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Original Article

Prevalence and Factors Associated with Minimum Dietary Diversity Among Children Aged 6-23 Months in Ngoma District, Rwanda

Authors: Médiatrice Murebwayire *[1], Amos Habimana [1]

Affiliation:

[1*1] Department of Public Health, Mount Kenya University, Rwanda

Correspondence Author: murebwayiremediatrice@gmail.com

Abstract

Minimum Dietary Diversity (MDD) is crucial in preventing malnutrition. However, only 28.3% of children in the age group of 6-23 months globally meet the recommended diversity in diet requirements, highlighting the scale of the problem. In Rwanda, despite improvements in child health outcomes, malnutrition and inadequate dietary diversity remain significant concerns. According to the Rwandan DHS 2019-2020, 33% of children aged 6-59 months are stunted, with the rate rising to 39% among children of the age group of 18-23 months. At the district level, in Ngoma, a rural district in the Eastern Province of the country, the nutritional challenges are particularly severe. According to the RDHS 2019/2020, 37.3% of children in Ngoma are stunted, reflecting an elevated rate of malnutrition in comparison with the average countrywide. Despite the presence of health interventions and nutrition programs, the dietary diversity in Ngoma remains low, particularly due to factors like poverty, insufficient access to a variety of foods, and inadequate nutrition education. Therefore, this study aims to determine the prevalence and factors linked to MDD among children between the ages of 6 and 23 months in Ngoma District. This study is significant as it evaluates child nutrition, informs targeted interventions to combat undernutrition, and contributes valuable insights to public health and nutrition research in low-resource settings. Methodologically this study utilized a cross-sectional quantitative research design where data collection used a questionnaire. The target population for this research study consisted of 15,679children aged 6–23 months residing in Ngoma District, Rwanda. The size of the sample for this research was 390 respondents obtained using the Slovin's formula. The data collected was analyzed using descriptive statistics to summarize the demographic characteristics and dietary diversity of the children participating to the study. Univariate, bivariate and multivariate analyses were used to measure the variables and their relationship, with p=0.05 and 95%CI. The findings showed that 40% of participants met the minimum dietary diversity, while 60% did not. The multivariate revealed that children whose households had access to radio, television, or a mobile phone were three times more likely to meet MDD compared to those without such access (AoR = 3.037; 95% CI: 1.411–6.537; p = 0.004). Regarding maternal education, children of mothers with secondary education were nearly seven times more likely to meet MDD (AoR = 6.838; 95% CI: 3.261–14.338; p < 0.001), while those whose mothers had university-level education had similarly increased odds (AoR = 6.74; 95% CI: 1.396–29.602; p = 0.01). Mothers who knew the importance of including grains in the child's diet were over twice as likely to ensure MDD (AoR = 2.536; 95% CI: 1.396–4.605; p = 0.002). Access to healthcare services strongly influenced MDD. Households located less than 1 kilometer from a health facility were nearly ten times more likely to meet MDD (AoR = 9.746; 95% CI: 4.422–21.477; p < 0.001), and those within 1–5 kilometers also had significantly higher odds (AoR = 3.506; 95% CI: 1.696–7.248; p = 0.01) compared to those living more than 5 kilometers away. Sufficient intake of tubers and roots was positively associated with dietary diversity (AoR = 2.239; 95% CI: 1.177–4.260; p = 0.01). In conclusion, the study revealed that less than half of children aged 6–23 months in Ngoma District met the minimum dietary diversity (MDD), with key determinants including access to media, maternal knowledge on

grains and fruits, proximity to healthcare services, and sufficient intake of legumes, nuts, seeds and tubers, access to radio, television, or phone, and maternal knowledge. These findings underscore the multifaceted nature of dietary diversity and highlight actionable areas for improving child nutrition in similar rural contexts.

Key words: Prevalence, Factors, Minimum Dietary Diversity, Children Aged 6-23 Months, Rwanda

Introduction

Globally, malnutrition among children continues to be among the most urgent public health challenges (Nature, 2024). According to the World Health Organization (WHO), an estimated 144 million children aged less than 5 experience stunting worldwide, a condition largely driven by poor nutrition (WHO, 2019). Minimum Dietary Diversity (MDD), defined as the consumption of foods from at least 5 out of 8 food groups, is crucial in preventing malnutrition. These 8 food groups include: (1) breast milk; (2) grains, roots and tubers; (3) legumes and nuts; (4) dairy products (milk, yogurt, cheese); (5) flesh foods (meat, fish, poultry, and liver/organ meats); (6) eggs; (7) vitamin A-rich fruits and vegetables; and (8) other fruits and vegetables. However, only 28.3% of children between the ages of 6 and 23 months globally meet the recommended dietary diversity requirements (White, 2017), highlighting the scale of the problem.

