area among children below 5years.Nutrition education, especially to mothers and integration of activities in all health units and communities will go a long way to fight malnutrition.

Keywords: *malnutrition, risk factors, prevalence, childhood, children 0-5 years, Cameroon*

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1. Introduction

Malnutrition is a major public health problem, especially in many low-income and middle- income countries [1]. It adversely affects the productivity of nations as well as creating economic and social challenges among vulnerable groups. Poor nutrition is associated with suboptimal brain development, which negatively affects cognitive development, educational performance and economic productivity in adulthood [2]. Child growth is the most widely used measure of children's nutritional status. The first1000 day of life (0-33months) is a very critical phase in a child's life during which rapid physical and mental development occurs [3]. Under nutrition during this critical phase can have irreversible consequences on the child's growth leading to an increased risk of morbidity and mortality in children. Under nutrition is commonly assessed through the measurement of child's anthropometry (height, weight and arm circumference), as well as through screening for biochemical and clinical markers [1]. Wasting, stunting and underweight are expressions of under nutrition and the anthropometric indicators for the assessment of a child's nutritional status.

Under nutrition is the underlying cause of child mortality in about 45% of all deaths reported for children

under-5 years of age [4]. In 2015, globally about 7.7% of children were wasted, 24.5% were stunted and 15% were underweight [5]. The African region and South-East Asia have reported the highest prevalence of under nutrition, with the former accounting 39.4% of the stunted, 24.9% of the underweight and 10.3% of the wasted children under-5 years of age [6]. According to the Sustainable Development Goals (SDG) report, sub-Saharan Africa (SSA) accounts for one third of all undernourished children globally, high lighting that malnutrition still remains a major health concern for children under 5 years in the Sub-region, thus buttressing the need for urgent intervention [7]. Other studies have reported the burden and determining factors of childhood malnutrition in SSA [8]. These studies have varied design and geographic operationalization, making it difficult to make regional comparisons and put in place regional initiatives to meet global agendas such as the SDGs.

2. Materials and Methods

2.1. Study Area and Setting

The study was carried out in the Buea Health district, precisely in Tole health area.Tole is a village in Buea, the chief town of Fako Division, South West Region of Cameroon. It is a rural community with heterogeneous and multi-ethnic setting of approximately 10000 inhabitants, the staples of these enthic groups mostly constitute carbohydrate (Buea Health District, 2016). The main food crops include maize, yams, cocoyams, vegetables and fruits. Theses fruits and vegetables are sold in large quantities to traders from neighbouring town and cities, and samll quanatities of fruits and vegetables are consumed by the inhabitants of Tole. Most of the dwellers are farmers who have no steady source of income.The main economic activitiy here is farming, and however, apart from being involed in farming at individual levels, most of the dwellers serve as employees in the Tole tea estate.

Unlike other rural areas in the South-West, school drop out rate remains a cause for concern in that it promotes unawareness in daily life realities like poor nutritional knowledge, poor family planning knowledge and prevention of infectious diseases (District Health Service Buea). The presence of fast flowing streams and rivers, swampy areas and thick bushes favours breeding sites for mosquitoes, miges, black fly just to name a few.Tole has two seasons, the long rainy season which starts from March to Novermber, and the dry season which starts from November to March.

2.2. Study Design and Population

This study was a cross-sectional community-based study conducted for five months from June to October 2017. It recruited children from 0-5years whose parents gave their consent. Random sampling techniques was used to select the sampling unit which was a parent and a child. All nine quarters of the health area was sampled and a ballot was selected we began counting at 4 and after every fourth house we selected the next household until our sample size was obtained. Parents who had children younger than 5years were interviewed until a sample size was obtained. Only one child was selected per household. Questionnaires were administered to these parents, and socio-demographic, socioeconomic and anthropometric measurements were obtained.

2.3. Inclusion and Exclusion Criteria

Parents of children less than 5 years, who gave their assent; and children within the ages of 0 -5years were included in this study. Parents of children who were more than 5 years old; parents who did not give their consent, children older than 5years and children within the age 0-5 years who were sick were excluded from this study.

2.4. Sample Size and Sampling Methods

2.4.1. Sample Size Determination

The sample size was determined using the formula:

$$\mathbf{N} = \frac{Z^2 pq}{d^2}$$

Where:
N = Desired sample size/Minimal sample size
z = Standard normal deviate of 1.96 which corresponds to 95% confidence level
p = Prevalence of characteristic being estimated (malnutrition) in infants aged 0 – 5years 23.4% [9]
q = 1-p, expected proportion of well-nourished infants aged 0 – 5years
(1-0.234) = 0.766
d = Acceptable error (precision) of +0.05

Substituting this parameter gives

$$\mathbf{N} = \frac{(1.96)^2 (0.234)(0.766)}{(0.05)^2} = 276$$

Thus, at least **276** parents/infant, pair were sampled in the study. This meant that parents and child constituted one sample, but to compensate for non-retention or loss to follow up 25 parent/infant pair was added, hence making an overall sample size of **301**.

