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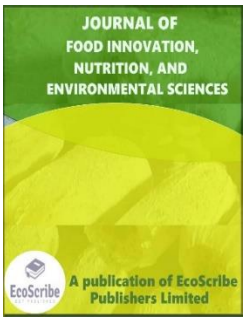

ORIGINAL RESEARCH ARTICLE

Nutritional Status of Children Aged 6–23 Months in The Komanda Health Zone, Democratic Republic of The Congo

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ABSTRACT

Child malnutrition remains a major public health problem in the Democratic Republic of the Congo, particularly in eastern regions. This study assessed the nutritional status of children aged 6–23 months in the Komanda Health Zone, Ituri Province, and described crude associations with selected sociodemographic factors. A community-based cross-sectional study was conducted from June 12 to 29, 2025, in 10 of 17 health areas. Seven areas were excluded because of insecurity. Multistage cluster sampling was used. Data were collected with KoboCollect and anthropometric measurements. WAZ, HAZ, and WHZ indices were calculated using WHO Anthro and analyzed with Stata v13. Among 475 children, stunting, underweight, and wasting affected 50.95%, 25.05%, and 15.79%, respectively. Maternal age, child sex, child age, and maternal education showed significant crude associations with anthropometric indicators. Findings indicate a high burden of malnutrition, requiring cautious interpretation due to unadjusted analyses and unaccounted cluster effects.

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1. INTRODUCTION

The effects of poor nutrition are reflected in suboptimal physical growth among undernourished children, particularly in many low- and middle-income countries (UNICEF/WHO, 2021). Undernutrition during the first 1,000 days of life compromises brain development and child growth, with long-lasting consequences for physical and cognitive health. It also produces both short- and long-term health consequences and negatively affects the economic productivity of nations (Akombi et al., 2017).

Malnutrition remains extremely high worldwide, affecting approximately 150.8 million children under five years of age with stunting, 50.5 million with wasting, and 38.3 million with overweight (Liao et al., 2023). Despite the global decline in undernutrition, several low- and middle-income countries (LMICs) are unlikely to achieve the World Health Organization (WHO) target of a 40% reduction in stunting by 2025 without substantial improvements in context-specific interventions (Akombi et al., 2017; Liao et al., 2023). According to the 2022 Global Nutrition Report, progress toward global nutrition targets in Africa has been modest, with only six countries on track to achieve the stunting target among infants and children under five years of age, and 19 countries on track to reduce stunting in this age group (Riwa et al., 2025). Of concern, eight Sub-Saharan African countries—namely Angola, Burundi, the Central African Republic, Djibouti, Eritrea, Mauritius, Niger, and South Africa-showed no progress or worsening stunting rates, while nine countries in Sub-Saharan Africa (Benin, Republic of the Congo, Guinea, Mali, Mauritania, Sudan, Senegal, and Togo) showed no progress or worsening undernutrition among infants and children under five years of age (Liao et al., 2023; Riwa et al., 2025).

The DRC is among the 34 countries worldwide with the highest prevalence of malnutrition. Chronic malnutrition, acute malnutrition, underweight, and micronutrient deficiencies remain major nutritional problems. One in two children under five years of age is stunted, more than 6 million children under five have suffered from chronic malnutrition, and 1.9 million cases of severe acute malnutrition (SAM) were expected in 2017. Approximately 600,000 children under five die each year from complications related to SAM (Ngoy et al., 2022). Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) conducted in the DRC consistently show that malnutrition in all its forms remains a major public health issue (COD-EDS-RDC-III-KIR., 2024).