In developed countries, like the United States, the prevalence of childhood malnutrition is significantly lower in comparison with other regions, with stunting rates as low as 2.5% (World Bank, 2021). Dietary diversity is generally higher due to better access to a variety of food groups, improved healthcare systems, and widespread nutrition education. For example, countries like Japan have implemented national policies promoting healthy diets, resulting in very low stunting rates of 3.1% (Ministry of Health, Japan, 2020). However, pockets of undernutrition still exist, particularly in low-income communities, where malnutrition rates can be significantly higher than the national average, often ranging between 5-10% in these vulnerable populations (UNICEF, 2020).

In middle and low-income countries, the challenges of achieving adequate dietary diversity are more pronounced due to limited access to diverse foods, poverty, and food insecurity. In India, for instance, despite government initiatives like the National Nutrition Mission, stunting remains a significant issue, with 35.5% of children under five affected (Ministry of Child Development and Women, India, 2021). Similarly, in China, despite rapid economic growth, rural areas have struggled with malnutrition, even though the rates of stunting have decreased from 32.4% in 2000 to 8.1% in 2020 due to improved policies and nutrition interventions (Commission of Health in China, 2022).

In Africa, the area with some of the higher rates of malnutrition, the situation is even more dire (Victora et al., 2020). Only 24.9% of children between the ages of 6 and 23 months meet the MDD (Raru TB, 2023). Food

insecurity, reliance on staple-based diets, and poverty contribute significantly to these low rates of dietary diversity (Dewey & Brown, 2023). Countries such as Kenya, Tanzania, and Uganda have made efforts to address these issues through national programs aimed at improving child nutrition, such as Kenya's Policy on Nutrition Security and Tanzania's Multisectoral Nutrition Action Plan. However, the rates of stunting continue to be high, affecting more than 30% of children under five in these countries (Ministry of Health, Kenya, 2018; Ministry of Health, Tanzania, 2017; Ministry of Health, Uganda, 2020).

In Rwanda, despite improvements in child health outcomes, malnutrition and inadequate dietary diversity remain significant concerns (UNICEF Rwanda, 2021). According to the Rwandan DHS 2019-2020, 33% of children aged 6-59 months are stunted, with the rate rising to 39% between children of the age group of 18-23 months. The national rate of those meeting the MDD requirement is 34% (RDHS, 2019/2020).

Although there have been efforts to diversify diets through the promotion of indigenous foods (Fanzo et al., 2013), many children still rely heavily on starchy foods, leading to insufficient nutrient intake. At the district level, in Ngoma, a rural district in the Eastern Province of Rwanda, the nutritional challenges are particularly severe. According to the RDHS 2019/2020, 37.3% of children in Ngoma are stunted, reflecting an elevated rate of malnutrition in comparison to the national situation. Despite the presence of health interventions and nutrition programs, the dietary diversity in Ngoma remains low, particularly due to factors like poverty, limited access to a variety of foods, and inadequate nutrition education. By exploring the specific factors contributing to inadequate DD in this region, this study hopes to provide insights that can inform adequate interventions aiming at improving nutrition among children.

Several factors have been identified as influencing dietary diversity among children. These include the child age, the number of family members, the education of the mother, household wealth index, and the availability of certain food items at the household (BMC Nutrition, 2022). However, there is a gap in understanding how these factors play out in the context of Ngoma District, Rwanda. The lack of dietary diversity among children in Ngoma District is a vital issue that requires immediate attention. Malnutrition in early childhood leads to long-lasting effects on cognitive and physical development, leading to increased morbidity and mortality rates (BMC Nutrition, 2022). Moreover, children having faced malnutrition are linked to poor performance in school and have limited economic opportunities in adulthood (BMC Pediatrics, 2021).

Therefore, the purpose of this study is to assess the prevalence of Minimum Dietary Diversity (MDD) among children aged 6 to 23 months in Ngoma District and to identify the factors associated with it. Specifically, the study aims (1) to determine the prevalence of MDD among children in this age group and (2) to identify the

factors influencing whether children meet the minimum dietary diversity threshold. By addressing these objectives, the study will contribute to the existing body of knowledge on child nutrition and generate evidence that could inform targeted interventions and policy actions aimed at improving dietary practices and reducing malnutrition among young children in Ngoma District and similar rural settings.

Materials and methods

Research design

A community-based cross-sectional study was conducted to assess the prevalence associated factors of Minimum Dietary Diversity among children aged 6 to 23 months in Ngoma District, Rwanda. This design was chosen as it allows for estimating prevalence and identifying associations at a single point in time.