2.5. Data Collection and Analysis

2.5.1. Data Collection

The Chief's representative was used as entry point into the community, and quarter heads as the entry points into the quarters. Random sampling method was used to select the primary unit which was a household with children 0-5years. A household was defined as a group of people living, cooking, eating and sleeping together. A preliminary study was conducted in the Molyko health area and a total of 30 questionnaires were administered in two quarters namely NewLayout Molyko and Wojoke. The rationale for this pilot study was to rephrase poorly formed questions and to evaluate the time used per questionnaire. At the end of this pilot study, some questions were left out and some rephrased to eliminate information bias and to avoid psychological trauma.

During the study, a face-to-face interview was conducted with the parents or guardians of the children to obtain basic demographic information, and socioeconomic information. The parents were presented with an information sheet document which explained the study design, risks, benefits and what was required of them. Verbal clarification was also provided in cases where questions were not understood by the parents. The questionnaires were also translated into Pidgin English, for those who could not read or write. The children's health record books were checked to determine immunization status. Consent from the parents or guardians were obtained before the interview

2.5.1.1. Administration of Questionnaires

A validated socio-demographic questionnaire included questions to define the population group by measures of size, age, level of literacy, income sources and basic living conditions, such as water source. Parents and children were visited, where the questionnaires were completed, through an interview process. The socio-demographic questionnaire contained information relating to number of people in the house, economic status, types of food consumed, water source just to name a few. The collected information was categorized into three domains: parental/child characteristics (demographic characteristics), socio economic indicators and anthropometric measurements. To evaluate parental characteristics, data was collected on parental age, marital status, educational level, occupation and maternal parity (*i.e.*, number of children born). Regarding child characteristics, data was collected on age in months, gender, birth weight and whether or not they were still breastfeeding. Additionally, the parents were asked if the child had experienced any serious health problems in the past, and if they (the parents), were concerned about the child's growth and development. To further evaluate economic conditions, the number of times and types of food given to the child were asked.

2.5.1.2. Anthropometric Measurements

As concerns anthropometric measurements, weight, height and mid upper arm circumference were measured. The height, weight, and mid upper arm circumference measures were taken using recommended procedures. The height of children younger than 24 months were measured lying down on a board (recumbent length), and standing height were measured for older children. Weights of undressed children were taken to the nearest 0.1kg using a digital scale. The mid-upper point of the child's left arm was obtained with the use of a measuring tape. Height-for-Age (HAZ) and Weight-for-Age (WAZ) scores were generated using the SPSS software version 22 for assessing growth and development [6]. A Z- score represented the number of standard deviations on observations or data point that were above or below the population mean. All anthropometric measures were taken by two trained assistants.

2.5.1.3. Height-for-Age: Z-score (HAZ)

In accordance with the WHO recommendations [10], the calculated HAZ were considered plausible within Z-score of -4 and Z-score +5 and any Z-score beyond these limits were considered implausible (extreme or potentially incorrect Z-score values). Children with a Z-score below -2 were classified as stunted and those with Z-scores above -2 and below +2 were classified as normal height for their age.

2.5.1.4. Weight-for-Age: Z-scores (WAZ)

In accordance with recommendation [6, the calculated WAZ were considered plausible within Z-score of -4 and Z-score of +5 and any Z-score beyond these limits were considered implausible. Children with Z-score of -2 were considered to be underweight for age, thus acute malnutrition; those with Z-score between -2 and +2 were considered to have a normal weight for their age [6].

2.5.1.5. Weight-for –Height: Z-score (WHZ)

Low weight-for-height, known as wasting, is reflected by a low body mass relative to age and is classified when the Z-score is below the median by -2SD. Low weight-for-height by a percentile lower than -3SD is regarded as severe wasting [11,12].

2.5.1.6. Mid-upper-arm-circumference (MUAC)

MUAC measurement of less than 10.0 cm were classified as Severe Acute Malnutrition (SAM); MUAC measurement of 11.0 cm to 12.5 cm were classified as Moderate Acute Malnutrition (MAM); MUAC measurement ≥12.5 cm to <13.5 cm was classified as child at risk of malnutrition: and that of ≥13.5 cm was classified as properly nourished child [6].