Despite global efforts to combat malnutrition and local initiatives in the DRC, the situation remains alarming, particularly among children under two years of age. Chronic and acute malnutrition continue to severely affect the health and development of young children, a situation exacerbated by persistent insecurity in Ituri Province, where armed group incursions cause frequent population displacement. The Komanda Health Zone, located in the Irumu territory of Ituri Province, illustrates these challenges. The area faces persistent insecurity due to armed conflict, resulting in massive population displacement and disruption of access to healthcare services and livelihoods. Families mainly depend on subsistence agriculture, which is heavily affected by instability, thereby worsening food insecurity. In addition, nutrition interventions remain limited due to the lack of updated local data to guide planning and resource allocation.

Given this context, it is crucial to assess the nutritional status of children under two years of age in this province, particularly in the Komanda Health Zone, in order to propose effective and context-adapted interventions. The objective of this study was therefore to assess the nutritional status of children aged 6–23 months in the Komanda Health Zone, Ituri Province, and to describe crude associations between selected sociodemographic factors and anthropometric indicators.

2. METHODOLOGY

2.1 Study setting

This study was conducted in the Komanda Health Zone, under the authority of the Ituri Provincial Health Division in northeastern DRC. The capital city of Ituri Province is Bunia, and the province includes the territories of Irumu, Aru, Djugu, Mahagi, and Mambasa. The Komanda Health Zone is located in the Irumu territory.

2.2 Study design and period

This was a descriptive cross-sectional study conducted from June 12 to June 29, 2025. Data were collected in 10 of the 17 health areas of the Komanda Health Zone: Komanda, Mangiva, Mangusu, Bandiboli, Makayanga, Bey, Bamande, Mandibe, Pinzili, and Ofay. The remaining seven health areas were excluded due to the unstable security context. This exclusion limits the representativeness of the findings for the entire Health Zone.

2.3 Study population

The target population consisted of children aged 6–23 months residing in the Komanda Health Zone for at least six months. Children whose parent or legal guardian provided free and informed consent were included.

2.4 Sample size

The minimum sample size was calculated using Schwartz's formula:

$$n_1 = \frac{z^2_{1-\&/2} * P(1-P)}{m^2} = 225$$

Using a malnutrition prevalence of 17.8% (COD-MICS-Palu, 2018), a 5% margin of error, a 5% alpha risk (Z = 1.96), and applying a design effect of 2 with an additional 5% adjustment for non-response, the minimum required sample size was estimated at 475 children.

The calculation was as follows:

Initial sample size = $(1.96^2 \times 0.178 \times 0.822) / 0.05^2 \approx 225$

Final sample size after adjustment for cluster effect and non-response = $225 \times 2 \times 1.05 \approx 473$, rounded to 475.

2.5 Sampling technique

A multistage cluster sampling technique was used. Health areas were first selected based on security accessibility. Within each selected health area, villages were randomly chosen. Households were then selected systematically from a central starting point until the required quota of children aged 6–23 months was reached. When a household had more than one eligible child, one child was selected randomly. The sample distribution by health area was proportional to the population size of children aged 6–23 months, as presented in Table 1. The exact sampling interval per village was not available in the final analytical database. Quotas by health area were adjusted to obtain a total sample of 475 children.

Table 1. Distribution of the population across the health areas included in the survey

No.	Health Areas	Total Population (2025)	Children Aged 6–23 Months (5.97%)	Percentage of Children by Health Area	Number of Children Surveyed
1	Bamande	20,109	1,201	12.58	60
2	Bandiboli	13,782	823	8.62	41
3	Bey	18,313	1,093	11.46	54
4	Komanda	25,608	1,529	16.02	76
5	Mandibe	14,806	884	9.26	44
6	Makayanga	13,080	781	8.18	39
7	Mangiva	12,430	742	7.78	37
8	Mangusu	10,468	625	6.55	31
9	Ofay	19,606	1,170	12.27	58
10	Pinzili	11,615	693	7.27	34
	TOTAL	159,817	9,541	100	475

Source: BCZ Komanda

Operational definitions of variables

Children's nutritional status was assessed according to WHO Child Growth Standards using Z-scores for weight-for-height, height-for-age, and weight-for-age compared with the WHO reference population, based on the following indicators:

- **Global acute malnutrition (wasting):** weight-for-height index below −2 standard deviations (WHZ < −2);
- **Global underweight:** weight-for-age index below −2 standard deviations (WAZ < −2);
- **Global chronic malnutrition (stunting):** height-for-age index below −2 standard deviations (HAZ < −2).

