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Factors Associated with Undernutrition among Children 6-59 Months of Age in Central River Region, the Gambia

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Abstract **Introduction**: Malnutrition remains a significant public health issue that mostly affects women and children across the world. Childhood undernutrition has a negative and permanent effect on a child's development and has a significant impact on a person's chance of dying throughout their lifetime. The prevalence of undernutrition (stunting, wasting, and underweight) in children 6 to 59 months in The Gambia is 35%. The purpose of the study was to determine the prevalence and factors associated with undernutrition among children aged 6 to 59 months in the Central River Region (CRR). **Methodology**: Selected communities in the Kuntaur and Janjanbureh LGAs in CRR participated in a community-based cross-sectional survey. Anthropometric measurements were taken after semi-structured questionnaires that had been pre-tested were given to 409 mothers and caregivers of children between the ages of 6 and 59 months. Chi-square at P-value ≤0.05 and descriptive statistics were used to analyze the data. **Results:** In this study, the prevalence of undernutrition in CRR was determined to be 109 (26.7%), of which 29 (7.1%) had SAM and 80 (73.35%) had MAM. At the time of this investigation, only 3 (0.7%) children had bilateral pitting edema. The child's weight and height, maternal and paternal education levels, birth interval, family type, and size, as well as availability and WASH practices, were significantly linked to undernutrition among children aged 6-59 months in the CRR. Other factors included diversified complementary foods, frequency of giving complementary foods, maternal nutrition education, maternal knowledge of signs and symptoms of malnutrition, and birth interval. **Conclusions:** According to this study, MAM cases outnumbered SAM cases. Stunting , wasting, and underweight were found to be the most prevalent types of undernutrition in CRR. To prevent undernutrition in CRR, interventions like rigorous sensitizations on personal hygiene, ideal nursing techniques, and other family members' support in child care are crucial.

Keywords: *Prevalence, Undernutrition, factors associated, Children 6-59 months, The Gambia*

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1. Introduction

One of the main issues affecting public health worldwide is malnutrition, which undernutrition stands out. According to Ema et al. [1], undernutrition causes more than 41% of all cases of malnutrition in children between the ages of 6 and 24 months and also accounts for over 2.3 million fatalities per year. WHO estimated in a recent report that the total number of malnourished children in the world 178 million, out of which 20 million suffer from severe malnutrition. Undernutrition contributes to 3.5 to 5 million annual deaths in children under 5 years [2].

Despite the global efforts toward the reduction in nutritional deficit-related malnutrition, the issue is still very serious in some regions of the world. With a higher concentration in sub-Saharan Africa and the Southern part of Asia, about 159 million children 0-59 months were stunted in 2014. similarly, fifty million children were at risk of dying that same year due to wasting (deficit in weight for height [1].The burden of malnutrition is not squarely distributed around countries in the world. In sub-Saharan Africa, nearly10% of children under five years of age were wasted with more than 80% out of two million malnourished children treated. [2]

In the Gambia, the National Nutrition Policy 2010–2020 and the National Micronutrient Survey (GNMS) [3] reported that malnutrition is still a significant public health challenge that mostly affects women within the childbearing age and children under the age of five years. The burden of undernutrition globally has devastating and long-term effects on individuals, families, communities, and nations affecting development, health, social issues, and economy. Among the anthropometric measurements

used to determine undernutrition in a population of children under five are stunting (low height-for-age), wasting (low weight-for-height), and underweight (low weight-for-age) [4,5,6,7].

Undernutrition in children has negative and lasting effects on a child's development and a significant impact on a person's chance of dying throughout their lifetime. Stunting and wasting during childhood still affect communities in the poorest areas of the developing world, although progress is being made in reducing undernutrition in low and middle-income nations [8]. According to FAO, goals against hunger set by the Millennium Development Goals ended in 2015, with the goals not having been met (2015). In Sub-Saharan Africa, the slow pace of improvement in fighting hunger over the years is particularly worrisome. These countries in this region still hold the highest prevalence of undernutrition than any other region, having the number of undernourished people increased by 44 million between 1990 and 2014 [9].

According to earlier research, factors that may contribute to undernutrition, particularly in children, include family size, parental education level, and family income, as well as natural disasters like earthquakes, droughts, floods, landslides, hurricanes, cyclones, and tsunamis [5]. However, according to some studies, social injustice and poverty are the main causes of undernutrition in developing nations. Like several other countries in sub-Saharan Africa, in The Gambia, all forms of undernutrition remain a major challenge. Many children living in rural areas are poorly nourished compared to those in urban areas. Additionally, stunting and underweight are more prevalent in children living in poorer households compared to wasting [3]. Caregivers should always seek care for their sick children when health care services are available, accessible and affordable [10]

In The Gambia, undernutrition levels are not reduced as expected. The Gambia National Demographic Health Survey reports for 2013 and 2019 showed that. 25% of children under 5 years were stunted in 2013, and 18% in 2019.Also, 12% were wasted in 2013 and 5% in 2019, while 16% and 12% were underweight in 2013 and 2019, respectively. As a country, the trend showed that underweight and stunting prevalence continued to decline gradually but at a slow pace; however for wasting, its has declined drastically but its prevalence is still unacceptable. CRR “Kuntaur” registered the highest rate of wasting with25% [11]. Therefore, the main aim of this study is to assess the factors associated with undernutrition among children below five years of age in CRR.

Stunting, however, remains relatively high in rural areas such as Kuntaur 26.6%, Janjangbureh 24.3%, and Kerewan 20.8% compared to 16.6% in Banjul and 14.4% in Kanifing Municipality [12]. Stunting and wasting prevalence in The Gambia are similar to those recently found in Ghana, where 21.4% and 7.0% of children were stunted and wasted, respectively [3].