2.5.2. Data Management and Analysis

Data was entered into excel version 13 and was analyzed using SPSS 22. Descriptive analysis was carried out to investigate the spread of scores. Univariate and Multivariate logistic regression was carried out to investigate the factors that predicted poor growth outcomes. In separate models, being underweight, stunted, and wasted was included as dependent variables while parental characteristics, child characteristics and economic indicators were included as independent variables. Chi square test ($\chi 2$) was used to test an association between sociodemographic characteristics and nutritional status. The Odds Ratio was used to measure the strength of association between potential predictive factors and nutritional status with significant levels measured at 95 % confidence interval (CI) with significant differences set at $P<0.05$.

2.6. Ethical and Administrative Consideration

Administrative clearance was obtained from the South West Regional Delegation of Public Health and District Health Service Buea. Ethical approval was obtained from the Institutional Review Board, of the Faculty of Health Sciences, University of Buea. Participant consent was sought before the start of the study. During the study, individual written informed consent was obtained from parents/caretakers and children found ill were not included in the study.

3. Results

3.1. Socio-demographic Characteristics of Respondents

Table 1. Sociodemographic Characteristics of Study Participants

VARIABLE	FREQUENCY	PERCENTAGE (%)
Maternal age(years)	**Mean± SD (25.85±4.225)**	
15-25	131	43.5
26-36	170	56.5
Child's age (months)	**Mean± SD (26.81±20.21)**	
<12	126	41.9
12-36	87	28.9
>36	88	29.2
Child's gender		
Male	137	45.5
Female	164	54.5
Maternal educational level		
Primary	74	24.6
Secondary	222	73.8
Tertiary	5	1.7
Maternal marital status		
Single	97	32.2
Married/cohabiting	199	66.1
Divorce/separated	5	1.7
Maternal religion status		
Christians	248	82.4
Muslims	43	14.3
Others	10	3.3
Maternal occupation		
Formal employment	26	8.6
Business	96	31.9
Farmers	161	53.5
Students	18	6.0
House hold size		
2-4	204	67.8
5-7	94	31.2
8+	3	1.0
Was pregnancy planned		
Yes	178	59.1
No	123	40.9
Quarters		
Center Street	42	14.0
Elio	36	12.0
Lower Wonganjou	10	3.3
New Quarter	19	6.3
Sax	6	2.0
Tole Camp	63	20.9
Tole Weeding1	77	25.6
Tole Weeding 2	48	15.9

A total of 301 respondents were recruited into the study. The mean maternal age was 25.85 ±4.225 years while the childrens' mean age was 26.81 ±20.21 months. As concerns children gender, more than half (54.5%) of children sampled were females. Educational wise, a vast majority (73%) of the mothers had attended secondary school while only 24.6% and 1.7% of them had attained primary and university level respectively. Pertaining to the maternal marital status, 66.1% were either married or cohabiting, 32.2% and 1.7% were single and divorce/separated respectively. Majority 82.4% of the respondents were predominantly Christians whereas respondents who were Muslims constituted 14.3% of the study population. One hundred and sixty-one (53.1%) of the respondents were farmers, while students and business people made up 31.9% and 6% of the study population respectively. With regards to house hold size, 67.8% of the respondents agreed that there were 2-4 persons in their households, 31.2% had 5-7 persons in their households and only 1% had 8 people and more in their households. Considering the quarters in which respondents came from, majority 25.6% of them were from Tole Weeding, and the least (2%) from Sax. As to whether the pregnancy was planned or not, more than half (59.1%) of the participants agreed that they unanimously decided to have the child while 40.9% said it was unplanned (Table 1).

3.2. Socioeconomic Characteristics of respondents

Table 2. Socioeconomic Characteristics of Study Participants

Statement/item	Frequency	Percentage (%)
Baby fully vaccinated		
Yes	268	89.0
No	33	11.0
Main source of drinking water		
Community tap	260	86.4
Open well on yard	15	5.0
Water from bore hole	6	2.0
Water from streams	20	6.6
Amount of money earn per month		
<50,000	214	71.1
50,000-100,000	84	27.9
>100,000	3	1.0
Baby currently breastfed		
Yes	121	40.2
No	180	59.8
Are you practicing exclusive breastfeeding/Did you practice Exclusive breastfeeding		
Yes	62	20.6
No	239	79.4
How many times do you feed the baby daily		
1-2 times	60	19.9
3-4 times	188	62.5
More than 4 times	53	17.6
How regular does child get sick in a month		
None	114	37.9
Once	175	58.1
Twice	12	4.0
Child experience serious health problem since birth		
Yes	24	8.0
No	277	92.0
Support from baby's father		
Yes	212	70.4
No	11	3.7
Sometimes	78	25.9
Which food type do you give the Baby		
Breast milk/carbohydrates/proteins	7	2.3
Carbohydrate/proteins	13	4.3
Proteins only	85	28.2
Carbohydrates only	100	33.2
Breast milk only	96	31.9