2.6 Data collection

Data were collected using an electronic questionnaire developed on KoboCollect and administered face-to-face to mothers or caregivers. Investigators, composed of nurses and community health workers, received three days of training on survey techniques and anthropometric measurements. Weight was measured using a calibrated portable electronic scale with 100 g precision. Recumbent length was measured using a graduated length board with 0.1 cm precision, according to the age of the included children. Age was recorded in months based on information provided by the parent or caregiver and, when available, verified using health records.

2.7 Data processing and analysis

Data were exported to Excel for quality control and analyzed using Stata v13. Anthropometric indices including weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) were calculated using WHO Anthro. Qualitative variables were presented as frequencies and percentages. Quantitative variables, including maternal age and child age, were summarized using medians and observed ranges because their distributions were not normal according to the Kolmogorov–Smirnov test.

Bivariate associations were assessed using Pearson's chi-square test or Fisher's exact test for qualitative variables and the Kruskal–Wallis test for non-normally distributed quantitative variables. Statistical significance was set at $p < 0.05$.

2.8 Ethical considerations

The research protocol was approved by the Ethics Committee of the University of Kisangani **(**UNIKIS/CE/KGB/001/07/2025**).** Prior administrative authorization was obtained from the Ituri Provincial Health Division (N°054/206/DPS/IT/05/2025), and local authorities were informed before field activities began. Free and informed consent was obtained from the parent or caregiver of each child. Data confidentiality was ensured.

3. RESULTS

A total of 475 children aged 6–23 months were included. The median age of the children was 11 months (range: 6–23 months), and the median age of mothers or caregivers was 26 years (range: 15–40 years). Among the children, 56.4% were female. Most mothers had primary-level education (68.21%), while 18.7% were illiterate. The majority of mothers were farmers (71.4%). Most households had six members or fewer (56.2%) **(Table 2).**

3.1 Nutritional status of participants

Anthropometric assessment revealed a high burden of undernutrition. Stunting affected 50.95% of children. Underweight affected 25.05% of children, while wasting affected 15.79% of children (**Table 3**).

Table 2. Distribution of participants according to the sociodemographic characteristics of mothers and children

Variables	Characteristics	Frequency (n=475)	Percentage (%)
Maternal age	Median (Range)	26 (15–40)	–
Child sex	Male	207	43.58
	Female	268	56.42
Child age (months)	Median (Range)	11 (6–23)	–
Maternal education level	Illiterate	89	18.74
	Primary level	324	68.21
	Secondary school diploma	59	12.42
	Higher or university education	3	0.63
Maternal occupation	Unemployed	53	11.16
	Trader	61	12.84
	Farmer	339	71.37
	Employed worker	22	4.63
Household size	≤ 6 persons	267	56.21
	> 6 persons	208	43.79
Maternal marital status	Single	17	3.58
	Cohabiting union	171	36.00
	Legally married	254	53.47
	Divorced	7	1.47
	Widow	26	5.47

Table 3. Distribution of participants according to nutritional status

Variables	Characteristics	Frequency (n=475)	Percentage (%)
Underweight	Yes	119	25.05
	No	356	74.95
Wasting	Yes	75	15.79
	No	400	84.21
Stunting	Yes	242	50.95
	No	233	49.05

The distributions of Z-scores (WAZ, HAZ, and WHZ) were generally shifted to the left compared with the WHO reference population. This finding indicates an overall deficit in linear growth and body weight among the study population. The median height-for-age Z-score (HAZ) was −2.01, confirming a substantial burden of stunting (**Figures 1, 2, and 3**).