Various activities to combat undernutrition are being implemented in The Gambia. These include iron/folate supplementation, Vitamin A supplementation, promotion of the consumption of micronutrient-rich foods, deworming, promotion of the use of iodized salt, and Social and Behavioral Change Communication on optimal Infant and Young Child Feeding practices [8]

Despite these interventions, the prevention, and treatment of undernutrition is still a priority. Hence the need for strengthening existing interventions such as prevention and control of emerging under nutritional cases is a necessity. Addressing undernutrition requires enhanced knowledge on good nutrition among others and appropriate care practices for parents, caregivers, and healthcare providers, focusing on both prevention and treatment [12]. These can be facilitated if the factors associated with undernutrition are known. Therefore, the main aim of this study is to assess the factors associated with undernutrition among children below five years of age in CRR

2. Methods

2.1. Study Design

This is a community-based Cross-sectional study. The study design allows researchers to compare many different variables at the same time.

2.2. Study Area

This study was conducted among selected communities within Kuntaur and Janjanbureh LGAs of the Central River Region. Central River is the largest of the five administrative divisions of the Gambia. Its capital is Janjanbureh, on MacCarthy Island. The largest settlement is Bansang, with an estimated population of 226,018 (2013 census). CRR is a rural settlement of about 332.74 km from the capital city Banjul. According to the Ministry of Health Projections 2020, it has a total number of 37, 339 children 6-59 months of age. Kuntaur LGA is located in the northern bank of CRR with a total of 16,117 children 6-59 months of age. Janjanbureh LGA on the other hand is located at the southern bank of CRR with a population of 21,222 children 6-59 months of age.

2.3. Study Population

The study population were children aged 6-59 months living with CRR and their nutritional status were ascertained using anthropometric measures. According to World Health Organization (WHO) 2006 growth standards, moderately acute malnourished Children was identified using a Mid Upper Arm Circumference (MUAC) of ≥11.4cm to ≤12.4cm as well as the weight for height-3SD< z-score ≤ 0. 2SD. Severely Acutely Malnourished (SAM) children was determined with a z-score ≤ 3SD or bilateral pitting edema.

2.4. Inclusion Criteria

The inclusion criteria were children aged 6-59 months of age living in CRR without chronic health condition and were included base on the consent of their parents or caregivers.

2.5. Exclusion Criteria

The exclusion criteria were children with chronic diseases that were not related to nutrition including congenital heart disease, renal failure, sickle cell disease, or liver disease, etc., children who did not live in CRR and children whose mothers did not give consent.

2.6. Sample Size Determination

The sample size was calculated using single proportion formula using 35% of the national prevalence of stunting stated in Gambia Demographic and Health Survey report, 2019/20, Using the Cochran's Formula with 95% Confidence Interval and 5% margin of error, the sample size was calculated as follows:

$N = Z^2pq = 1.96^2 \times 0.35(1-0.35) = 1.96^2 \times 0.35*0.65 = 349.6 \approx 350$

$e^2 \quad 0.05^2 \quad 0.0025$

N = sample Size; Z = Z-score; p = Standard normal deviate; q =1 - P; e2 = Margin of error

$N = (350 + 35) \times 1.062 = 408.9 \approx 409$

All together a total of approximately 409 under five children were selected for this study with their mothers/caregivers taking as the interviewee. By using 10% as non-response rate with a design effect of 1.062, the final sample size was 409 under five children.

Table 2.1. Circuits in CRR

No.	Circuits Janjanbureh LGA	No. of participants	No.	Circuitsin Kuntuar LGA	No. of participants
1	Babu Jobe		1	**Wassu**	**41**
2	**Katamina**	**41**	2	Fass	
3	Bati Njole		3	**Dingerai**	**41**
4	**Sotokoi**	**41**	4	Buduck	
5	Patehsam		5	**Njau**	**41**
6	Bioram		6	Ballangharr	
7	Kerr Samba Serreh		7	Jarumeh Koto	
8	**Fulabantang**	**41**	8	Pachonki	
9	Pacharr		9	**Njangabantang**	**41**
10	Kerr Ousman Boye		10	Karamba wollof	
11	**Gallehmanda**	**41**	11	**Kayai**	**41**
12	Dobong Kunda		12	Kunting	
13	Librass				
14	**Santanto Bubu**	**40**			

The researcher used a multi-stage sampling technique to select the participants.

Stage One: Central River Region was sampled using a Purposive Sampling because it has the highest number of malnourished children 6-59 [11] and represents about 50% of the country's data.

Stage Two: CRR has two LGAs, Janjanbureh and Kuntaur in the South and North respectively. Thus, the researcher selected the two LGAs for this study. These LGAs were divided by the river Gambia and health-wise, CRR has 26 circuits with 12 in Kuntaur and 14 in Janjanbureh. A circuit is a cluster of villages of up to 20 which are manned by a Community Health Nurse.

Stage Three: Using a Cluster Sampling method, participants were divided base on circuits. In each LGA, 5 circuits were selected using a simple random sampling method. Making it a total of 10 circuits

Stage Four: In each selected circuit, Community Health Nurses (CHNs) as the Community Health and Nutrition Service providers identified 41 children 6 to 59 months within their circuit using a simple random sampling technique.

2.8. Data Collection Instruments

Questionnaire and Anthropometric measurements were used for the data collection. Trained Community Health Nurses were recruited to collect the anthropometric measurements on the study subjects as well as administer the questionnaire to the correspondent mothers/caregivers.

A semi-structured questionnaire was used to collect information from the mothers and caregivers of children through an interview method. After a detailed literature review, the questionnaire was developed, pretested and validated before use for this study.

Anthropometric measurement: instruments and equipment used include the following: MUAC tape to measure the upper arm circumference of children. Height /Length Measuring board was used to measure the standing height of children two years and older, or the recumbent length of infants less than two years of age. A weight scale was used to take the weight of the child.