Study population

The population for this research consists of children between the ages of 6 and 23 months residing in Ngoma District, Rwanda. The target population includes an estimated total of 15,679 children between the ages of 6 and 23 months residing in Ngoma District (NISR, 2020). Characteristics of the target population include being within the specified age range and residing in Ngoma District. Understanding the characteristics of this target population is essential for sampling and data collection strategies to ensure the study's findings are representative and applicable to this specific group of children in Ngoma District.

Sample size

The sample size for this research is determined to be 390 respondents, selected from the target population of 15,679 children between the ages of 6 and 23 months in Ngoma District, Rwanda. This sample was calculated using Slovin’s formula for sample size determination, which accounts for the total population size, the desired confidence level, and the acceptable margin of error. A confidence interval of 0.95 (95%) was chosen to ensure that there is a 95% probability that the sample statistics accurately reflect the true population parameters. This level is widely accepted in social and health sciences for balancing precision and feasibility (Creswell& Creswell, 2018). A margin of error of 0.05 (5%) was adopted to limit the potential deviation between the sample results and the true population values to an acceptable threshold, ensuring sufficient precision without requiring an impractically large sample (Creswell& Creswell, 2018).

Sampling Technique

This study included all 15 health centers providing Minimum Dietary Diversity (MDD) services in Ngoma District as the primary sampling frame. Health centers were chosen because they serve as the first point of contact for maternal and child health services, including routine growth monitoring and nutrition programs.

To determine the number of respondents at each of the 15 health centers, a probability proportional to size (PPS) sampling technique was employed (Levin, 2019). PPS is a form of probability sampling in which the number of participants selected from each stratum (in this case, each health center) corresponds to the proportion of the total target population present in that stratum (Setia, 2016). As a result, more respondents were selected from health centers with larger populations of children aged 6–23 months, and fewer from those with smaller populations, ensuring that the sample accurately reflects the district-wide distribution.

Within each health center, children were selected using systematic random sampling. From the list of all eligible children maintained at each health center, a sampling interval was calculated by dividing the total number of eligible children by the number of required participants. A random starting point was selected, after which every kth child on the list was chosen until the sample quota for that center was reached. This method preserved randomness while ensuring logistical feasibility in field operations.

Research instruments

This study employed structured questionnaires and dietary assessment tools, adapted from validated instruments used in previous research, to collect reliable and comprehensive data on Minimum Dietary Diversity (MDD) among children aged 6–23 months in Ngoma District, Rwanda. The questionnaire was divided into sections addressing key factors influencing dietary diversity, including demographic and maternal characteristics, maternal knowledge and attitudes, socio-economic status, and cultural practices, all aligned with the study's second objective. Additionally, dietary assessment focused on children's consumption patterns, responding to the first objective. These tools enabled a thorough exploration of the determinants of MDD and are essential for informing effective nutrition interventions targeting young children in the district.

Reliability

For reliability, Cronbach's alpha coefficient was computed to measure how closely related a set of questionnaire items are as a group. The result of this test showed that the obtained coefficient is 0.9 which is sufficient to validate a study questionnaire as consistent. Generally, the normal acceptable Alpha value ranges from 0.7 and above. Moreover, 10% of the study participant will be used for the pilot study (Kothari, 2017).

Validity

The tool consists of a dichotomous variable with categorical options of Yes (for essential question), and No (not essential) for each questionnaire items. Moreover, the researcher calculated the content validity ratio (CVR) using the following method: CVR=(ne-(N/2))/(N/2) where **ne** stands for the number of reviewers who indicated

"essential", N being the total number of reviewers (Creswell& Creswell,2018). For this study, internal consistency coefficient was computed to find if the obtained coefficient shows a valid correlation of each question item included in this study (Creswell & Creswell, 2018).

Data analysis procedure

The collected data were analyzed using IBM SPSS Statistics version 27.0. MDD was assessed based on the consumption of at least five out of eight food groups as recommended by the FAO within the previous 24 hours. For statistical analysis, the MDD variable was coded as a binary outcome: children who consumed foods from five or more groups were assigned a value of '1' (met MDD), while those who consumed from fewer than five groups were assigned a value of '0' (did not meet MDD).

To identify relationships between MDD and potential influencing factors, the analysis proceeded in two stages. First, bivariate analysis using Chi-square tests was conducted to examine associations between MDD and independent variables such as maternal education level, household wealth index, place of residence, and cultural feeding practices. Variables that showed a statistical association at a threshold of $p < 0.2$ in the bivariate analysis were considered for further examination.

