

Research Article

Economic and Social Determinants of Micronutrient Consumption and Supplementation Among Children Under Five Years in Cameroon

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Abstract

Malnutrition among children less than five years is an important public health challenge in resources limited countries. This study analyzes the economic and social determinants of micronutrient consumption and supplementation among Cameroonian's children under five years. A cross-sectional study design was undertaken using a stratified nationwide, two-level sampling with a sample of 4,074 children under five years and their mothers. Data were analyzed using a logistic regression model with the level of statistical significance set at $p < 0.05$. The slightly majority of children were male (50.8%). Children in age groups older than 23 months were less likely ($OR < 1$; $p < 0.01$) to be consuming and/or supplemented with micronutrients compared to children aged 6 to 23 months. Children of mothers of middle and high income quintiles were more likely to be consuming and/or supplemented with micronutrients compared to children of mothers of low and very low income quintiles, while those in the very high income quintiles were less likely ($OR = 0.994$ $p > 0.05$). Children of mothers with low (primary) and average (secondary) education were likely ($OR = 0.854$ and 0.870 respectively), while children of mothers with high (tertiary) education were non-significantly more likely ($OR = 1.093$; $p > 0.05$) to be consuming and/or supplemented with micronutrients compared to children of non-educated mothers. Overall, these study's findings showed that the gender of the child, the child's birth order, the children from married mothers, the education's level of mothers, standard of living, the non-use of any contraceptive method by mothers with intention to use one, employment, religion, and the children from mothers in the low, middle and high income quintiles were significant determinants associated with the function of micronutrients' consumption and/or supplementation in children under five in Cameroon. Policy makers should therefore strive to improve the socio-economic conditions of women while raising their awareness of the harmful effects of child malnutrition.

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Keywords

Economic and Social Determinants, Children Under Five Years, Micronutriments, Consumption, Supplementation, Cameroon

1. Introduction

In many resources limited countries, several infants under five years have a reduced nutritional storage capacity as well as an underdeveloped organism, which makes them essentially susceptible to malnutrition [1, 2]. Thus, malnutrition among children less than five years is an important public health challenge because of its extent and severity in resources limited countries where little is known about what children should eat as many bodily processes depend on micronutrients consumption and supplemental nutrition. Indeed, malnutrition constitutes one of the main causes of mortality among children less than five years [3, 4]. In this perspective, Sustainable Development Goal 2 (SDG-2) aims to eliminate the global burden of malnutrition [5]. Reducing malnutrition constitutes a challenge for many low income countries [6]. Micronutrients (vitamins and minerals) are an important component of the diet and are essential for normal functioning as many infants' body processes depend on micronutrients, it's worthy to plan a supplementary diet with optimum consumption for children under five years [1, 2]. The infants under five years' appropriate growth and development depend on their dietary demands being satisfied, yet even brief nutritional deficiencies can have a negative impact on long-term health [7].

Although micronutrients are only needed in trace amounts, but their deficiency can have a large range of negative consequences on health. Micronutrient deficiencies are usually referred to as 'hidden hunger' because they develop progressively [8]. Micronutrient deficiencies are of particular concern in resources limited countries, due to insufficient food consumption, inexistence of dietary diversity and poor absorption of nutrients due to infectious, inflammatory and chronic disease [2]. Children under the age of five years are essentially vulnerable, as their speedily growth and development requires an increased use of micronutrients [1, 2]. Several factors are known to be concerned with the aetiology of micronutrient deficiency and stunting. The international literature has shown that low socio-economic conditions is associated with micronutrient deficiency, including anaemia, iron deficiency anaemia and vitamin D deficiency [9, 10].

Other studies in Pakistan show that micronutrient consumption is a cost-effective intervention to improve micronutrient status, haemoglobin levels and growth parameters in children under five years of age, which can be scaled up within the existing health policy intervention to address the alarming rates of undernutrition [11]. Moreover, both the Sri Lanka and Bangladesh's studies have shown that low socio-economic status, overcrowding and educated parents are

associated with undernutrition in children [12, 13]. In the perspective of addressing malnutrition in Cameroon, a good understanding of the relationship between micronutrient consumption and supplementation and the economic and social status in Cameroon is needed. The objective of this study was to analyze the economic and social determinants of micronutrient consumption and supplementation in children less than five years in Cameroon.

2. Methods

2.1. Study Design

This study used secondary population-level data from the last Demographic and Health Survey 2018 (DHS-V) to evaluate economic and social determinants of micronutrient consumption and supplementation among Cameroonians' children under five years in Cameroon [14].

2.2. Study Site and Period

The household-level study was undertaken, with both mothers and children under five (aged 6-59 months), in the 10 regions of Cameroon. Data collection took place from 16 June 2018 to 19 January 2019, the period during which the DHS-V was implemented by the National Institute of Statistics in collaboration with the Ministry of Public Health.

2.3. Sampling Technique

A stratified two-stage sampling technique was employed to select clusters and households within each cluster. In each selected household, all mothers of children aged between 6 and 59 months were targeted as the study's participants.

2.3.1. Selection Criteria

With this sampling approach, all mothers of children who gave and signed voluntary the informed consent form were selected as participants of the study. Conversely, all mothers of children who did not give and sign voluntary the informed consent form were excluded from this study.

2.3.2. Sample Size

In accordance with the inclusion and exclusion criteria, the study included a total sample of 4,074 children less than five

years of age (aged between 6 and 59 months).