2.9. Reliability and Validity of Instruments

The questionnaire was developed by the researcher through an extensive literature review on Infant and Young Child Feeding Practices procedures and guidelines and the instrument underwent scrutiny by my research supervisor. The questionnaire was developed in English and later translated into Mandinka, Wolof, and Fula during the pretesting to compare the consistency of the different languages.

To ensure reliability, the questionnaire was pretested in 10% of selected communities of CRR that have similar characteristics with the study communities. However, these communities were not part of the sampled communities. Corrections and revisions suggested during the pretest were integrated into the instruments. Further modifications were done based on observations and experiences from the respondents' reaction to the questions.

2.10. Variables

Independent: The independent variables were; household's main source of livelihood, father's educational level, mother's educational level, family size, birth interval, colostrum feeding, initiation of breastfeeding, frequency of breastfeeding (BF), pre lacteal feeding, Initiation of complementary feeding, drinking unhygienic water, diarrhea in the last two weeks, and

presence of latrine.

Dependent variables: The dependent variables were Child nutrition status defined by MAM, SAM and normal.

Potential confounders: The potential confounders in this study were: Low birth weight (LBW), Access to food aid (targeted Supplementary Feeding Programs), and the mother's nutritional status during pregnancy.

2.11. Data Management

Trained Community Health Nurses collected the data through a face-to-face interview using a pre-tested questionnaire. The filled questionnaires were checked for completeness, coded, and then entered into Epi-data version 3.1. The entered data was then exported to SPSS software (26 version) for data handling and analysis.

2.12. Data Analysis

We applied descriptive statistics (number of participants (N), percentages (%), mean and standard deviations) to describe the demographic characteristics of the study participants. Further, we executed bivariate analysis based on the nature of the predictor variables (Chi-Squared for categorical and t-test for continuous) to test whether there is a significant difference within the levels of a variable by nutritional status (Normal vs. undernourished). Where the assumption of the chi-squared test is not fulfilled ($N \geq 40$ & $T \geq 5$), we presented the results of the Yates corrections chi-squared test ($N > 40$ and $1 \leq T < 5$) or a fisher's exact test ($N < 40$ or $T < 1$). Only the *P*-values of these results were presented. In addition, logistic regression models were used to assess the risk (odds ratio) of having normal nutrition (vs. undernourished) for all the variables that were significant in the bivariate analysis. The crude model was unadjusted, while the adjusted model was adjusted for the child's age, the mother's education level, and the father's occupation. For the logistic regression models of the demographic variables, the variables adjusted for one another. Statistical significance was taken at P-value ≤ 0.05, and all analyses were performed in R.

2.13. Ethical Procedures

Approval was first sought from the thesis committee of the Department of Public and Environmental Health, then from the Medicine and Allied Health Research and Publication Committee (RePubliC) of the University of The Gambia. And lastly The Gambia Government/ MRC Joint Ethics committee. Informed written consent were obtained from the Regional Health Directorate of CRR and the participants. The UTG republican consent form were administered to seek the consent of the respondents, who were assured of their confidentiality in this study and informed that they have all rights to withdraw at any stage of the study. The privacy and confidentiality of the respondents were maintained and kept anonymous. The respondents were assigned codes to eliminate personal identification. The data was used not for any other purpose aside from academics and will never be shared with a third party for any other purpose.

3. Results

3.1. Sociodemographic Characteristics of Participant

The results presented in Table 1 show participants' sociodemographic characteristics based on their children's nutrition status, 6-59months. All the respondents for this interview were mothers and housewives. Most of them were between the ages of 21- 30, N=247 (59.2%). Most of the women were the biological mothers of the children observed, N=400 (97.8%). Most mothers have not attained tertiary education and the majority of them (155(37.9%)) attained only primary level education, followed by 142(34.7%) that were never attended school. Paternal education was observed to be very low as 137 (33.5%) of the fathers have never been to school. Farming was the predominant occupation of the household heads (fathers), denoting 369(90.2%). The monthly earnings of the households interviewed is less than 5000 GMD, representing 402 (98.3%) of the respondents. Most of the participants 233 (57%) were from monogamous, and extended families of more than 6 inhabitants representing 212 (51.8%). The major ethnicities were Wollof and Mandinka. And, most of the mothers mentioned that their husbands were the breadwinners of their families, N=375 (91.7%).

The results presented in Table 2 shows the prevalence of undernutrition among children 6-59months in CRR. From the survey, that 73.3% (N=300) of the children had normal nutritional status, while 26.7% (N=109) were undernourished, and 19.6% and 7.1% of them had Moderate Acute Malnutrition (MAM) and Severe Acute Malnutrition (SAM), respectively. Edema symptoms were not present in 406 (99.3%) participants**.** The majority of the children were between the ages of 13- 24 months (N=197), of which 74.1% had normal nutritional status, while 25.9% were undernourished**.**

Table 3 shows the associations between socio-demographic characteristics and the risk of normal nutrition status among children 6 to 59 months of age in CRR. It showed that a 1 kg increase in the current weight of a child was associated with an increased likelihood of having a normal nutritional status (OR=6.8; 95%CI: 4.6-22.3; $P<0.01$). Similar to the Child's height in cm (OR=1.9; 95%CI: 1.3- 1.5; $P<0.01$). In addition, those children whose caregivers were not their biological parents were less likely to have a normal nutrition status (OR=0.1; 95%CI: 0.002- 0.6; $P=0.02$). Attainment of primary education by the mother (OR=10.4; 95%CI: 5.7-20.0; $P<0.01$) and father (OR=12.1; 95%CI: 5.0-34.5; $P<0.01$) was associated with increased risk of having a normal nutritional status. Those children who had a birth interval of ≥24 months with their immediate siblings were 28 times more likely to have a normal nutritional status (OR=27.6; 95%CI: 12.2- 68.1; $P<0.01$). Participants whose husbands were the breadwinners had greater odds of reporting a normal nutritional status for their children than those who mentioned 'uncle' (OR=42.9; 95%CI: 6.7-850.5; $P<0.01$). Also, having a family size of more than ten (10) members (OR=0.1; 95%CI: 0.04-0.2; $P<0.01$) and

polygamous family type (OR=0.1; 95%CI: 0.03-0.2; *P*<0.01) were associated with a reduced likelihood of having a normal nutritional status.