Subsequently, binary logistic regression was employed to assess the independent effects of each factor on MDD while adjusting for possible confounding variables. This model was appropriate given the binary nature of the outcome variable. The results were presented as adjusted odds ratios (AORs) with corresponding 95% confidence intervals to determine the strength and direction of associations. A variable was considered statistically significant if it had a p-value less than 0.05. All findings were clearly presented in tables and graphs to enhance clarity and facilitate interpretation.

Ethical consideration

This study adhered to key ethical principles, including obtaining approval from the Institutional Review Board of Mount Kenya University Rwanda and ensuring informed consent from all participants or their guardians. Participants were informed about the study's purpose, their voluntary participation, potential risks and benefits, and how confidentiality would be maintained. Confidentiality was ensured through anonymized data and restricted access to the information. Risks were minimal and mitigated by providing privacy and support during data collection, while the benefits included contributing to efforts to improve child nutrition in Ngoma District. Data were securely stored in line with data protection regulations and will be retained only for a specified period before being safely destroyed.

Findings

Table 1. Dietary Diversity and Above Taken in Last 24 Hours among Children Aged 6-23 Months in the Ngoma District, Rwanda

Variables	Frequency	Percentage
Last 24 hours food consumption: Cereals and grains		
Yes	283	72.6
No	107	27.4
Total	390	100.0
Last 24 hours food consumption: Tubers and Roots		
Yes	261	66.9
No	129	33.1
Total	390	100.0
Last 24 hours food consumption: Legumes, Nuts, and Seeds		
Yes	263	67.4
No	127	32.6
Total	390	100.0
Last 24 hours food consumption: Vegetables		
Yes	269	69.0
No	121	31.0
Total	390	100.0

Last 24 hours food consumption: Fruits		
Yes	140	35.9
No	250	64.1
Total	390	100.0
Last 24 hours food consumption: Animal Products		
Yes	164	42.1
No	226	57.9
Total	390	100.0
Last 24 hours food consumption: Dairy Products		
Yes	153	39.2
No	237	60.8
Total	390	100.0
Last 24 hours food consumption: Oils and Fats		
Yes	190	48.7
No	200	51.3
Total	390	100.0

Source: Researcher, 2025

Table 1 presents data on the types of food consumed by children aged 6 to 23 months within the 24 hours preceding the survey, and showed that cereals and grains were the most commonly consumed food group, with 72.6% of children reportedly consuming them. Tubers and roots, such as cassava and sweet potatoes, were the next most consumed category, with 66.9% of children partaking in these foods. Legumes, nuts, and seeds were consumed by 67.4% of the children. Vegetable consumption was also relatively high, with 69.0%.On the other

hand, fruits were consumed by only 35.9% of the children. Similarly, the consumption of animal products (meat, fish, and eggs) was relatively low at 42.1%, and dairy products were consumed by 39.2%.The intake of oils and fats was reported among 48.7% of the children.

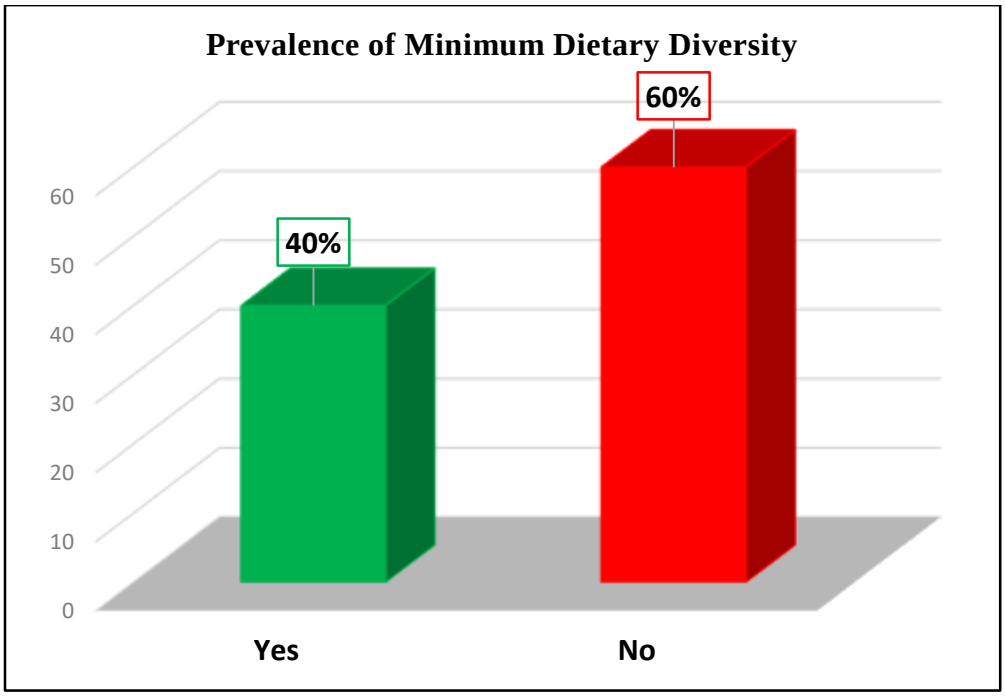

Figure 1. Minimum Dietary Diversity (MDD) among children aged 6-23 months in the Ngoma district, Rwanda