The socioeconomic status of the participants was also determined, and as concerns the child vaccination status, 89% of the respondents reported that their children were fully vaccinated. Majority of the respondents (86.4%) used community tap as the source of drinking water whereas just (2%) of them drink water from bore holes. Two hundred and fourteen (71.1%) of the respondents declared earning less than 50,000FCFA monthly whereas (27.9%) and (1%) declared a monthly income of 50,000-100,000 and >100,000FCFA respectively. Regarding breastfeeding status of the children, 40.2% were currently breastfed and all these children that were currently breastfed were less than 12months. With regards to exclusive breastfeeding, it was revealed that only (20.6%) of the respondents reported to have practiced or were practicing exclusive breastfeeding meanwhile 79.4% were practicing or had practiced mixed feeding. Out of the 301 who responded to the questionnaires, (17.6%) of the respondents said they fed their children more than 4 times a day (predominantly children less than 12months) meanwhile (62.5%) fed their children 3-4(children from 12 -36 months) and (19.9%) reported that they fed their children 1-2 times a day (children greater than 36months).

Out of 301 respondents, (37.9%) noted that their children do not get sick in a month whereas (58.9%) and (4%) said their children get sick once or twice a month respectively. As to whether the child had experienced any serious health problem since birth, (8%) noted that their children had experienced serious health problem since birth. As per the food type given to the children, majority (33.2%) fed their children predominately with carbohydrates, (31.9%) stated that they fed their children only with breast milk and (28.2%) with at least three classes of food (proteins, vitamins, fruits and vegetables etc). Respondents who combine carbohydrates and proteins only made 4.3% of the study population (Table 2).

3.3. Prevalence of Malnutrition and Its Different Forms in the Study Population

Out of the 301 children recruited for this study, 36.5% were malnourished meanwhile the prevalence of stunting, wasting and underweight was 20.9%, 7% and 8.6 % respectively (Figure 1).