Table 4 below shows the statistically significant differences between nutritional status and all the [8] Infant Young Child Feeding (IYCF) Knowledge & Practice variables, such as 'How long did child breastfeed,' 'How long after birth should a baby breastfeed,' 'Child was feed with colostrum,' 'Child feed ≥8times per day,' 'Is exclusive breastfeeding possible,' 'For how long was child exclusively breastfeed,' 'Age when complementary feeding (CF) should be introduced,' 'When was child introduced to CF,' 'What classes of complementary foods are given (1- 4 classes),' 'Important to eat a diverse diet,' and 'Know about the nutrition of optimal pregnant women,' etc. (Table 4). However, logistic regression results for these eleven [4] variables listed above were inflated due to missing/zero columns in the two-by-two table, hence we didn't present these results in table 4.

In Table 5, shows the Association of mothers' IYCF Knowledge & Practice with the risk of nutrition status of children 6 to 59 months of age in CRR. According to the survey result, those who mentioned that child should feed on breast milk (OR=15.5; 95%CI: 5.7- 47.9; *P*<0.01) and those that reported that the child received breast milk only within the first 1hour after birth (OR=14.5; 95%CI: 2.6- 275.8; *P*=0.01) had a higher odds of having a child with normal nutritional status, compared to those who didn't know 'what should Child feed on immediately after birth' and gave child water and other fluids, respectively. Those who breastfeed ≥18 months, compared to those currently breastfeeding, had a reduced risk of having a child with normal nutritional status (OR=0.2; 95%CI: 0.1- 0.6; *P*=0.01). Mothers who were counseled about how to feed a baby had increased odds of reporting a normal nutritional status for their child than those who were not (OR=5.8; 95%CI: 2.2- 16.9; *P*=0.01). The risk of reporting a normal nutritional status for the child was higher for mothers who gave 2 classes of complementary feeds (OR=4.8; 95%CI: 2.6- 9.2; *P*=0.01) and 3 classes of complementary feeds (OR=4.8; 95%CI: 4.7- 62.9; *P*=0.01), compared to those who gave only one. Mothers who feed their children with complementary feeds thrice and more were 12 times more likely to report a child with normal nutritional status (OR=12.26; 95%CI: 5.2-31.5; *P*=0.01) than those who feed the child with complementary food ≤2 times. Similarly, for those who give snacks to their children between main meals (OR=2.4; 95%CI: 1.3- 4.3; *P*=0.01); taught nutrition during lactation (OR=41.1; 95%CI: 10.2- 285.3; *P*=0.01), and know the signs of malnutrition (OR=10.2; 95%CI: 4.0- 29.01; *P*=0.01), compared to those did not know or do the aforementioned (Table 4**)**.

Table 6 below shows the significant associations between all eight [13] variables describing mothers' hygiene practices and nutritional status. However, the logistic regression results for 3 of these variables ('types of toilet facilities (*P*=0.004),' 'wash hands after visiting the toilet (*P*=0.01),' 'wash hands with water and soap (*P*<0.01),') were inflated due to missing/zero columns in the two-by-two table, hence we didn't present these results. In addition, in both the crude and adjusted models, those who 'use pit latrine (OR=11.0; 95%CI: 2.9- 48.6; *P*<0.01),' 'usually wash their hands before handing child's food (OR: 23.4; 95%CI: 6.9- 111.5; *P*<0.01),' 'usually wash hands before feeding their child (OR=7.6; 95%CI: 3.8- 15.7; *P*<0.01)' and 'wash hands after cleaning the child who passed stool (OR=9.9; 95%CI: 5.0- 20.5; *P*<0.01)' had increased risk of having a child with a normal nutritional status (Table 7).

Table 1. Sociodemographic characteristics of participants base on the nutrition status of their children 6-59months

Socio-Demographic Characteristics	N (%)	Nutritional status		*P*
		Normal N=300 (73.3%)	Undernourished N=109(26.7%)	
Mothers age				
<=20	61 (14.9)	49 (80.3)	12 (19.7)	
21-30	242 (59.2)	169 (69.8)	73 (30.2)	0.14
>=31	106 (25.9)	82 (77.4)	24 (22.6)	
The biological mother of the child				
Yes	400 (97.8)	298 (74.5)	102 (25.5)	<0.05
No	9 (2.2)	2 (22.2)	7 (77.8)	
Maternal education status				
Primary	155 (37.9)	139 (89.7)	16 (10.3)	
Secondary	100 (24.4)	89 (89.0)	11 (11.0)	<0.05
Never been to school	142 (34.7)	65 (45.8)	77 (54.2)	
Paternal education status				
Primary	96 (23.5)	90 (93.8)	6 (6.3)	
Secondary	98 (24.0)	85 (86.7)	13 (13.3)	<0.05
Madrassa	47 (11.5)	41 (87.2)	6 (12.8)	
Never been to school	137 (33.5)	64 (46.7)	73 (53.3)	
Father's Occupation: Farming	369 (90.2)	271 (73.4)	98 (26.6)	0.01
Monthly earnings (in Dalasi)				
<=5000 GMD	402 (98.3)	294 (73.1)	108 (26.9)	0.71
6000- 10,000 GMD	6 (1.5)	5 (83.3)	1 (16.7)	
Households own land occupying				
Yes	394 (96.3)	297 (75.4)	97 (24.6)	<0.05
No	15 (3.7)	3 (20)	12 (80)	
Birth interval (months) of the child with the younger sibling				