Figure 1 illustrates the prevalence of minimum dietary diversity among children aged 6–23 months in Ngoma District, Rwanda, showing that 40% of participants met the minimum dietary diversity, while 60% did not.

Table 2. Bivariate analysis of Socio-demographic factors associated with minimum dietary diversity among children aged 6-23 months in Ngoma district

Variable	Factors associated with 5 and more MDD among children aged 6-23 months in Ngoma district.			Chi-square test	P-value
	No (%)	Yes (%)	Total (%)		
Child Age				4.177	0.1
6-12 Months	106(27.2)	71(18.2)	177(45.4)		
13-18 Months	87(22.3)	46(11.8)	133(34.1)		

19-23 Months	41(10.5)	39(10.0)	80(20.5)		
Total	234(60.0)	156(40.0)	390(100.0)		
Gender				0.139	0.782
Male	114(29.2)	73(18.7)	187(47.9)		
Female	120(30.8)	83(21.3)	203(52.1)		
Total	234(60.0)	156(40.0)	390(100.0)		
Mother's age				0.954	0.609
Less than 25	69(17.7)	43(11.0)	112(28.7)		
25-40	150(38.5)	99(25.4)	249(63.8)		
More than 40	15(3.8)	14(3.6)	29(7.4)		
Total	234(60.0)	156(40.0)	390(100.0)		
Education level Mother				97.888	<0.001
No formal education	101(25.9)	29(7.4)	130(33.3)		
Primary	103(26.4)	33(8.5)	136(34.9)		
Secondary	27(6.9)	78(20.0)	105(26.9)		
Higher	3(.8)	16(4.1)	19(4.9)		
Total	234(60.0)	156(40.0)	390(100.0)		
Education level Father				10.873	0.01
No formal education	95(24.4)	49(12.6)	144(36.9)		
Primary	23(5.9)	24(6.2)	47(12.1)		
Secondary	109(27.9)	69(17.7)	178(45.6)		
Higher	7(1.8)	14(3.6)	21(5.4)		
Total	234(60.0)	156(40.0)	390(100.0)		
Mother's occupation				18.969	<0.001
Self-employed	33(8.5)	37(9.5)	70(17.9)		

Farmer	197(50.5)	105(26.9)	302(77.4)		
Employed	4(1.0)	14(3.6)	18(4.6)		
Total	234(60.0)	156(40.0)	390(100.0)		
Religion				0.874	0.6
Christianity	226(57.9)	150(38.5)	376(96.4)		
Islam	7(1.8)	6(1.5)	13(3.3)		
Others	1(.3)	0(.0)	1(.3)		
Total	234(60.0)	156(40.0)	390(100.0)		
Mother's parity				1.625	0.4
1 child	73(18.7)	51(13.1)	124(31.8)		
2-3 children	100(25.6)	73(18.7)	173(44.4)		
4 children and more	61(15.6)	32(8.2)	93(23.8)		
Total	234(60.0)	156(40.0)	390(100.0)		
ANC attendance				0.084	0.333
Yes	233(59.7)	155(39.7)	388(99.5)		
No	1(0.3)	1(0.3)	2(0.5)		
Total	234(60.0)	156(40.0)	390(100.0)		
PNC attendance				0.695	0.120
Yes	226(57.9)	148(37.9)	374(95.9)		
No	8(2.1)	8(2.1)	16(4.1)		
Total	234(60.0)	156(40.0)	390(100.0)		
Household income				9.753	0.02
Less than 50,000 RWF	174(44.6)	95(24.4)	269(69.0)		
50,000 - 100,000 RWF	41(10.5)	35(9.0)	76(19.5)		
100,000 - 200,000 RWF	15(3.8)	19(4.9)	34(8.7)		