2.4. Data Collection

The dataset was requested from ICF International Macro Demographic and Health Surveys via online registration and a formal access to the data-based. Additional permission was sought from the Ministry of Public Health and the National Institute of Statistics of Cameroon. The DHS-V survey collected information on children's micronutrient consumption and supplementation. Respondents were classified as children who had consumed/supplemented micronutrients and children who had not consumed/supplemented micronutrients during the last year. The data management used the methods of identifying, sorting and extracting key variables that pointed out the mothers' micronutrient consumption and supplementation, or not, according to their economic and social characteristics and status.

2.5. Statistical Analysis

A logistic regression model was used for the data analysis

$$y_i = \begin{cases} 1 & \text{If a child under five consumes and/or supplements micronutrients} \\ 0 & \text{If not} \end{cases}$$

Let y_i^* be the unobserved variable defined by $y_i^* = x_i\beta + \varepsilon_i$ where ε_i is a random variable with mean zero and standard deviation σ_ε , with $\frac{\varepsilon_i}{\sigma_\varepsilon}$ which follows a logistic distribution function $\phi(x) = \frac{\exp(x)}{1 + \exp(x)}$.

The multivariate logistic regression model adapted from Nugroho and Widyaningsih [15] and Kamuyango et al. [16] were used to assess the relationship between the child's consumption and/or supplementation micronutrients and a range of their economic, social and demographic factors that may affect this consumption and/or supplementation.

Considering the latent variable y_i^* as follows:

$$\begin{cases} y_i = 1 & \text{if } y_i^* > 0 \\ y_i = 0 & \text{if } y_i^* \leq 0 \end{cases}$$

The estimated model is written as follows:

$$y_i^* = \beta_0 + \beta x_i + \varepsilon_i$$

The detailed specifications are as follows:

$$y_i^* = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \beta_7 x_{7i} + \beta_8 x_{8i} + \beta_9 x_{9i} + \beta_{10} x_{10i} + \beta_{11} x_{11i} + \beta_{12} x_{12i} + \beta_{13} x_{13i} + \beta_{14} x_{14i} + \beta_{15} x_{15i} + \beta_{16} x_{16i} + \varepsilon_i$$

Where:

β is a vector of coefficients for the estimated model, β_0 is the constant term and ε_i is the error term.

Therefore,

where the dependent variable is a binary indicator "child under five years' consumption and/or supplementation of micronutrients" which indicates whether a child under five consumes or supplements a micronutrient. The independent variables constituted of a set of economic, social as well as demographic factors with 2 or more modalities. Hence, this model constructs a binary logistic regression technique to estimate the probability of a binary response as a function of a set of predictor variables. The set of independent variables includes the characteristics of both mother and child. For the mother, the economic and social characteristics included: her age group, employment status, religion, highest level of education, place of residence, marital status, access to the media, access to prenatal care, region of residence, and quintile of economic well-being. For the child, the economic and social characteristics included: gender, age, birth rank, perceived birth weight and the number of children less than 5 years living in the household.

Our dependent variable "child under five year's consumption and supplementation of micronutrients" is defined as follows:

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}, \beta_{16}$ are coefficients of the estimated model and ε_i is the error term.

x_i is a set of economic and social determinants that can impact micronutrients' consumption and/or supplementation in children under five years.

- x_{1i} : Child's age (in months) i;
- x_{2i} : Child's sex i;
- x_{3i} : Child's birth order i;
- x_{4i} : Child's weight at birth i;
- x_{5i} : Number of children less than five in the household i;
- x_{6i} : Age of mother's at child birth i;
- x_{7i} : Mother's education level of child i;
- x_{8i} : Mother's marital status of child i;
- x_{9i} : Mother's employment status of child i;
- x_{10i} : Mother's religion of child i;
- x_{11i} : Mother's economic welfare status of child i;
- x_{12i} : Mother's accessibility to media of child i;
- x_{13i} : Mother's awareness of non-neglecting the child i;
- x_{14i} : Contraceptive use by the mother of child i;
- x_{15i} : Antenatal care attendance by the mother of child i;
- x_{16i} : Region of residence the mother of child i;
- x_{17i} : Residence area of the mother of child i.

Data analysis was performed in Excel and Stata software (version 14). Odds ratios were calculated. The data of this study was initially analysed on the basis of descriptive statistics and the Chi2 dependence test. This technique provided an initial view of the level of association between the micronu-

trients' consumption and/or supplementation in children and the economic and social factors. Two techniques were used for data analysis: both bivariate and multivariate for descriptive analysis and multivariate analysis for explanatory investigation. The associations were analysed and the level of statistical significance was set at a 95% confidence interval with $p < 0.05$.

3. Results and Interpretation

3.1. Characteristics of the Study Population

The study sampled a total sample of 4,074 children under five years (aged between 6 and 59 months). Table 1 presents the socio-demographic characteristics of the mothers and children, and a bivariate analysis with micronutrients' consumption and supplementation by the children under five years in Cameroon. Concerning the characteristics of children, the majority (35.64%) were aged between 24 and 42 months, followed by children aged ranging between 6 and 23 months (35.25%), and finally children aged between 43 and 59 months (29.11%), whose micronutrients' consumption and/or supplementation rates were significantly different, at 11.93%, 8.21% and 3.95% respectively ($p < 0.00$). The children aged between 6 to 23 months had the highest proportion (32.03%) of micronutrients' consumption and/or supplementation in the sample. The majority of children (50.73%) were male, but there was no statistical difference between male and female children with respect to micronutrients' consumption and/or supplementation. There was also no statistical difference in the perceived birth weight of children on micronutrients' consumption and/or supplementation, although the majority of children had an average birth weight (52.1%) of whom 22.17% had received micronutrient supplements compared with 29.93% who had not. There was no statistical difference between the birth order of the children and micronutrients' consumption and/or supplementation.