Socio-Demographic Characteristics	N (%)	Nutritional status		*P*
		Normal N=300 (73.3%)	Undernourished N=109(26.7%)	
First Child	53 (12.9)	15 (28.3)	38 (71.7)	
<24 months	28 (6.8)	2 (7.1)	26 (92.9)	<0.01
≥24 months	321 (78.5)	283 (88.2)	38 (11.4)	
Last born	7 (1.7)	0 (0.0)	7 (100)	
Household head/breadwinner				
Uncle	12 (2.9)	1 (8.3)	11 (91.7)	
Husband	375 (91.7)	293 (78.1)	82 (21.9)	<0.05
Grandfather	13 (3.8)	3 (100)	0 (0.0)	
Ethnic group				
Wollof	142 (34.7)	102 (71.8)	40 (28.2)	
Serahuleh	33 (8.1)	22 (66.7)	11 (33.3)	0.66
Mandinka	130 (31.8)	100 (76.9)	30 (23 .1)	
Fula	97 (23.7)	70 (72.1)	27 (27.8)	
Family type				
Monogamous	233 (57.0)	218 (93.6)	15 (6.4)	<0.05
Polygamous	167 (40.8)	78 (46.7)	89 (53.3)	
Family size				
<=5	97 (23.7)	82 (84.5)	15 (15.5)	
6-10	212 (51.8)	187 (88.2)	25 (11.8)	<0.05
>10	100 (24.4)	31 (31.0)	69 (69.0)	

N= number of participants; %= Percentage; For continuous variables, *P* was calculated by t-test, while chi-square was applied for categorical variables.

Table 2. Prevalence of under nutrition among children 6 to 59 months of age in CRR

Prevalence of undernutrition	N (%)	Nutritional status		*P*
		Normal N=300 (73.3%)	Undernourished N=109 (26.7%)	
CRR North	204 (49.9)	150 (73.5)	54 (26.5)	0.93
CRR South	205 (50.1)	150 (73.2)	55 (26.8)	
Child's Sex				
Male	234 (57.5)	175 (74.5)	60 (25.5)	0.50
Female	174 (42.5)	125 (71.8)	49 (28.2)	
Child's weight at birth in kg: Mean (SD)		3.0 (0.7)		<0.05
Child's current weight in kg: Mean (SD)		9.9 (2.4)		<0.05
Child's height in cm: Mean (SD)		76.5 (9.1)		<0.05
Child's age (months)				
<=12	140 (34.2)	109 (77.9)	31 (22.1)	
13-24	197 (48.2)	146 (74.1)	51 (25.9)	0.05
>24	72 (17.6)	45 (62.5)	27 (37.5)	

N= number of participants; %= Percentage; For continuous variables, *P* was calculated by t-test, while chi-square was applied for categorical variables.

Table 3. Associations between socio-demographic characteristics and the risk of normal nutrition status among children 6 to 59 months of age in CRR

Socio-demographic Characteristics	**OR (95%CI)[a]**	***P***
Child's weight at birth in kg	0.9 (0.6- 1.2)	0.41
Child's current weight in kg	6.8 (4.6- 22.3)	**<0.01**
Child's height in cm	1.9 (1.3- 1.5)	**<0.01**
Child's age (months)		
<=12	Ref.	Ref.
13-24	0.8 (0.4- 1.4)	0.4
>24	0.5 (0.3- 1.4)	0.1
The biological mother of the child		
Yes	Ref.	**0.02**
No	0.1 (0.02- 0.6)	
Maternal education status		
Primary	10.4 (5.7- 20.0)	**<0.01**
Secondary	9.5 (4.8- 20.3)	**<0.01**
Never been to school	Ref.	Ref.
Paternal education status		
Primary	12.1 (5.0- 34.5)	**<0.01**

Socio-demographic Characteristics		OR (95%CI)[a]	*P*
	Secondary	5.1 (2.5-11.0)	**<0.01**
	Madrassa	7.5 (2.8-24.3)	**<0.01**
	Never been to school	Ref.	Ref.
Father's Occupation			
	Farming	1.4 (0.6- 3.2)	0.4
	Others	Ref.	Ref.
Households own land occupying			
	Yes	Ref.	Ref.
	No	**0.06 (0.01- 0.2)**	**<0.01**
Birth interval (months) of the child with the younger sibling			
	First Child	Ref.	Ref.
	<24 months	0.3 (0.04- 1.5)	0.2
	≥24 months	27.6 (12.2- 68.1)	**<0.01**
Household head/breadwinner			
	Uncle	Ref.	Ref.
	Husband	42.9 (6.7- 850.5)	**<0.01**
	Grandfather	2.4 (0.2- 58.2)	0.5
Family type			
	Monogamous	**Ref.**	**<0.01**
	Polygamous	0.1 (0.03-0.2)	
Family size			
	<=5	Ref.	Ref.
	6-10	1.4 (0.6- 3.0)	0.38
	>10	0.1 (0.04-0.2)	**<0.01**

[a]= variables adjusted for one another in this model; Ref.= reference group; OR= odds ration; 95%CI: 95% confidence interval; *P= P-value*

Table 4. Bivariate analysis of Mothers' IYCF Knowledge & Practice by nutritional status