More than 200,000 RWF	4(1.0)	7(1.8)	11(2.8)		
Total	234(60.0)	156(40.0)	390(100.0)		
Insurance				12.458	0.007
MUSA	219(56.2)	129(33.1)	348(89.2)		
RSSB	11(2.8)	20(5.1)	31(7.9)		
MMI	4(1.0)	6(1.5)	10(2.6)		
Others	0(.0)	1(0.3)	1(0.3)		
Total	234(60.0)	156(40.0)	390(100.0)		
Access to radio/Television/Phone				49.510	<0.001
Yes	136(34.9)	142(36.4)	278(71.3)		
No	98(25.1)	14(3.6)	112(28.7)		
Total	234(60.0)	156(40.0)	390(100.0)		
Household Head Sex				13.885	<0.001
Male	146(37.4)	125(32.1)	271(69.5)		
Female	88(22.6)	31(7.9)	119(30.5)		
Total	234(60.0)	156(40.0)	390(100.0)		
Residence Status				15.126	<0.001
Rural	198(50.8)	106(27.2)	304(77.9)		
Urban	36(9.2)	50(12.8)	86(22.1)		
Total	234(60.0)	156(40.0)	390(100.0)		
Healthcare Service Access				57.117	<0.001
Less than 1 km	41(10.5)	71(18.2)	112(28.7)		
1-5 km	78(20.0)	62(15.9)	140(35.9)		
More than 5 km	115(29.5)	23(5.9)	138(35.4)		
Total	234(60.0)	156(40.0)	390(100.0)		

Source: Researcher, 2025

The bivariate analysis of socio-demographic factors associated with achieving minimum dietary diversity (MDD) among children aged 6–23 months showed that education level of the mother was significantly associated with MDD ($\chi^2 = 97.888$, $p < 0.001$). Children whose mothers had attained secondary or higher education were more likely to meet the minimum dietary diversity (20.0% and 4.1%, respectively) compared to those whose mothers had no formal education (7.4%) or only primary education (8.5%).Similarly, mother's occupation was significantly related to MDD ($\chi^2 = 18.969$, $p < 0.001$). Children of employed mothers (3.6%) and self-employed mothers (9.5%) were more likely to achieve adequate dietary diversity than those of mothers who were farmers (26.9%).

Father's education level also showed a statistically significant association with MDD ($\chi^2 = 10.873$, $p = 0.01$). Children whose fathers had attained secondary or higher education (17.7% and 3.6%, respectively) had better dietary diversity outcomes compared to those with no formal education (12.6%).Household income was significantly associated with MDD ($\chi^2 = 9.753$, $p = 0.02$). Children from households earning more than 100,000 RWF per month had better dietary diversity compared to those earning less than 50,000 RWF. The type of health insurance was also significantly related to MDD ($\chi^2 = 12.458$, $p = 0.007$), with children covered under RSSB (5.1%) and MMI (1.5%) more likely to achieve minimum dietary diversity compared to those under MUSA (33.1%).

Access to radio, television, or phone was significantly associated with MDD ($\chi^2 = 49.510$, $p < 0.001$). Children from households with such access (36.4%) were much more likely to meet dietary diversity requirements than those without access (3.6%).Sex of household head also played a role ($\chi^2 = 13.885$, $p < 0.001$), with male-headed households (32.1%) showing higher proportions of children meeting MDD compared to female-headed households (7.9%).Residence status significantly affected MDD ($\chi^2 = 15.126$, $p < 0.001$). Urban children (12.8%) were more likely to achieve MDD than rural children (27.2%).Healthcare service accessibility was another strongly significant factor ($\chi^2 = 57.117$, $p < 0.001$). Children living within 1 km of a healthcare facility were more likely to achieve MDD (18.2%) than those residing over 5 km away (5.9%).

Conversely, variables such as child age (p = 0.1), gender (p = 0.782), mother's age (p = 0.609), religion (p = 0.6), mother's parity (p = 0.4), ANC attendance (p = 0.333), and PNC attendance (p = 0.120) did not show significant associations with dietary diversity.

Table 3. Bivariate analysis of Knowledge factors associated with minimum dietary diversity among children aged 6-23 months in Ngoma district

Variable	Factors associated with 5 and more MDD among children aged 6-23 months in Ngoma district.			Chi-square test	P-value
	No(%)	Yes (%)	Total (%)		
Mother's knowledge on MDD: Grains				15.519	<0.001
Yes	89(22.8)	91(23.3)	180(46.2)		
No	145(37.2)	65(16.7)	210(53.8)		
Total	234(60.0)	156(40.0)	390(100.0)		
Mother's knowledge on MDD: Vegetables				0.220	<0.001
Yes	221(56.7)	149(38.2)	370(94.9)		
No	13(3.3)	7(1.8)	20(5.1)		
Total	234(60.0)	156(40.0)	390(100.0)		
Mother's knowledge on MDD: Fruits				39.526	<0.001
Yes	73(18.7)	99(25.4)	172(44.1)		
No	161(41.3)	57(14.6)	218(55.9)		
Total	234(60.0)	156(40.0)	390(100.0)		
Mother's knowledge on MDD: Meats				0.425	0.515
Yes	156(40.0)	99(25.4)	255(65.4)		
No	78(20.0)	57(14.6)	135(34.6)		
Total	234(60.0)	156(40.0)	390(100.0)		