Unadjusted bivariate analyses showed several sociodemographic associations with nutritional indicators. Maternal age was associated with underweight ($p = 0.019$) and stunting ($p = 0.042$). Child sex was associated with underweight ($p = 0.030$) and stunting ($p = 0.010$), with higher proportions observed among boys. Child age was associated with underweight and wasting ($p < 0.001$). Maternal education level was associated with stunting ($p < 0.001$) (**Table 4**). In contrast, household size, maternal occupation, and marital status were not statistically significantly associated with the nutritional indicators assessed in these bivariate analyses.

In these bivariate analyses, maternal age was associated with underweight and stunting. Male sex was associated with higher proportions of underweight and stunting. Child age was associated with underweight and wasting. Maternal education level was associated with stunting. These findings should not be interpreted as independent factors because no multivariable adjustment was performed.

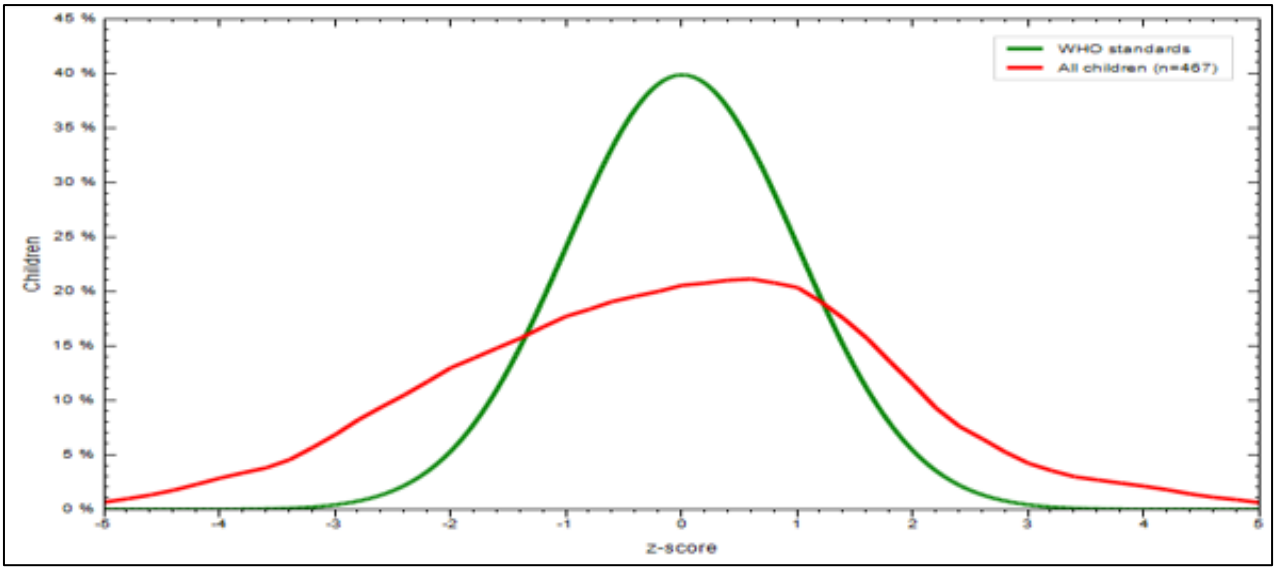

Fig.1. Comparison of the nutritional status of surveyed children with the WHO reference population.