IYCF Knowledge & Practice		Normal N (%)	Undernourished, N (%)	*P*
What should a Child feed on immediately after birth	breast milk	294 (77.2)	87 (22.8)	<0.01
	Don't know	6 (21.4)	22 (78.6)	
The feed child received within the first 1hr. after birth	Breast milk only	299 (75.3)	98 (24.7)	<0.01
	Water & others	1 (8.3)	11 (91.7)1	
Counselled about how to feed a baby	Yes	293 (76.5)	90 (23.5)	<0.01
	No	7 (26.92)	19 (73.1)	
How often do u give CF	Twice	9 (23.10	30 (76.9)	<0.01
	Thrice and more	291 (81.1)	68 (18.9)	
Do you give any snacks to your children between main meals	Yes	248 (77.3)	73 (22.7)	0.01
	No	52 (59.1)	36 (40.9)	
Taught about optimal maternal nutrition	Yes	298 (77.2)	88 (22.8)	<0.01
	N o	2 (8.7)	21 (91.3)	
Know the signs of malnutrition	Yes	293 (77.5)	85 (22.5)	<0.01
	No	7 (22.6)	24 (77.4)	
How long did the child breastfeed	Currently breastfeeding	263 (79.2)	69 (20.8)	<0.01
	<18 months	37 (52.1)	34 (47.9)	
	≥18 months	0 (0.0)	6 (100)	
How long after birth should a baby breastfeed	Within 1hr	300 (76.1)	94 (23.9)	<0.01[c]
	Within 2hr	0 (0.0)	12 (100)	
	Within 1st day	0 (0.0)	3 (100)	
The child was fed with colostrum	Yes	300 (75.4)	98 (24.6)	<0.01[b]
	No	0 (0.0)	11 (100)	
Child feed ≥8times per day	Yes	300 (87.5)	43 (12.5)	<0.01
	No	0 (0.0	53 (100)	
Is exclusive breastfeeding possible	Yes	300 (76.1)	94 (23.9)	<0.01[b]
	No	0 (0.0)	15 (100)	
For how long was the child exclusively breastfed	2- 3 months	0 (0.0)	40 (100)	<0.01
	4-6 months	0 (0.0)	29 (100)	
	>6 months	300 (89.8)	34 (10.2)	
Age when complementary feeding (CF) should be introduced	Within the 1st 3 months	0 (0.0)	5 (100)	<0.01[c]
	Between 4-6 months	0 (0.0)	11 (100)	
	At 6 months	300 (76.5)	92 (23.5)	
When was the child introduced to CF	Within the 1st three months	0 (0.0)	29 (100)	<0.01
	Between 4-6 months	0 (0.0)	18 (100)	

IYCF Knowledge & Practice		Normal N (%)	Undernourished, N (%)	*P*
What classes of complementary foods are given (1- 4)	Immediately after 6 months	300 (89.8)	34 (10.2)	<0.01
	After 7 months	0 (0.0)	28 (100)	
	One class	70 (47.3)	88 (52.7)	
	2 classes	97 (84.4)	18 (15.65)	
	3 classes	44 (93.6)	3 (6.4)	
	4 classes	80 (100)	0 (0.0)	
Important to eat a diverse diet	Yes	300 (79.2)	79 (20.8)	<0.01
	No	0 (0.0)	30 (100)	
Know about the nutrition of optimal pregnant women	Yes	300 (75.6)	97 (24.4)	<0.01
	No	0 (0.0)	12 (100)	

[b]= P-value calculated by chi-squared with Yates continuity correction; [c]=P-value calculated by fishers' exact test; IYCF= Young Infant and Child Feeding; *P*=*P*-value.

Table 5. Association of mothers' IYCF Knowledge & Practice with the risk of nutrition status of children 6 to 59 months of age in CRR

IYCF Knowledge & Practice		N (%)	Crude model		Adjusted model	
			OR (95%CI)	*P*	OR (95%CI)	*P*
What should a Child feed on immediately after birth	breast milk	381 (93.2)	12.4 (5.2- 34.5)	<0.01	15.5 (5.7- 47.9)	<0.01
	Don't know	28 (6.8)	Ref.		Ref.	
The feed child received within the first 1hr. after birth	Breast milk only	397 (97.1)	33.6 (6.4- 617.4)	<0.01	14.5 (2.6- 275.8)	0.01
	Water & others	12 (2.9)	Ref.		Ref.	
ow long did the child breastfeed	Currently breastfeeding	332 (81.2)	Ref.	Ref.	Ref.	Ref.
	<18 months	71 (17.4)	0.3 (0.2- 0.5)	<0.01	0.2 (0.1- 0.6)	<0.01
Counselled about how to feed a baby	Yes	383 (93.6)	8.8 (3.7- 23.2)	<0.01	5.8 (2.2- 16.9)	<0.01
	No	26 (6.4)	Ref.		Ref.	
What classes of complementary foods are given (1- 4)	One class	115 (28.1)	Ref.	Ref.	Ref.	Ref.
	2 classes	167 (40.8)	6.0 (3.4-11.1)	<0.01	4.8 (2.6- 9.2)	<0.01
	3 classes	47 (11.5)	16.3 (5.7- 69)	<0.01	4.8 (4.7- 62.9)	<0.01
How often do u give CF	Twice	39 (9.5)	Ref.	<0.01	Ref.	<0.01
	Thrice and more	59 (87.8)	14.3 (6.7-33.2)		12.3 (5.2-31.5)	
Do you give any snacks to your children between main meals	Yes	321 (78.5)	2.4 (1.4-3.9)	<0.01	2.4 (1.3- 4.3)	<0.01
	No	88 (21.5)	Ref.		Ref.	
Taught nutrition during lactation	Yes	386 (94.4)	35.5 (10.2- 225.1)	<0.01	41.1 (10.2- 285.3)	<0.01
	N o	23 (5.6)	Ref.		Ref.	
Know the signs of malnutrition	Yes	378 (92.4)	11.8 (5.2- 30.6)	<0.01	10.2 (4.0- 29.01)	<0.01
	No	31 (7.6)	Ref.		Ref.	