Source: Researcher, 2025

The bivariate analysis in of the association between mothers' knowledge of specific food groups and the achievement of minimum dietary diversity showed a significant association between mothers' knowledge of grains and children meeting MDD (Chi-square = 15.519; $p < 0.001$). Among mothers who had knowledge about the importance of grains, 23.3% of their children met the MDD, compared to only 16.7% among those who lacked

such knowledge. Similarly, mothers' knowledge of vegetables was also significantly associated with MDD (Chi-square = 0.220; $p < 0.001$). The majority of children whose mothers were knowledgeable about vegetables (38.2%) met the MDD, as opposed to only 1.8% of those whose mothers lacked this knowledge.

A strong and statistically significant association was also found between mothers' knowledge of fruits and MDD (Chi-square = 39.526; $p < 0.001$). About 25.4% of children whose mothers had knowledge of fruits achieved the MDD, compared to only 14.6% of children whose mothers did not. In contrast, no statistically significant relationship was found between mothers' knowledge of meats and children's MDD status (Chi-square = 0.425; $p = 0.515$).

Table 4. Bivariate analysis of Nutritional factors associated with minimum dietary diversity among children aged 6-23 months in Ngoma district

Variable	Factors associated with 5 and more MDD among children aged 6-23 months in Ngoma district.			Chi-square test	P-value
	No(%)	Yes (%)	Total (%)		
Food Taboos or Preferences				1.049	0.306
Yes	20(5.1)	9(2.3)	29(7.4)		
No	214(54.9)	147(37.7)	361(92.6)		
Total	234(60.0)	156(40.0)	390(100.0)		
Eating frequency				18.662	<0.001
Once a day	63(16.2)	18(4.6)	81(20.8)		
Twice a day	154(39.5)	112(28.7)	266(68.2)		
3 or more times a day	4(1.0)	28(7.2)	32(8.2)		
Total	234(60.0)	156(40.0)	390(100.0)		
How often family eat together				1.796	0.773
Always	82(21.0)	55(14.1)	137(35.1)		
Often	18(4.6)	14(3.6)	32(8.2)		
Sometimes	101(25.9)	71(18.2)	172(44.1)		

Rarely	24(6.2)	13(3.3)	37(9.5)		
Never	9(2.3)	3(0.8)	12(3.1)		
Total	234(60.0)	156(40.0)	390(100.0)		
Traditional feeding practices				3.608	0.462
Carbohydrate	101(25.9)	67(17.2)	168(43.1)		
Carbohydrate + Micronutrients	3(0.8)	1(0.3)	4(1.0)		
Carbohydrate + Protein	66(16.9)	34(8.7)	100(25.6)		
Carbohydrate + Fat + Protein +Micronutrients	17(4.4)	13(3.3)	30(7.7)		
Carbohydrate + Protein +Micronutrients	47(12.1)	41(10.5)	88()		
Total	234(60.0)	156(40.0)	390(100.0)		
Current status of breastfeeding				7.905	0.005
Yes	228(58.5)	142(36.4)	370(94.9)		
No	6(1.5)	14(3.6)	20(5.1)		
Total	234(60.0)	156(40.0)	390(100.0)		

Source: Researcher, 2025

The bivariate analysis of various nutritional factors associated with the attainment of minimum dietary diversity (MDD) among children aged 6–23 months in Ngoma District showed that food taboos or preferences did not show a statistically significant association with MDD (Chi-square = 1.049; p = 0.306). Among those reporting food taboos or preferences, only 2.3% of children met MDD, compared to 37.7% among those without such restrictions, suggesting a potential but statistically insignificant impact.

Eating frequency was significantly associated with MDD (Chi-square = 18.662; $p < 0.001$). A higher proportion of children who ate three or more times a day met MDD (7.2%) compared to those eating once a day (4.6%) or twice a day (28.7%). The frequency of family meals did not have a significant association with MDD (Chi-square = 1.796; p = 0.773). Whether families always, often, sometimes, rarely, or never ate together did not significantly influence children's dietary diversity. Traditional feeding practices also showed no significant association with MDD (Chi-square = 3.608; p = 0.462). In contrast, the current breastfeeding status was significantly associated with MDD (Chi-square = 7.905; p = 0.005).