In the household, there is also a statistical difference between the number of children under 59 months and micronutrients' consumption and/or supplementation. The majority of children who received micronutrient supplements were in households with 2 children (16.52%), followed by households with 3 children (10.55%) and finally households with 4 or more children (7.95%).

Concerning the mothers' characteristics, it was noted that the relative high proportion (49.91%) was in the 25-34 group of age. This is followed by the children aged 15-24 months (30.16%) and finally the 35-49 age group (19.92%), whose proportions of micronutrients' consumption and/or supplementation were 21.31%, 15.87% and 6.13% respectively. The majority of mothers had secondary education (37.92%), followed by primary education (34.24%), no education (22.89%) and higher education (4.96%). Here, although there was no statistical difference, the proportions of micronutri-

ments' consumption and/or supplementation were 16.7%, 14.62%, 9.7% and 2.3% respectively. The data showed that 82.61% of mothers were married and 36.12% of children had received micronutrient supplements, compared with 7.79% of single mothers. The high proportion of mothers (54.81%) lived in rural settings, with 24.75% of their children under five years having taken micronutrient supplements, compared with 18.56% of mothers in urban areas. Although there was no statistical difference in maternal employment, religion, wealth, access to media, antenatal care, region and micronutrients' consumption and/or supplementation proportions, we did note that 67.32% of mothers were employed with a micronutrients' consumption and/or supplementation rate of 29.36% compared to 13.95% for mothers without employment.

The high proportion of mothers practiced the Christian faith (70.53%), followed by Muslim mothers (25.88%), and animists, and mothers of other faiths made up 3.59% of our sample and micronutrients' consumption and/or supplementation rates were 30.64%, 11.33% and 1.34% respectively. The very poor and poor mothers made up 19.40% and 23.13% respectively, while 23.15% were to the middle class of income status and 8.16% and 6.02% belonged to the rich and very rich income status respectively. While the rates of micronutrients' consumption and/or supplementation in these groups of economic status were 8.49% and 10.68% for the poorest and poorer, respectively, and 9.96%, 8.16% and 6.02% for the middle, richest and richest. About 83.35% of the sampled mothers had no accessibility to the media, and the rate of micronutrients' consumption and/or supplementation was 35.79%, compared with 7.51% for mothers who did have access to media. About 45.65% of the sampled mothers had no intention contraceptive use, followed by those who intended to use it after (29.30%), while 20.98% utilized a modern contraceptive and 4.07% a traditional contraception. The rates of micronutrients' consumption and/or supplementation were 18.51% and 12.43% of mothers who had no intention of contraceptive use and those who have intention to use it in the future respectively, 10.20% of mothers using a modern contraception and 2.17% among mothers using a traditional contraception. About 75.47% of the mothers in the sample were not exposed to violence against women if the child was neglected by the mother and recorded a micronutrients' consumption and/or supplementation rate of 32.16% compared with 23.99% of the mothers who were exposed and recorded a micronutrients' consumption and/or supplementation rate of 10.98%. About 89.37% of mothers had received antenatal care in a health centre, compared with 10.63% in a traditional birth clinic, with micronutrients' consumption and/or supplementation rates of 38.87% and 4.44% respectively. The high proportion of mothers (19.12%) was from the region of Centre, followed by mothers of the littoral region (13.86%), the north (11.97%) and at the last the south-west region with only 1.75%. Here the rates of micronutrients' consumption and/or supplementation were 8.75%, 6.11%, 5.15% and 0.65% respectively.

Table 1. Socioeconomic characteristics and Bivariate analysis of the sample (N =4074).

Variables	Observations (N)	Frequency (%)	Micronutrients' Consumption/Supplementation (%)		P value
			No	Yes	
Child's characteristics					
Age (in months)					
6 to 23	1436	35,25	3,22	32,03	0.000
24 to 42	1452	35,64	29,50	6,14	
43 to 59	1186	29,11	20,30	8,81	
Sex of Child					
Male	2345	50,78	28,82	21,96	0.925
Female	2273	49,22	27,87	21,35	
Birth order					
1= 1 birth	1032	22,35	12,06	10,29	0.007
2= 2 birth	908	19,66	10,55	9,12	
3= 3 birth	771	16,70	9,44	7,25	
4= 4 birth	594	12,86	7,51	5,35	
5=5 and more	1313	2843	17,13	11,30	
Perceived weight at birth					
Very large	526	11,39	6,26	5,13	0.471
larger than average	902	19,53	11,30	8,23	
Average	2406	52,10	29,93	22,17	
Smaller than average	464	10,05	5,35	4,70	
Very small	210	4,55	2,47	2,08	
Don't know	110	2,38	1,39	1,00	
Number of children under five years (59 months) in the household					
0 to 1 child	1146	24,82	16,52	8,29	0.000
2 children	1641	35,53	19,01	16,52	
3 children	1019	22,07	11,52	10,55	
4 children and more	812	17,58	9,64	7,95	
Characteristics of mother					
Age of mother at child's birth (years)					
15 – 24	1393	30,16	14,29	15,87	0.000
25 – 34	2305	49,91	28,61	21,31	
35 – 49	920	19,92	13,79	6,13	
Mother's level of education					
No education	1057	22,89	13,19	9,70	0.612
Primary	1581	34,24	19,62	14,62	
Secondary	1751	37,92	21,22	16,70	