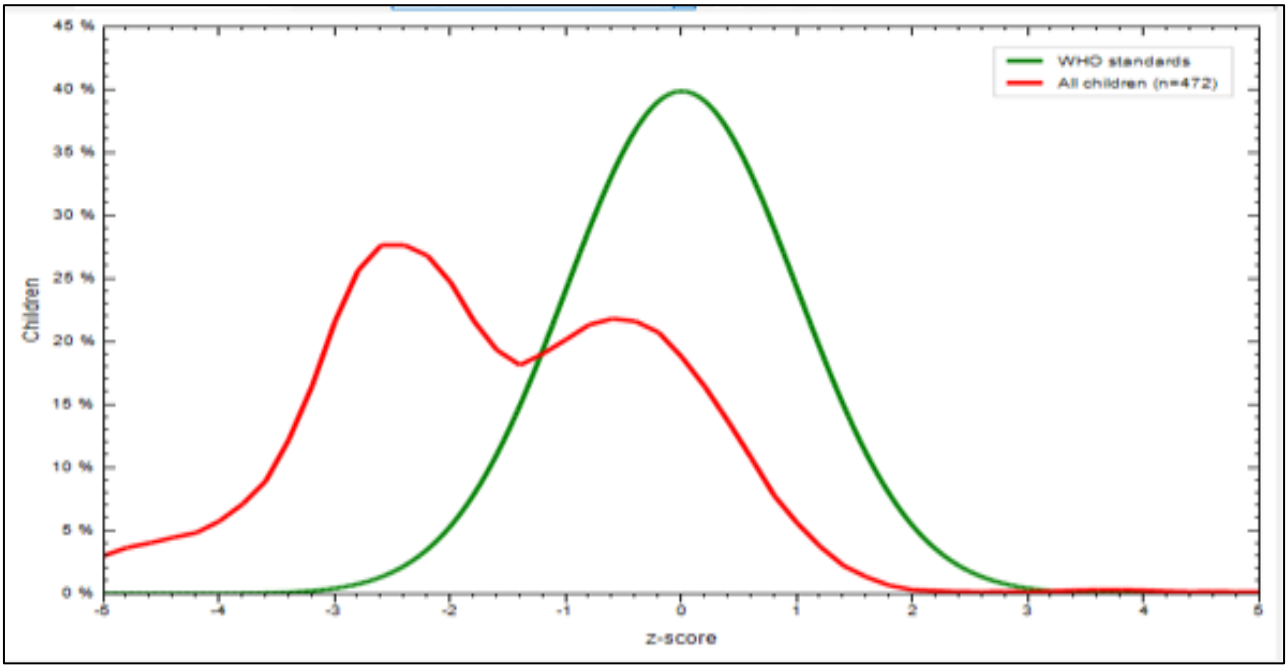

Fig. 2. Distribution of height-for-age Z-scores (HAZ) among surveyed children compared with WHO standards