N=number of participants; %=percentages; OR=odds ratio; 95%CI= 95% Confidence interval; *P*=*P*-value.crude model, unadjusted; adjusted model, adjusted for age, ethnicity, mothers' education level, and father's occupation; IYCF= Young Infant and Child Feeding

Table 6. Bivariate analysis of Mothers' hygiene practices by nutritional status

Mothers' hygiene practices		Normal N (%)	Undernourished N (%)	*P*
Types of toilet facilities	Pit latrine	296 (76.1)	93 (23.9)	0.004[c]
	VIP	4 (28.6)	10 (71.4)	
	Flush	0 (0.0)	5 (100)	
Wash hands after visiting the toilet	Yes	300 (74.1)	105 (25.9)	0.01
	No	0 (0.0)	4 (100)	
Wash hands with water and soap	Yes	300 (76.0)	95 (24.0)	<0.01
	No	0 (0.0)	14 (100)	
Source of drinking water	Borehole	89 (77.4)	26 (22.6)	<0.01
	Public taps	210 (73.4)	76 (26.6)	
Usually wash with soap and water hands before handing child's food	Yes	297 (77.1)	88 (22.9)	<0.01
	No	3 (12.5)	21 (87.5)	
Usually wash hands with soap and water before feeding child	Yes	282 (80.3)	69 (19.7)	<0.01
	No	18 (31.0)	40 (69.0)	
Wash hands with soap and water after cleaning the child who passed stool	Yes	282 (81.5)	64 (18.5)	<0.01
	No	18 (28.6)	45 (71.4)	

[C]=means *P-value calculated* with fishers' correction, when the condition of Chi-squared test and Yates continuity correction are not fulfilled; *P*=*P*-value; VIP=Ventilated Improved Pit Latrine

Table 7. Association of mothers' hygiene practices with the risk of normal nutritional status of children 6 to 59 months of age in CRR

Mothers' hygiene practices	N (%)	Event, N (%)	Crude Model		Adjusted model	
			OR (95%CI)	*P*	OR (95%CI)	*P*
Borehole source of drinking water *[ref. Public taps]*	115 (28.1)	26 (22.6)	1.2 (0.75- 2.90)	0.41	1.2 (0.7- 2.1)	0.63
Use pit latrine *[ref. VIP]*	389 (95.1)	93 (23.9)	8.0 (2.6- 29.6)	<0.01	11.0 (2.9- 48.6)	<0.01
Usually wash hands with soap and water before handing child's food [*ref. No]*	385 (94.1)	88 (22.9)	23.6 (7.9- 101.7)	<0.01	23.4 (6.9- 111.5)	<0.01
Usually wash hands with soap and water before feeding child [*ref. No]*	351 (85.8)	69 (19.7)	9.1 (5.0- 17.2)	<0.01	7.6 (3.8- 15.7)	<0.01
Wash hands with soap and water after cleaning the child who passed stool [*ref. No]*	346 (84.6)	64 (18.5)	11.0 (6.1- 20.7)	<0.01	9.9 (5.0- 20.5)	<0.01

N=number of participants; %=percentages; Event N (%) = number of participants undernourished; OR=odds ratio; 95%CI= 95% Confidence interval; *P=P*-value; *Ref= means reference group*.crude model, unadjusted; adjusted model, adjusted for age, ethnicity, mothers' education level, and father's occupation.

4. Discussion

Prevalence of undernutrition

From this study, the prevalence of undernutrition in CRR was found to be 109 (26.7%), of which 29(7.1%) had SAM and 80(73.35) had MAM, only 3 (0.7%) children had bilateral pitting oedema at the time of this study. The findings are in line with a recent estimate based on the 2019 mini–Ethiopian Demographic Health Survey (EDHs) [14] which indicated their national prevalence of stunting to be at 37%, wasting at 7%, and underweight at 21%. The trends of malnutrition among children in Ethiopia are also decreasing at a lower rate. Considering stunting, it was at 52% in 2000 compared to 37% in 2019; and wasting was at 11% compared to 7% in 2019. However, undernutrition remains a public health concern as reported by the WHO [13]. The findings are also in line with the Gambia National Demographic Health Survey 2019/2020 and the Gambia National Micronutrient Survey 2018, where MAM cases were always more than SAM cases. This could be because several interventions like the distribution of rations and cooking demonstrations are ongoing in this part of the country, targeting both SAM and MAM children 6-59 months. Thus, the majority of the SAM cases have improved to MAM or normal. This finding of more MAM cases than SAM in our study is in line with a study conducted in rural communities (Jharkhand and Odisha) of eastern India, where moderate and severe acute malnutrition in children aged 6–18 months showed more MAM cases than SAM [9].

5.1.2. Factors associated to undernutrition among children 6-59 months in Central River Region

In this study bivariate analysis was conducted for all the variables after which further test was conducted on the significant variables to determine their association with undernutrition. Under the sociodemographic characteristics, we found that child's current weight and height, biological mother of the child been the respondent for this interview, maternal and paternal education levels, Household ownership, birth interval, Husband as the bread winner of the household, Family type and Family size of >10 people were all found to be statistically significant.

Accordingly, a child's current weight and height are variables that determine the child's nutritional status as such if a child is undernourished, he/she will weigh and/or measure less. This could be because CRR has 44% of all stunted children in The Gambia, ,according [11] report, which represents the highest in the country compared to other regions, and this is consistent with my study

The findings on the child's paternal and maternal educational levels in this study were statistically significant. Education is key in determining a lot of factors, including nutrition. About 53.3% of respondents who have never been to school have their children undernourished. This is worsened by the fact that about 54.2% of the nourished children's fathers also had never been to school, which shows that caregivers' education is a great contributor to undernutrition in children 6-59 months. This study is consistent with similar studies conducted in Ethiopia, where the findings showed that mothers' education, sex of child, prelacteal feeding, and child immunization status were significantly associated with underweight in the study community [4].

Mother's birth interval with a p-value of 0.01in a regression analysis was also found to be significant statistically. This is because in this part of the country family planning is minimally practice as it is regarded as not tolerated in Islam. The findings are in line with a study conducted in Angola, Malawi and Senegal where analysis confirmed the type of residence, sex of the child, age of the child, mother's level of education, birth interval, wealth index and birth order as statistically significant risk factors of malnutrition in these countries [5].