Variables	Observations (N)	Frequency (%)	Micronutrients' Consumption/Supplementation (%)		P value
			No	Yes	
Higher	229	4,96	2,66	2,30	
Mother's marital status					
Married	3815	82,61	46,49	36,12	0.217
Not Married	803	17,39	10,20	7,19	
Employment					
No	1509	32,68	18,73	13,95	0.546
Yes	3109	67,32	37,96	29,36	
Mother's religion					
Christians	3257	70,53	39,89	30,64	0.283
Muslim	1195	25,88	14,55	11,33	
Animist/none/other	166	3,59	2,25	1,34	
Moyher's economic well-being and wealth					
Poorest	896	19,40	10,91	8,49	0.121
Poorer	1068	23,13	12,45	10,68	
Middle	1069	23,15	13,19	9,96	
Richer	937	20,29	12,13	8,16	
Richest	648	14,03	8,01	6,02	
Mother's acces to media					
No	3849	83,35	47,55	35,79	0.266
Yes	769	16,65	9,14	7,51	
Violence justified if Wife neglects the children					
No	3485	75,47	43,31	32,16	0.095
Yes	1108	23,99	13,01	10,98	
Contraceptive use					
Modern method user	969	20,98	10,78	10,20	0.000
Traditional method user	188	4,07	1,91	2,17	
Non-user - intends to use later	1353	29,30	16,87	12,43	
Does not intend to use	2108	45,65	27,13	18,51	
Prenatal Assistance					
Traditional birth assistance	491	10,63	6,19	4,44	0.461
Health center assistance	4127	89,37	50,5	38,87	
Region					
Centre	883	19,12	10,37	8,75	0.316
Adamawa	373	8,08	4,83	3,25	
East	546	11,82	7,02	4,81	
Far-north	454	9,83	5,46	4,37	

Variables	Observations (N)	Frequency (%)	Micronutrients' Consumption/Supplementation (%)		P value
			No	Yes	
Littoral	640	13,86	7,75	6,11	
North	553	11,97	6,82	5,15	
North-west	239	5,18	2,79	2,38	
West	439	9,51	5,20	4,31	
South	410	8,88	5,35	3,53	
South-west	81	1,75	1,10	0,65	
Mother's area of residence					
Urban	2087	45,19	26,63	18,56	0.005
Rural	2531	54,81	30,06	24,75	
Total	4074	100	56,69	43,31	

Source: Estimations of authors based on DHS-V data 2018, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

3.2. Logistic Regression of the Function of Micronutrients' Consumption and/or Supplementation

The logistic regression's results of the function of micronutrients' consumption and/or supplementation are presented in Table 2. The estimates of the function of micronutrients' consumption and/or supplementation are overall significant [$\text{Prob} > \chi^2 (0.000)$] and have an explanatory power of 39.79% (adjusted R^2). The age of the child was found to be an important determinant of micronutrients' consumption and/or supplementation. Thus, children in age groups older than 23 months were less likely ($OR < 1$) to be consuming and/or supplemented with micronutrients than children aged 6 to 23 months; with a statistically non-significant difference in micronutrients' consumption and/or supplementation between the children's age groups ($p < 0.05$). Female children were 0.9 times less likely to be consuming and/or supplemented with micronutrients than male children, with a statistically non-significant difference in micronutrients' consumption and/or supplementation ($p > 0.05$). Children with a birth rank greater than or equal to two were less likely ($OR < 1$) to be consuming and/or supplemented with micronutrients than children with a 1st birth rank; with a non-significantly statistical difference in micronutrients' consumption and/or supplementation between birth ranks ($p > 0.05$).

The children perceived at birth as very small and of unknown weight were respectively 1.31 and 1.32 times more likely to be consuming and/or supplemented with micronutrients than larger weight children ($p > 0.05$). However, larger and smaller than average weight children were 0.92 and 0.99 times less likely to be consuming and/or supplemented with micronutrients, with a non-significantly statistical difference

in micronutrients' consumption and/or supplementation between different groups of weight ($p > 0.05$).

The children from mothers who were experienced the domestic violence if the mother neglected the child were 1.1 times more likely to be consuming and/or supplemented with micronutrients compared to mothers who did not experience, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation ($p < 0.342$). On the other hand, the children of mothers who did not have an opinion on domestic violence were 0.14 times less likely to be consuming and/or supplemented with micronutrients compared to mothers who did not have an opinion, with a significant statistical difference in micronutrients' consumption and/or supplementation ($p < 0.05$).