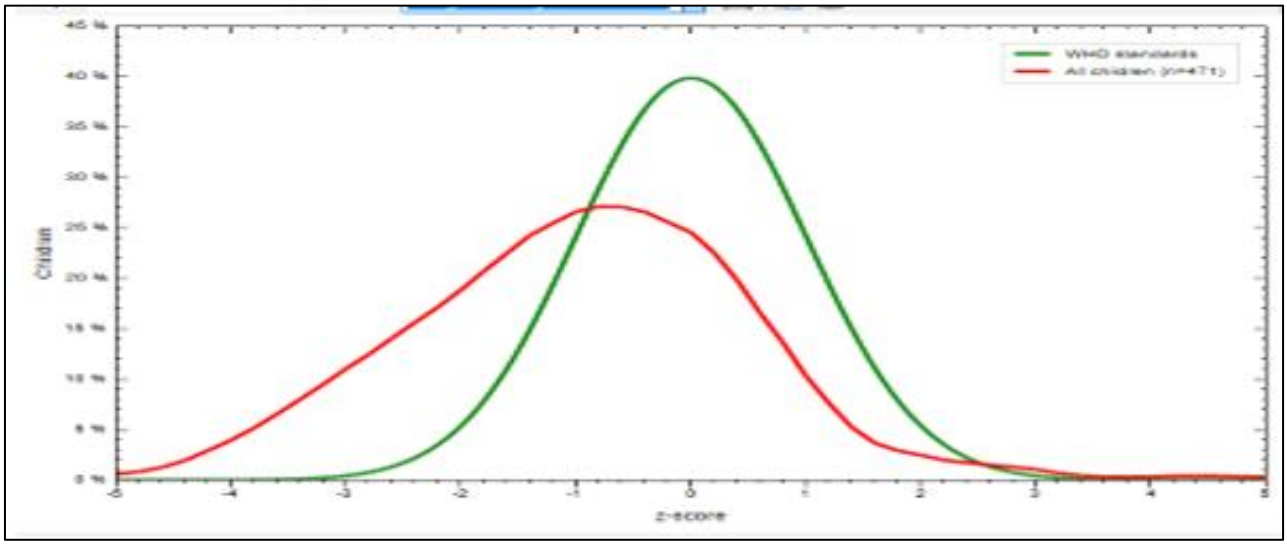

Fig. 3. Distribution of weight-for-height Z-scores (WHZ) among surveyed children compared with WHO standards

4.DISCUSSION

This study assessed the nutritional status of children aged 6–23 months in 10 health areas of the Komanda Health Zone. The findings revealed a high burden of stunting, underweight, and wasting. These results are useful for local planning, although they remain limited by the cross-sectional design, the absence of multivariable analysis, and the lack of adjustment for cluster effects.

Stunting was the most frequent form of malnutrition observed in the sample. This finding is consistent with national reports describing stunting as a persistent form of undernutrition in the DRC. However, comparisons with national or global estimates should be made cautiously because those sources generally concern children under five years of age, whereas the present study focused exclusively on children aged 6–23 months (Institut National de la Statistique & UNICEF, 2019; UNICEF et al., 2025).

Underweight affected one quarter of the children studied. This proportion may reflect a combination of chronic and recent growth deficits. Studies conducted in Sub-Saharan Africa have also described underweight as an indicator sensitive to socioeconomic conditions, infectious morbidity, and feeding practices. Nevertheless, studies involving children under five years of age are not directly comparable with surveys focused specifically on children aged 6–23 months (Akombi et al., 2017; Sewenet et al., 2022).

The level of wasting observed in this study indicates a substantial burden of acute malnutrition within the surveyed population. However, interpretation should remain cautious because the study did not assess recent episodes of diarrhea, fever, respiratory infections, vaccination status, household food security, or WASH conditions. These variables are important for understanding the mechanisms underlying wasting and for guiding prevention and management interventions (WHO & UNICEF, 2019; WHO, 2023).

The associations observed with maternal age, child sex, child age, and maternal education level are consistent with findings from previous studies. A narrative review reported higher nutritional vulnerability among boys in several contexts, although the mechanisms vary between countries (Thurstans et al., 2022). Studies on complementary feeding practices also show that children aged 6–23 months are highly sensitive to dietary diversity, minimum meal frequency, and the quality of feeding practices (Kambale et al., 2021; Gatica-Domínguez et al., 2021; WHO & UNICEF, 2021). In this study, these associations remained crude and do not establish independent effects.

This study has several limitations. Its cross-sectional nature does not allow causal inference. The analyses were bivariate and did not control for potential confounding factors between maternal age, education level, occupation, household size, and child characteristics. Cluster effects were not incorporated into precision estimates or p-values, which may have underestimated statistical uncertainty. In addition, the seven health areas excluded because of insecurity were not covered, thereby limiting representativeness for the entire Health Zone.

CONCLUSION

This study shows that children aged 6–23 months surveyed in 10 health areas of the Komanda Health Zone experience a high burden of malnutrition, particularly stunting. Bivariate analyses suggest crude associations between nutritional indicators and maternal age, child sex, child age, and maternal education level. These findings should be interpreted cautiously because they were not derived from adjusted models and did not account for cluster effects. Further multivariable analyses and additional data on feeding practices, morbidity, vaccination, and WASH conditions are needed to better guide local interventions.