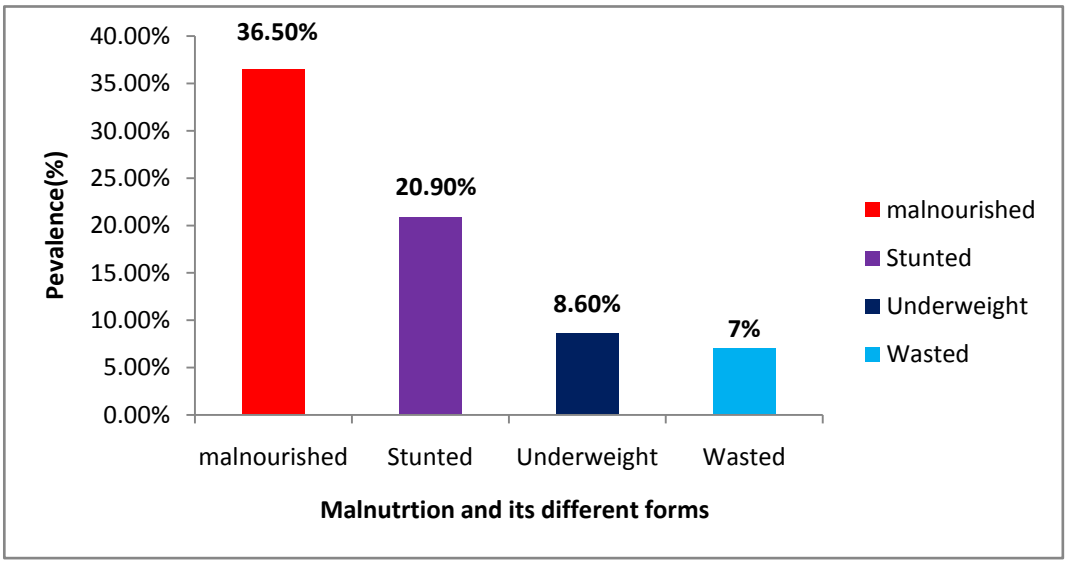

Figure 1. Prevalence of malnutrition

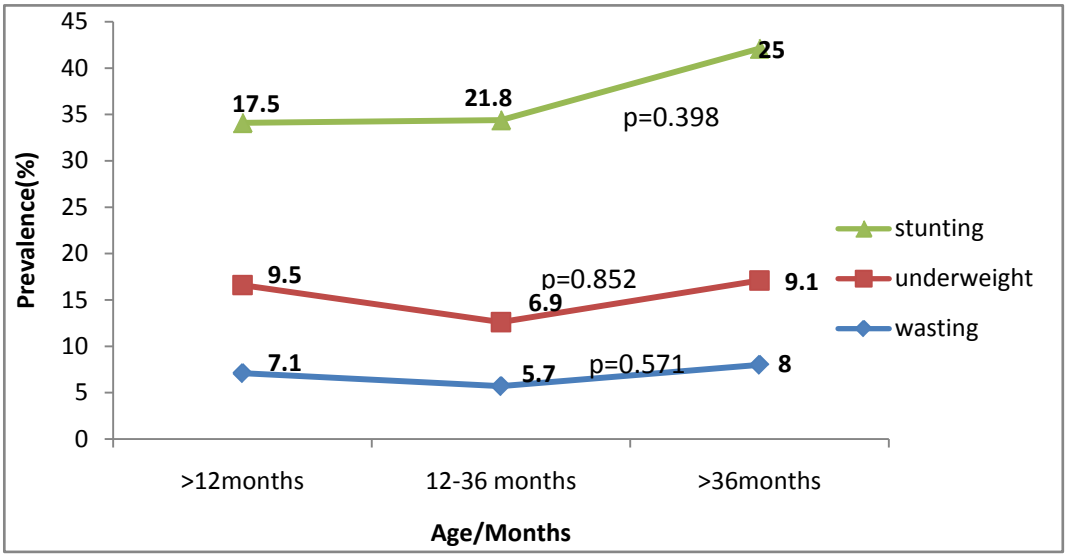

Figure 2. Variation of stunting, wasting, and underweight with age

3.4. Variation of Stunting, Wasting, and Underweight with Age

The ages of the children were grouped into three categories and the prevalence of stunting, wasting and underweight was determined in each age category. Although not statistically significant as shown in Figure 2, the prevalence of stunting with age increased from 17.5% in children less than 12months to 25% in children older than 36months. As concerns variation of the prevalence of underweight with age, the prevalence among children less than 12 months was 9.5%, 6.9% in children within the age group of 12-36months and 9.1% in children older than 36months and it was not statistically significant. As per the prevalence of wasting with age, younger children had 7.1% and 5.7% in children between 12-36months and 8% in older children (Figure 3).