The children from married mothers were 1.6 times more likely to be consuming and/or supplemented with micronutrients than children of single mothers with a statistically significant difference in micronutrients' consumption and/or supplementation ($p < 0.05$). Children of mothers from 25-34 and 35-49 age groups were respectively 0.7 and 0.5 times less likely to be consuming and/or supplemented with micronutrients than children of mothers in the 15-24 age group; with a statistically significant difference in micronutrients' consumption and/or supplementation between the age groups ($p < 0.05$). The children of mothers who attended both primary and secondary education levels were respectively 0.8 and 0.9 times more likely to be consuming and/or supplemented with micronutrients than children of mothers with no education, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation between the different levels of education ($p > 0.05$); however, children of mothers who attended tertiary education were 1.1 times more likely to be consuming and/or supple-

mented with micronutrients ($p>0.05$). Children of working mothers were 1.1 times more likely to be consuming and/or supplemented with micronutrients than children of non-working mothers, but this was not significant ($p>0.05$). The children of mothers who practiced the Muslim, animist, no religion and other religions were respectively 0.9 and 0.6 times less likely to be consuming and/or supplemented with micronutrients than the children of Christian mothers of all religions, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation ($p>0.01$). Children of mothers living in rural settings were significantly more likely ($OR=1.237$) to be consuming and/or supplemented with micronutrients compared to children of mothers living in urban settings. Children of mothers in the poorer, middle and rich income quintiles were respectively 1.2, 1.1 and 1.1 times more likely to be consuming and/or supplemented with micronutrients than children of mothers in the very poor income quintiles, while those in the very rich income quintiles were 0.9 times less likely, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation between the different income quintiles ($p>0.05$). The children of mothers with access to media were slightly more likely ($OR=1.056$) to be consuming and/or supplemented with micronutrients than the children of mothers who did not, but this was statistically not significant. Children from mothers who used traditional contraception were 1.2 times more likely to be consuming and/or supplemented with micronutrients than children of

mothers who used modern contraception but not significantly difference ($p>0.01$). Children of mothers who intended to use modern contraception in the future were 0.8 times less likely than children of mothers who used modern contraceptive methods with a non-significantly statistical difference in micronutrients' consumption and/or supplementation ($p>0.05$). Children of mothers with no intention of using contraception were 0.7 times less likely than children of mothers who used modern contraceptive methods with a non-significantly statistical difference in micronutrients' consumption and/or supplementation ($p>0.05$).

The children of mothers who made their prenatal visits in a health center were 1.1 times more likely to be consuming and/or supplemented with micronutrients compared to children of mothers who undertaken the prenatal visits from the traditional birth attendant, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation ($p>0.05$). The children of mothers in the Adamaoua, Littoral, North, Far North, South and South West regions were less likely ($OR<1$) to be consuming and/or supplemented with micronutrients than children of mothers in the region of Centre, whereas children in the West, East and North West regions were more likely ($OR>1$) to be consuming and/or supplemented with micronutrients than children of mothers in the Centre region, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation between the different regions ($p>0.05$).

Table 2. Logit estimation of the function of micronutrients' consumption and/or supplementation in children aged 6-59 months.

Independent variable:	Micronutrients' consumption and/or supplementation (1= if micronutrients' consumption and/or supplementation was given to children aged 6 to 59 months; 0= otherwise)		
	OR	95% CI	P value
Characteristics of child			
Child age (in months)			
6 to 23	Ref.		
24 to 42	0,014	[0,011 - 0,019]	0,000
43 to 59	0,032	[0,025 - 0,042]	0,000
Child's Sex			
Male	R. 1.		
Female	0,953	[0,803 - 1,131]	0,585
Order of birth			
1 birth	R. 1.		
2 births	0,876	[0,672 - 1,141]	0,328
3 births	0,809	[0,602 - 1,085]	0,158
4 births	0,712	[0,506 - 1,002]	0,052
5 and more births	0,722	[0,518 - 1,006]	0,054

Independent variable:	Micronutriments' consumption and/or supplementation (1= if micronutriments' consumption and/or supplementation was given to children aged 6 to 59 months; 0= otherwise)		
	OR	95% CI	P value
Perceived weight at birth			
Very large	R ƒ.		
Larger than average	0,918	[0,665 - 1,266]	0,605
Average	1,003	[0,756 - 1,331]	0,980
Smaller than average	0,990	[0,680 - 1,440]	0,959
Very small	1,307	[0,820 - 2,082]	0,259
Don't know	1,318	[0,713 - 2,437]	0,377
Number of children under 5 in the household			
0 to 1 child	R ƒ.		
2 children	3,348	[2,592 - 4,325]	0,000
3 children	4,576	[3,443 - 6,082]	0,000
4 children and more	4,172	[3,082 - 5,647]	0,000
Characteristics of mothers			
Age of mothers at child's birth (years)			
15 – 24 ans	R ƒ.		
25 – 34 ans	0,757	[0,596 - 0,960]	0,022
35 – 49 ans	0,503	[0,355 - 0,713]	0,000
Mother's education level			
No education	R ƒ.		
Primary	0,854	[0,646 - 1,128]	0,268
Secondary	0,870	[0,629 - 1,202]	0,400
Higher	1,093	[0,641 - 1,865]	0,743
Statut matrimonial			
Married	R ƒ.		
Not Married	1,618	[1,260 - 2,078]	0,000
Employment			
No	R ƒ.		
Yes	1,159	[0,945 - 1,422]	0,155
Religion			
Christians	R ƒ.		
Muslim	0,922	[0,721 - 1,180]	0,521
Animist/none/other	0,630	[0,388 - 1,021]	0,061
Moyher's economic well-being and wealth			
Very poor	R ƒ.		
Poor	1,238	[0,929 - 1,650]	0,144
Middle	1,066	[0,765 - 1,486]	0,702