Table 4. Unadjusted bivariate associations between sociodemographic characteristics and malnutrition indicators

Variables	Characteristics	Underweight Yes n (%)	Underweight No n (%)	p-value	Stunting Yes n (%)	Stunting No n (%)	p-value	Wasting Yes n (%)	Wasting No n (%)	p-value
Maternal age	Median (Range)	25 (16–36)	26 (15–40)	0.019*	26 (16–40)	25 (15–38)	0.042*	25 (16–40)	26 (16–40)	0.173*
Child sex	Male	62 (29.95)	145 (70.05)	0.030**	119 (57.49)	88 (42.51)	0.010**	40 (19.32)	167 (80.68)	0.063**
	Female	57 (21.27)	211 (78.73)		122 (45.52)	146 (54.48)		35 (13.06)	233 (86.94)	
Child age	Median (Range)	9 (6–22)	12 (6–23)	<0.001*	11 (6–23)	11 (6–23)	0.749*	8 (6–21)	12 (6–23)	<0.001*
Maternal education level	Illiterate	31 (34.83)	58 (65.17)	0.113**	62 (69.66)	27 (30.34)	<0.001**	18 (20.22)	71 (79.78)	0.414**
	Primary level	75 (23.15)	249 (76.85)		156 (48.15)	168 (51.85)		46 (14.20)	278 (85.80)	
	Secondary school diploma	12 (20.34)	47 (79.66)		20 (33.90)	39 (66.10)		11 (18.64)	48 (81.36)	
	Higher or university education	1 (33.33)	2 (66.67)		3 (100.00)	0 (0.00)		0 (0.00)	3 (100.00)	
Maternal occupation	Unemployed	14 (26.42)	39 (73.58)	0.289§	23 (43.40)	30 (56.60)	0.294§	7 (13.21)	46 (86.79)	0.341§
	Government employee	3 (13.64)	19 (86.36)		11 (50.00)	11 (50.00)		1 (4.55)	21 (95.45)	
	Trader	11 (18.03)	50 (81.97)		26 (42.62)	35 (57.38)		8 (13.11)	53 (86.89)	
	Farmer	91 (26.84)	248 (73.16)		181 (53.39)	158 (46.61)		59 (17.40)	280 (82.60)	
Household size	≤ 6 persons	62 (23.22)	205 (76.78)	0.297*	130 (48.69)	137 (51.31)	0.312*	35 (13.11)	232 (86.89)	0.069*
	> 6 persons	57 (27.40)	151 (72.60)		111 (53.37)	97 (46.63)		40 (19.23)	168 (80.77)	
Maternal marital status	Single	4 (23.53)	13 (76.47)	0.113**	8 (47.06)	9 (52.94)	0.124**	3 (17.65)	14 (82.35)	0.881**
	Cohabiting union	51 (29.82)	120 (70.18)		90 (52.63)	81 (47.37)		30 (17.54)	141 (82.46)	
	Legally married	52 (20.47)	202 (79.53)		120 (47.24)	134 (52.76)		36 (14.17)	218 (85.83)	
	Divorced	2 (28.57)	5 (71.43)		6 (85.71)	1 (14.29)		1 (14.29)	6 (85.71)	
	Widow	10 (38.46)	16 (61.54)		17 (65.38)	9 (34.62)		5 (19.23)	21 (80.77)	

* Kruskal–Wallis test
** Pearson's chi-square test
§ Fisher's exact test

AUTHORS' CONTRIBUTIONS

DNG, **RIB**, **ETK** and **JLL** contributed to the study design, data collection, data analysis and interpretation, manuscript drafting and critical revision, as well as scientific discussions. All authors read and approved the final version of the manuscript.

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CONFLICT OF INTEREST

All authors declare that they do not have any conflicts of interest that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

The data used to support the findings of this study are available upon reasonable request from the corresponding author.

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