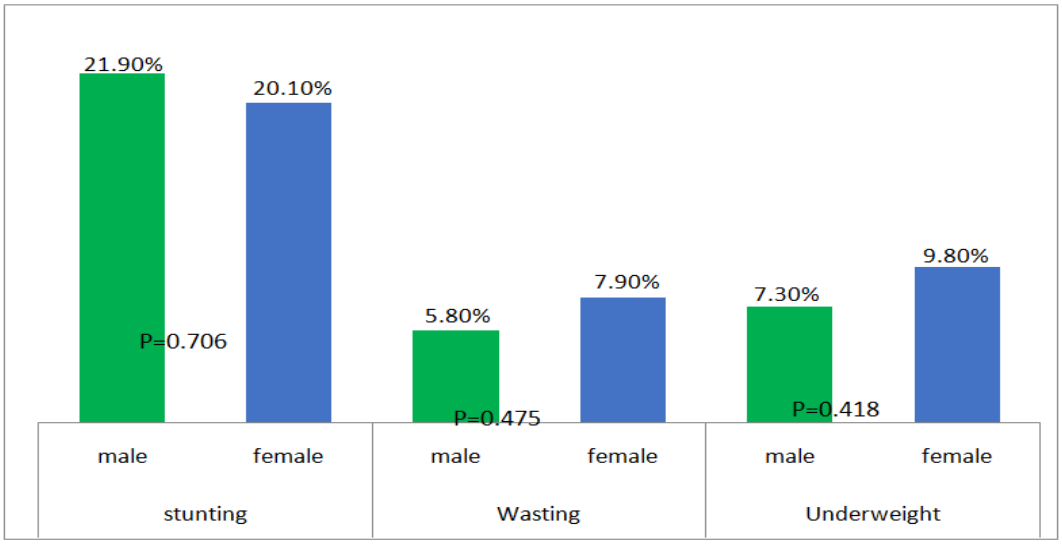

Figure 3. Prevalence of wasting, stunting and underweight with respect to gender

Table 3. Risk factors for Malnutrition

Variables	COR(95% CI)	P-value	AOR(95%CI)	P-value
Maternal age				
15-25	1	**0.033**	I	0.44
26-36	3.3(1.55-6.11)		2.6(0.91-4.22)	
Child's age				
<12months	1		1	
12-18months	2.7(1.11-8.11)	**0.044**	2.8(1.31-7.22)	**0.047***
>18months	3.1(1.81-10.22)		3.2(1.23-8.88)	
Child's gender				
Male	1	0.302	-	-
Female	2.9(0.36-4.36)		-	-
Maternal educational level				
Primary	1		1	
Secondary	2.2(1.12- 5.31)	**0.023**	1.9(0.32-6.21)	0.059
Tertiary	3.1(1.22-6.43)		2.0(0.77-4.32)	
Monthly income				
<50,000	1		-	-
50000-100,000	1.9(0.89-2.21)	0.750	-	-
>100000	2.2(0.99-2.71)		-	-
Frequency of child getting sick in a month	milk/carbohydrates/Proteins			
None	1		1	
Once	1.7 (1.12-3.39)	**0.035**	1.9(1.31-4.71)	**0.045***
Twice	3.8 (2.09-7.00)		3.7(2.11-4.51)	
Baby fully vaccinated				
No	1	0.54	-	-
Yes	2.1(0.91-3.22)		-	-
Which food type do you give the Baby				
Breast milk/carbohydrates/Proteins	1		1	
Proteins/ breast milk	2.2(1.72-3.44)	**<0.001**	2.4(1.63-3.66)	
Carbohydrates /proteins	2.5(1.23-3.87)		2.6(1.11-3.97)	**0.002***
Carbohydrate only	3.3(1.52-4.21)		3.5(1.92-4.33)	
Breastfeeding status				
No	1	0.99	-	-
Yes	2.3(1.16-5.81)		-	-
House hold size				
2-4	1	**0.042**	1	
5-7	2.0(1.16-3.53)		1.8(1.11-3.44)	**0.047***
8+	3.1(1.71-4.22)		2.9(1.33-3.95)	

*Satistically significant values (P<0.05) COR:Crude Odd Ratio, AOR:Adjusted Odd Ratio.

Table 4. Association between the nutritional status of children and Socio-demographic /Socioeconomic characteristics

Variables	Nutritional status								
	Wasted			stunted			Underweight		
Household size									
2-4	16(7.8%)	188(92.2%)		38(18.6%)	166(81.4%)		19(9.3%)	185(53.9%)	
5-7	5(5.3%)	89(94.7%)	**0.024**	24(25.5%)	70(74.5%)	0.794	7(7.4%)	87(92.6%)	**0.001**
8+	0(0%)	3(100%)		1(33.3%)	2(66.7%)		0(0.0%)	3(100%)	
Baby currently breastfed									
Yes	8(6.6%)	113(93.4%)		23(19%)	53(43.8%)	**0.013**	6(5%)	115(95%)	**0.041***
No	13(7.2%)	167(92.8%)	0.835	40(22.2%)	140(77.8%)		20(11.1%)	159(88.3%)	
Monthly income									
<50,000	16(3.4%)	149(69.6%)		103(48.1%)	111(51.9%)		90(42.1%)	124(57.9%)	
50000-100,000	4(23.8%)	64.(76.2%)	0.052	37(44%)	47(16.0%)	0.153	45(53.6%)	39(46.4%)	0.183
>100000	1(33.3%)	2(66.7%)		3(100%)	0(0%)		1(33.3%)	2(66.7%)	
Baby fully vaccinated									
Yes	20(7.5%)	248(92.5%)	0.346	53(19.8%)	215(80.2%)	0.135	26(9.7%)	215(80.2%)	**0.028**
No	1(3%)	32(97%)		10(30.3%)	23(69.7%)		10(30.3%)	23(69.7%)	
Child experienced serious health problem since birth									
Yes	1(4.2%)	23(95.8%)		5(20.8%)	19(79.2%)	0.599	58 (20.9)	252(89.1%).	
No	20(7.2%)	257(92.8%)	0.5	58(20.9%)	219(79.1%)		1(4.2%)	23(95.8%)	**0.002***
Marital status									
Single	10(10.3.7%)	87(89.7%)	0.262	16(16.5%)	81(83.5%)	0.274	8(8.2%)	89(91.8%)	
Married/cohabiting	11(5.5%)	188(94.5%)		45(22.6%)	154(77.4%)		17(8.5%)	182(91.5%)	**0.001***
Divorce/Separated	0(0%)	5(100%)		2(40%)	3(60%)		1(20%)	3(60%)	
Maternal Educational level									
Primary	8(10.8%)	66(89.2%)		16(21.6%)	58(78.4%)		6(8.1%)	67(90.5%)	
Secondary	13(5.9%)	209(94.1%)	0.289	46(20.7%)	176(79.3%)	0.985	19(8.6%)	203(91.4%)	0.418
Tertiary	0(0%)	5(100%)		4(20.0%)	4(80%)		1(20%)	1(80.0%)	

3.5. Prevalence of Wasting, Stunting and Underweight with Respect to Gender

The prevalence of stunting was comparative in males (21.9%) and females (20.1%). With respect to wasting, females recorded (7.9%) as compared to males (5.8%) the difference was not also statistically significant (**P = 0.475**). Although not statistically significant the prevalence of underweight was higher (9.8%) in females (98%) than males (7.3%) (Figure 3).