Independent variable:	Micronutriments' consumption and/or supplementation (1= if micronutriments' consumption and/or supplementation was given to children aged 6 to 59 months; 0= otherwise)		
	OR	95% CI	P value
Rich	1,055	[0,711 - 1,564]	0,788
Very rich	0,994	[0,627 - 1,577]	0,982
Mother's access to media			
No	R ƒ.		
Yes	1,056	[0,814 - 1,371]	0,677
Violence experienced if wife neglects the children			
No	R ƒ.		
Yes	1,106	[0,898 - 1,362]	0,342
Don't know	0,138	[0,393 - 0,483]	0,002
Use of contraception			
Modern contraception user	R ƒ.		
Traditional contraception user	1,194	[0,754 - 1,891]	0,448
Non-user - intends to use later	0,814	[0,636 - 1,042]	0,103
Does not intend to use	0,757**	[0,593 - 0,967]	0,026
Prenatal Assistance			
Traditional birth attendance	R ƒ.		
Health Centre	1,154	[0,853 - 1,561]	0,352
Region of residence			
Centre	R ƒ.		
Adamawa	0,758	[0,501 - 1,147]	0,191
East	1,101	[0,794 - 1,526]	0,563
Far-north	0,916	[0,633 - 1,326]	0,644
Littoral	0,992	[0,685 - 1,438]	0,970
North	0,741	[0,511 - 1,073]	0,113
North-west	1,371	[0,893 - 2,105]	0,148
West	1,175	[0,827 - 1,668]	0,367
South	0,807	[0,565 - 1,154]	0,242
South-west	0,864	[0,432 - 1,726]	0,679
Mother's area of residence			
Urbain	R ƒ.		
Rural	1,237	[0,971 - 1,575]	0,085
Constant	4,431	[2,192 - 8,953]	0,000
Total Number of observations	4074		
LR chi2 (Prob>chi2)	2241,27 (0.000)		
Pseudo R ²	0.3979		

Source: Estimated by the authors based on DHS-V data 2018, *** p<0.01, ** p<0.05, * p<0.1

4. Discussion

The estimated function of micronutrients' consumption and/or supplementation was significant overall [Prob>chi2 (0.000)] with an explanatory power of 39.79% (adjusted R2). The results show that children in age groups older than 23 months were less likely (OR<1; p<0.05) to be consuming and/or supplemented with micronutrients than children of age 6 to 23 months. This could be explained by the fact that at this age children already consume the majority of the family's ordinary meals. This result corroborates those of previous studies conducted in several developing countries [3, 17, 18]. Children with a birth order of two or more were less likely (OR<1; p>0.05) to be consuming and/or supplemented with micronutrients than children with a birth order of one or more. This finding corroborates those of a study conducted in Sub-Saharan Africa [19].

Children from married mothers were more likely (OR=1.618; p<0.05) to be consuming and/or supplemented with micronutrients than children of single mothers. This result corroborates those of a study conducted in Sub-Saharan Africa [19]. Children with a birth order greater than or equal to two were less likely (OR<1) to be consuming and/or supplemented with micronutrients than children with a 1st birth order; with a non-significantly statistical difference in micronutrients' consumption and/or supplementation between birth orders (p>0.05). This result corroborates those of a study conducted in India [8]. Children from mothers age between 25-34 and 35-49 groups were less likely (OR=0.757 and 0.503 respectively; p<0.05) to be consuming and/or supplemented with micronutrients compared to those of mothers in the 15-24 age group. At this age, women are already experienced in the nutritional variation of their children. They are already familiar with foods that provide children with more vitamins without these foods being micronutrients. This result corroborates those of a study conducted in India [8]. The children of mothers who attended prenatal visits at a primary health centre were more likely to be consuming and/or supplemented (OR>1; p>0.05) with micronutrients as compared to those of mothers who attended prenatal visits from a traditional birth attendant, with a difference in micronutrients' consumption and/or supplementation. This result corroborates those of a study conducted in Sub-Saharan Africa [16] or that conducted specifically in Ethiopia [20]. The children of animist's mothers, no religion and other religion were significantly less likely (OR<1; p<0.05) to be consuming and/or supplemented with micronutrients compared to children of Christian mothers of all faiths. In fact, women practicing religions other than Christianity generally tend to be more traditional in the way they feed their children. This result corroborates those of a study in India [8].

The children from rural mothers were significantly more likely (OR=1.237; p<0.05) to be consuming and/or supplemented with micronutrients than children of urban mothers. This result corroborates those of previous studies conducted in Senegal [21]; and in Papua New Guinea [19]. The children of mothers with no