Husband as the bread winner of the household was also found to be associated with undernutrition in our study. This is due to the fact the majority 90.2% of the husbands/child fathers are farmers. In this part of the country farming is not a lucrative occupation and most a time farmers harvest are not adequate to feed their families all year round, thus the children in those households might be subjected to undernutrition due to food insecurity. Family type and Family size of >10 were variables found to be statistically significant. In a bivariant

analysis, it was realized that most of the families of the undernourished children were from polygamous family and a family size of more than 10 people. In either situation, the nutrition/Food intake and accessibility to healthcare reduces with higher family size especially in low-income families. Additionally, in a lager family settings limited care is given to children as the mother has so many kids to look after with other household chores. Our findings are consistence with a study conducted in a cross-sectional survey in Fars province, Iran [6].

A bivariate analysis for all the variations on knowledge and practices of mothers on IYCF taking into considerations undernourished and normal children showed a statistically significant for all, however in further analysis with OR (95% CI) only nine variables were found to be statistically significant for undernutrition. Our findings have showed that; most of the children (381) were fed on breastmilk immediately after birth, and 397 were given breastmilk within the first 1hr. after birth, this shows that early initiation of breastfeeding is not much of an issue in CRR. This result is substantiated by a similar study in Nepal [12] where early initiation of breastfeeding was also found to be statistically significant. However early initiation of breastfeeding with colostrum is supported with the continuation of appropriate Exclusive Breast-Feeding practices (EBF) for up to 6 months and continuous breastfeeding with complementary feeding up to 2 years. If complementary feedings practices are not done adequately, the benefits of early breastfeeding will not be felt as a result the child will be undernourished. How long the child breastfeed was showed to be statistically significant with 71 children been breastfed less than 18months. 93.6% of mothers said they were counseled of which 23.5% were found to be undernourished during this study. In CRR of the Gambia, like in any other African countries, mothers' knowledge on exclusive breastfeeding does not necessarily mean they practice it. In the rural communities of the Gambia, EBF and appropriate child feeding practices can only be effectively done if the grandmothers and fathers are well aware and ready to support their daughters-in-law and wives respectively to practice EBF. Otherwise, if mothers leave behind their babies, grandmothers and other family members can give other feeds to the child. This variable was also found statistically significant and we maintain that it is a significant public health subject that still needs to be stimulated and further explored in large-scale association studies.

The study showed that complementary food groups are given children 6 to 59 months, how often do mothers give CF to children 6-59moths and children given snacks between main meals were all found to be statistically significant. Our finding is consistent with results from studies conducted in Vietnam [15] but differ from those from Ethiopia [16,17]. The reason for these findings could be that community-based interventions for newborn care and support to mothers has been implemented in the study area by WFP and UNICEF. Also, other government agencies are conducting series of cooking demonstrations with mothers and caregivers in this part of the country.

Additionally, our study showed that mothers taught on nutrition during lactation and mother's Knowledge on signs and symptoms of malnutrition were variables found to be statistically significant in a logistic regression analysis. nutrition during lactation with timely and appropriate treatment-seeking for malnutrition for children are important factors in determining the nutritional status of the child. The Mother MUAC concept has been implemented in this part of the country by the Ministry of Health (MoH), hence this might be the reason why mothers have adequate knowledge on malnutrition signs and causes. Despite that, the rate of undernutrition in this region is unacceptably high, which can be attributable to the attitudes and practices of the caregivers or parents.

The findings of our study also revealed that the use of pit latrine is common in CRR north and associated with Undernutrition in a multivariant analysis. This could be due to fact that UNICEF in collaboration with Ministry of Health has conducted Community-Led Total Sanitation programs in this part of the country. Our finding is consistence with a study conducted in pastoral community in Northeast Ethiopia that shows in the bivariate logistic regression model that sex and age of child, prelacteal feeding, child immunization status, timely complementary feeding, diarrhoea in the last two weeks, and presence of latrine were associated with stunting [4].

Our findings also revealed that handwashing with soap and water at these critical times; before handing child's food, before feeding child and after cleaning the child who passed stool were found to be the most common practices among mothers which are in contrast with the studies conducted in Bangladesh which detected that handwashing with water only is the most common practice, and the prevalence of handwashing with soap around food-related events is considerably lower than for post-feces contact, this was similar with our finding [18]. Our finding on the hygienic practice of mothers shows that greater numbers 78.26% of the mothers practice good hygiene which was not in line with the finding of [18] which revealed that among the malnourished children, 67% of mothers had inadequate hygienic practice and 33% mothers practiced good hygiene.

5.4. Conclusion

The study revealed that the prevalence of undernutrition in CRR was found to be 109 (26.7%) of which 29(7.1%) had SAM and 80(73.35) had MAM, only 3 (0.7%) children had bilateral pitting oedema at the time of this study. Undernutrition results to stunting, underweight and wasting, which can affect the child's growths, cognitive development, physical functions, general wellbeing, and eventually leading to morbidity and mortality. The study also reveal that SAM is more identified by MUAC than Odema. This shows than undernutrition in terms of wasting and underweight are the commonest type in CRR. It also shows that SAM is more prevalent in CRR North than the south which was an expected outcome of this study.

Recommendations

The findings from this survey imply that a multi-sectorial and multi-dimensional approaches are important to address malnutrition in CRR of The Gambia. Also Fathers, grandmothers and other family members who

take care of babies in the absences of their mothers should be provided with health education to encourage positive behaviors towards childcare and infant feeding practices. Similarly, households practicing open defecation should change their behaviors by using a proper latrine to defecate. This will contribute in preventing or reducing diarrhea and other waterborne diseases.

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Disclosure of Conflict of Interest

The authors have no competing interests

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