3.6. Risk Factors Associated with Malnutrition

Establishing an association between the nutritional status of the children and Socio-demographic and socioeconomic status, a chi square test was carried out. With respect to household size, household with 2-4 persons had 7.8% for wasting while those with 5-7 persons had 5.3%. Those with more than 8 members in the house, had zero prevalence of wasting and the difference in wasting with respect to household size was statistically significant (**P=0.024**). Also, the prevalence of underweight with respect to household size was high (9.3%) in household with 2-4 members as compared to 7.4% recorded in household size of 5-7 members and this difference in prevalence was statistically different (**P=0.001**). With regards to the current breastfeeding status of the children and stunting, (22.2%) was recorded in children who were not currently breastfed compared to 19% in those who were being breastfed and the difference was statistically significant (***P*=0.013**). Children who were not breastfed had an underweight prevalence of 11.1% and those that were currently breastfeeding had an underweight prevalence of 5% and this difference in prevalence was statistically significant (**P=0.041**) (Table 4).

As per the vaccination status of the children, children who were not fully vaccinated had a 30.3% for underweight as compared to the 9.7% in those that had received full vaccination and was statistically significant (***P*=0.028**). Children who experienced serious health problem since birth recorded an underweight prevalence of 20.9% and those who never had serious health problem since birth recorded 4.2% and the difference was also statistically significant (**P=0.002**). Children whose parents were either separated or divorce recorded (20%) for underweight as compared to 8.5% recorded among children whose parents were cohabiting/married and 8.2% in children with single parents. This different was statistically significant (Table 4).

4. Discussion

This study determined the prevalence and assessed the risk factors of malnutrition in children< 5years in the Tole health area. The overall prevalence of malnutrition of 36.5% is higher than that of a study carried out in the same Health district by [9] that reported 23.4% but lower than the 58.1% reported by [13]. The reason for this difference may be due to the fact that the study by [9] was a hospital-based study which recruited only children who came for consultation in the outpatient department within that period whereas, this study is a community-based study which sampled children below five in all the quarters of the study area. In addition, the discrepancy

with the study by [13], in the year 2008 may be due to frequent health and nutrition education given to parents over the years in njangi' groups, church groups, outreach activities, children welfare clinic etc.

Among the malnourished children, the prevalence of stunting was highest at 20.9%, while underweight and wasting were 8.6% and 7% respectively. This trend is different from that observed from the results of the Demographic and Health Survey in Cameroon in 2011, where the prevalence of stunting was highest at 33%, underweight 15%. The reason for the discrepancy is that the health survey was a nationwide study and had wider age range whereas this study included just one health area.

The prevalence of wasting in this study is in line with that of [14] that reported 5.5% in a different health area in the same Health District. Specifically, although not significant, the prevalence of stunting was higher in males, while, wasting and underweight were higher in females, and this is in line with a study carried out by [14] in the South –West Region of Cameroon and in a study carried out in Iraq but it is in contract with other studies done in Oman [15] and Ethiopia [16].

Age was significantly associated with the nutritional status of children. The prevalence of malnutrition was significantly highest in children > 12months than their counterparts. Furthermore, an increasing trend of stunting was observed from the various age groups i.e., from 0-12 months, 12-36 months and < 36months a finding similar to that by [17] in Nigeria and [18] in Kenya. Stunting reflects chronic malnutrition and becomes more apparent as age increases. And this association between age and malnutrition is supported by the study of [8] in Nigeria, [19] in Zambia and [20] in Malawi. But on the contrary, a number of studies like [21] in Northern Ghana and [22] in Central Australia reported a lack of significant association between age and nutritional status of children. The reason for association could be supported by the fact that the feeding habits of these children changes as they grow older from breast milk to complementary feeding and this transition period is always very delicate to these young children. The choices made unfortunately may be reflective of the poor income status of the parents and these choices may not be adequate in terms of a quality (nutrients) and amount needed for proper development of the body. Amongst children under Five years of age, those between 12months and above had a 3-fold risk of being malnourished than their counterparts as revealed in the multivariate logistic regression.