intention to use a contraceptive method were significantly less likely (OR=0.757; p<0.05) to be consuming and/or supplemented with micronutrients than children of mothers who used modern contraceptive methods. This result are in line with those of a study conducted in India [23]. The children of mothers with access to media were somewhat likely (OR=1.056; p>0.05) to be consuming and/or supplemented with micronutrients than children of mothers who did not. This result is similar to those of a study conducted in Bangladesh [24]. The children perceived at birth as very small and of unknown weight were respectively 1.3 and 1.3 times more likely to be consuming and/or supplemented with micronutrients than larger children (p>0.05). However, slightly large and slightly average children were 0.9 and 0.9 times less likely to be consuming and/or supplemented with micronutrients, with a non-significantly statistical difference in micronutrients' consumption and/or supplementation between the different weight groups (p>0.05). This result corroborates those of a study conducted in Sub-Saharan Africa [19]. The children of mothers in the low, middle and high income quintiles were respectively 1.2, 1.1 and 1.1 times more likely (R >1; p>0.05) to be consuming and/or supplemented with micronutrients than children of mothers in the very poor income quintiles, while those in the very high income quintiles were 0.9 times less likely (R <1; p>0.05) to be consuming and/or supplemented with micronutrients than children of mothers in the very low income quintiles. These results corroborate those of previous studies in Papua New Guinea [22] or that conducted specifically in Ethiopia [20]. Children of mothers in the Adamaoua (OR=0.758), Littoral (0.992), North (OR=0.741), Far North (OR=0.916), South (OR=0.807) and South West (OR=0.864) regions were non-significantly less likely to be consuming and/or supplemented with micronutrients than children of mothers in the Central region, while children in the West (OR=1.175), East (OR=1.101) and North-West (OR=1.371) were more likely to be consuming and/or supplemented with micronutrients than children of mothers in the Central region.

5. Limitations of the Study

This study pointed out some key information on the economic and social determinants of children under five years consumption and supplementation in micronutrients in Cameroon. However, the cross-sectional design uses can limit the likelihood of making any judgments on the changes in these economic and social determinants over time. Moreover, few other determinants such as health system, environmental and macroeconomic-related factors that can influence the population access to micronutrients were no included in this study. These limitations call for the findings of this study to be somewhat interpreted with little cautious before any generalisation.

6. Conclusion

This study analysed economic and social determinants of

micronutrients' consumption and/or supplementation in children under five years of age in Cameroon. It emerged that the sex of the child, the child's birth order, the children of married mothers, the mother's level of education, standard of living, the children of mothers who did not use any contraception, employment, religion, and the children from mothers in the low, middle and high income quintiles were significant factors associated with the function of micronutrients' consumption and/or supplementation in children under five in Cameroon. To this end, policy decision-makers must strive to improve the economic and social conditions of childbearing women while raising their awareness of the harmful effects of child malnutrition.

Abbreviations

DHS-V	Demographic and Health Surveys
OR	Odds Ratio

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Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Khan A. U., Hasan S., Siddiqua F., Sultana S., Moniruzzaman, Hossain M., Shaheed S. I., and Shahid A.. (2024). The Significance of Providing the Optimal Micronutrients to the Preterm Low Birth Weight Infants to Prevent Long-Term Health Consequences. *European Journal of Preventive Medicine*, 2024. Vol. 12, No. 2, pp 35-46. <https://doi.org/10.11648/j.ejpm.20241202.12>
- [2] Bailey RL, West KP Jr, Black RE. The epidemiology of global micronutrient deficiencies. *Ann Nutr Metab*. 2015; 66 Suppl 2: 22-33. <https://doi.org/10.1159/000371618> Epub 2015 Jun 2. PMID: 26045325
- [3] Pacifique, N. K., Ntahuma, B., Bujiriri, K., Masirika, Z., Bisengi, F., Ntana, N.,... & Malengera, K. (2023). Evaluation du statut nutritionnel et de la mortalité des enfants de 0 à 59 mois dans l'aire de santé Lwiro, Bukavu, Est RD Congo. *International Journal of Innovation and Applied Studies*, 39(1), 392-400. <http://www.ijias.issr-journals.org/>
- [4] Keita, S. (2022). *Étude de la malnutrition aiguë sévère chez les enfants de 6 à 59 mois hospitalisés dans le service de pédiatrie du CSREF de Kalaban Coro de Janvier 2018 à Décembre 2019* (Doctoral dissertation, USTTB). <https://www.bibliosante.ml/handle/123456789/5698>
- [5] Gil, J. D. B.; Reidsma, P.; Giller, K.; Todman, L.; Whitmore, A.; Van Ittersum, M. Sustainable development goal 2: Improved targets and indicators for agriculture and food security. *Ambio* 2019, 48, 685–698. <https://doi.org/10.1007/s13280-018-1101-4>
- [6] Sabbahi, M.; Li, J.; Davis, C.; Downs, S. M. The Role of the Sustainable Development Goals to Reduce the Global Burden of Malnutrition. In *Advances in Food Security and Sustainability*; Elsevier BV: Amsterdam, The Netherlands, 2018; Volume 3, pp. 277–333. <https://doi.org/10.1016/bs.afs.2018.09.007>
- [7] Langley-Evans, S. C. (2015): Nutrition in Early Life and the Programming of Adult Disease: A Review. *J. Hum. Nutr. Diet* 2015, 28, 1–14. <https://doi.org/10.1111/jhn.12212>
- [8] Srivastava, S., Kumar, S. Does socio-economic inequality exist in micro-nutrients supplementation among children aged 6–59 months in India? Evidence from National Family Health Survey 2005–06 and 2015–16. *BMC Public Health* 21, 545 (2021). <https://doi.org/10.1186/s12889-021-10601-6>
- [9] Kim, J. Y.; Shin, S.; Han, K.; Lee, K.-C.; Kim, J.-H.; Choi, Y. S.; Kim, D. H.; Nam, G. E.; Yeo, H. D.; Lee, H. G.; et al. Relationship between socioeconomic status and anemia prevalence in adolescent girls based on the fourth and fifth Korea National Health and Nutrition Examination Surveys. *Eur. J. Clin. Nutr.* 2013, 68, 253–258. <https://doi.org/10.1038/ejcn.2013.241>
- [10] Hu, Y.; Chen, J.; Wang, R.; Li, M.; Yun, C.; Li, W.; Yang, Y.; Piao, J.; Yang, X.; Yang, L. Vitamin D Nutritional Status and its Related Factors for Chinese Children and Adolescents in 2010–2012. *Nutrients* 2017, 9, 1024. <https://doi.org/10.3390/nu9091024>
- [11] Khan, A., Ul-Haq, Z., Fatima, S., Ahmed, J., Alobaid, H. M., Fazid, S.,... & Safi, S. Z. (2023). Long-Term Impact of Multiple Micronutrients' consumption and/or supplementation on Micronutrient Status, Hemoglobin Level, and Growth in Children 24 to 59 Months of Age: A Non-Randomized Community-Based Trial from Pakistan. *Nutrients*, 15(7), 1690. <https://doi.org/10.3390/nu15071690>
- [12] Galgamuwa, L. S.; Iddawela, D.; Dharmaratne, S. D.; Galgamuwa, G. L. S. Nutritional status and correlated socio-economic factors among preschool and school children in plantation communities, Sri Lanka. *BMC Public Health* 2017, 17, 377. <https://doi.org/10.1186/s12889-017-4311-y>