As per vaccination status, there was an association which showed that children who were not vaccinated or had incomplete vaccination had a higher chance of having severe malnutrition in both univariate and multivariate analysis and this is supported by the result of a studies of [23] carried out in Mwana, Tanzania who reported that lack or incomplete vaccination was an important risk factor of malnutrition. The rationale for this can be due to the fact that children when vaccinated have reduced chances of acquiring infections like pulmonary TB, diarrheal disease, measles and severe pneumonia, all of which are clinical conditions that can lead to malnutrition [6].

Children who were reported to be sick twice a month were strongly associated with malnutrition than those who were not. These sick children were 3.7 times at odds of being malnourished and this finding is in line with the study of Diana in Papua New Guinea reported that children who frequently got sick were more at risk of being malnourished than those who were not. This could be supported by the fact that infection significantly lowers immunological response, thus a higher possibility of having a vicious cycle between recurrent infection and malnutrition [6].

Feeding habit is a significant predictor for childhood malnutrition in the multivariate analyses children who were fed with unbalanced diet had a higher chance of developing malnutrition. These children were 3.5 times at odds of being malnourished than the others. This study is in line with a study carried in Congo by [24] and [23] in Mwana, Tanzania reported that children who were fed on unbalanced diet had a higher chance of developing malnutrition. This is supported by the fact that low intake of nutrients reflect poor diet quality among children, and these children are more likely to live in a low social-economic environment with limited access to nutritious food. Food for majority of children is still a challenge; these children are not getting enough food, not only in terms of amount, but also poor in quality so they are prone to all types of malnutrition.

In addition, the prevalence of wasting in households with 5-7 members had an association with malnutrition (**p= 0.023**), and this is consistent with a study by [25] in India and a study done by [26] in Living stone Zambia, in 2005, found that 43% of undernourished children were associated with extended families (five to seven members). The family-size and number of children living in the same house are important factors for nutritional status of the children, which reflects the quality of care given to children and also places a heavy burden on the scarce household resources, particularly on finances and food. However, other studies like [23] *had* no association between malnutrition and family size.

Children whose parents were either separated or divorce was significantly associated with malnutrition in a logistic regression analysis. This finding is similar to results from studies done in Botswana and in a demographic health survey in Tanzania (Tanzania Ministry of Health) where the chances of malnutrition were decreasing when both parents were living together. This is supported by the fact that single parents maybe struggling to earn more income in order to sustain their children. There was no association between severe malnutrition and either sex of the child, parents' occupation, parents' level of education, income level, and source of water etc. Hence the health and growth potential of children in this health district and area can be improved upon by integrating interventions directly linked to malnutrition programmes already in place.

5. Conclusion

Based on the findings, the following conclusions were made:

The overall prevalence of malnutrition was 36.5%, and the prevalence of wasting, underweight and stunting were 7%, 8.6% and 20.9% respectively. Stunting and wasting

was most prevalent among children<12 months of age. Risk factors of malnutrition were: child's age, frequency of the child getting sick in a month, food type given to the child, the house hold size, immunization status of the child and maternal marital status. There exist an association between child's age and wasting, household size and wasting and child immunization status and underweight.

6. Recommendations

1. The population should be encouraged to add fruits and vegetables in their meal plan, especially for children; thus reducing malnutrition in our communities.
2. The community members should also be encouraged to completely vaccinate their children from 0-5 years so as to build a stronger immunity to fight against infection and malnutrition.
3. Systematic screening for malnutrition should be carried for all children consulting in all health facilities (both preventives and curative).

Perspectives

In Cameroon, particularly in Tole health area, very little work has been done on the determinants and risk factors of malnutrition among children in the age of 0-5yrs. These children are at high risk of nutritional deficiency and their nutritional status is poorly documented this further indicates the need for more research on this area. While the containment of this issue requires more extensive resources, prefatory results show it its worthwhile if more is known in regards to the real time needs.

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Competing Interest

The authors declare they have no competing interests.

List of Abbreviations

ARTI- Acute Respiratory Tract Infection.
BMI- Body mass index.
DHS- District health service
FAO - Food and Agricultural Organization.
GDP- Gross Domestic Product
HIV- Human Immuno Virus
MAM- Moderate acute malnutrition
MDG - Millennium Development Goal.
MOH - Ministry of Health.
MUAC - Mid-upper Arm Circumference.
NE - Nutritional Education
OPD- Out patient consultation
PEM - Protein Energy malnutrition.
SAM-Severe acute malnutrition
SD - Standard Deviation.
SSA - Sub Saharan Africa.
UN - United Nations.
UNICEF - United Nation International Children's Fund.
WHO - World Health Organization.

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