- [13] Rahman, M. S.; Howlader, T.; Masud, M. S.; Rahman, M. L. Association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh: Do Mother's Education, Socio-Economic Status, and Birth Interval Matter? *PLoS ONE* 2016, 11, e0157814. <https://doi.org/10.1371/journal.pone.0157814>
- [14] National Institute of Statistics (NIS), Ministry of Public Health (MoPH) & ICF Macro, (2018). Cameroon: Fifth Demographic and Health Survey, Yaounde, Cameroon.
- [15] Nugroho W. N. and Vitri W. (2016). Socioeconomic Determinants of Health Insurance Membership Of Women Of Reproductive Age In Indonesia. Proceedings ICHWB (International Conference on Health and Well-Being) 2016. (Universitas Muhammadiyah Surakarta, 2016-05 27). <http://hdl.handle.net/11617/7406>
- [16] Kamuyango, A., Yu, T., Ao, C. K., Hu, S. C., Salim, L. A., Sulistyorini, Y., & Li, C. Y. (2023). Associations of Urban Residence and Wealth Index With Various Sources of Contraceptives Among Young Women Aged 15–24 Years in 25 Sub-Saharan African Countries. *Journal of Adolescent Health*. <https://doi.org/10.1101/2023.04.11.23288416>
- [17] UNICEF (2023) La nutrition dans la petite enfance: Prévenir la malnutrition chez les nourrissons et les jeunes enfants. New York, USA.
- [18] Tchagbele, O. B., Segbedji, K. A. R., Talboussouma, S. M., Toï A., Agoro, S., Djadou, K. E.,... & Azoumah, K. D. (2023). Évaluation des pratiques alimentaires chez les nourrissons de 6 à 23 mois dans la ville de Kara. *Journal de Pédiatrie et de Puériculture*. <https://doi.org/10.1016/j.jpp.2023.06.007>
- [19] Engidaw, M. T., Gebremariam, A. D., Tiruneh, S. A. *et al.* Micronutrient intake status and associated factors in children aged 6–23 months in sub-Saharan Africa. *Sci Rep* 13, 10179 (2023). <https://doi.org/10.1038/s41598-023-36497-3>
- [20] Lucha, T. A., Engida, T. A. & Mengistu, A. K. Assessing the potential determinants of national vitamin A supplementation among children aged 6–35 months in Ethiopia: further analysis of the 2019 Ethiopian Mini Demographic and Health Survey. *BMC Pediatr* 22, 439 (2022). <https://doi.org/10.1186/s12887-022-03499-5>
- [21] Thiam, M., Diouf, A., Coly, O. B., Kébé S. D., Diongue, O., Badiane, A.,... & M'eloc, J. M. (2022). Dietary intakes and nutritional status of mother-child (6-23 months old) pair targeted through the "organic residual products for biofortified foods for africa project" in rural area in Senegal.
- [22] Pham, B. N., Silas, V. D., Okely, A. D., & Pomat, W. (2021). Breastfeeding rate, food supplementation, dietary diversity among children aged 6–59 months, and associated factors in Papua New Guinea. *Frontiers in Nutrition*, 8, 18. <https://doi.org/10.3389/fnut.2021.622645>
- [23] Lal S. Integrated Reproductive and Child Health Register (IRCHR) Version- 2.0: A Ready Reckoner and Learning Resource for UGs and PGs. *Indian J Community Med*. 2023 Mar-Apr; 48(2): 205-208. https://doi.org/10.4103/ijcm.ijcm_933_22 Epub 2023 Apr 7. PMID: 37323751; PMCID: PMC10263033.
- [24] Marjan, N., Rahman, A., Rois, R. *et al.* Factors associated with coverage of vitamin A supplementation among Bangladeshi children: mixed modelling approach. *BMC Public Health* 21, 648 (2021). <https://doi.org/10.1186/s12889-021-10735-7>