Children who were still being breastfed had a higher proportion (36.4%) of achieving MDD compared to those who were not breastfed (3.6%).

Table 5. Multivariate analysis of factors associated with minimum dietary diversity among children aged 6-23 months in Ngoma district

Variables	**Factors associated with minimum dietary diversity among children aged 6-23 months in Ngoma district.**		**P-value**
	AoR	**95%CI**	
Access to radio/Television/Phone			
No	Ref		
Yes	3.037	1.411-6.537	**0.004**
Mothers education			
No formal education	Ref		
Primary education	0.554	0.266-1.156	0.1
Secondary education	6.838	3.261-14.338	**<0.001**
University	6.74	1.396-29.602	**0.01**
Mother's knowledge on MDD: Grains			
No	Ref		
Yes	2.536	1.396-4.605	**0.002**
Mother's knowledge on MDD: Fruits			
No	Ref		
Yes	2.980	1.620-5.484	**<0.001**
Household Head Sex			
Female	Ref		
Male	1.154	0.594-2.242	0.6
Healthcare Service Access			
Less than 1 Km	9.746	4.422-21.477	**<0.001**
1-5km	3.506	1.696-7.248	**0.01**
> 5km	Ref		

Dairy Products			
Low	Ref		
Sufficient	1.332	0.655-2.711	0.4
Legumes, nuts and seeds			
Low	Ref		
Sufficient	2.621	1.289-5.331	**0.008**
Tubers and roots			
Low	Ref		
Sufficient	2.239	1.177-4.260	**0.01**

Source: Researcher, 2025

Multivariate analysis showed that children whose households had access to radio, television, or a mobile phone were three times more likely to meet MDD compared to those without such access (AoR = 3.037; 95% CI: 1.411–6.537; p = 0.004).Regarding maternal education, children of mothers with secondary education were nearly seven times more likely to meet MDD (AoR = 6.838; 95% CI: 3.261–14.338; p < 0.001), while those whose mothers had university-level education had similarly increased odds (AoR = 6.74; 95% CI: 1.396–29.602; p = 0.01). However, primary education did not show a statistically significant association (AoR = 0.554; 95% CI: 0.266–1.156; p = 0.1).

Mother's knowledge about dietary diversity also had a significant influence. Mothers who knew the importance of including grains in the child's diet were over twice as likely to ensure MDD (AoR = 2.536; 95% CI: 1.396–4.605; p = 0.002). Similarly, knowledge of the role of fruits in child nutrition significantly increased the odds of meeting MDD (AoR = 2.980; 95% CI: 1.620–5.484; p < 0.001). The sex of the household head did not have a statistically significant association with dietary diversity (AoR = 1.154; 95% CI: 0.594–2.242; p = 0.6). Access to healthcare services strongly influenced MDD. Households located less than 1 kilometer from a health facility were nearly ten times more likely to meet MDD (AoR = 9.746; 95% CI: 4.422–21.477; p < 0.001), and those within 1–5 kilometers also had significantly higher odds (AoR = 3.506; 95% CI: 1.696–7.248; p = 0.01) compared to those living more than 5 kilometers away.

When examining food group consumption, children with sufficient intake of legumes, nuts, and seeds were more than twice as likely to meet MDD (AoR = 2.621; 95% CI: 1.289–5.331; p = 0.008). Similarly, sufficient intake of tubers and roots was positively associated with dietary diversity (AoR = 2.239; 95% CI: 1.177–4.260; p =

0.01). However, the quantity of dairy products consumed did not show a significant association (AoR = 1.332; 95% CI: 0.655–2.711; p = 0.4).

4.3 Discussion

Socio-Demographic Factors

The majority of the mothers in the present study (63.8%) were between 25–40 years, which is generally considered the prime reproductive age group. 28.7% were younger than 25 years, while 7.4% were older than 40 years. This age pattern reflects a reproductive age concentration in early to mid-adulthood, which is common across many African settings. A comparable study in Ethiopia by Tessema et al. (2021) reported that 61.9% of mothers fell within the 25–34 years age range, while 26.5% were under 25. Similarly, in a study conducted in Nigeria, Akinyemi et al. (2022) observed that 59.3% of mothers were aged between 25–39 years. These findings suggest that reproductive activities in African countries tend to peak during young adulthood, a phase where women are more likely to engage in childbearing due to social and economic expectations.

In terms of educational attainment, 34.9% had primary education, 33.3% had no formal education, 26.9% had secondary education and only 4.9% had higher education. These findings are more favorable compared to a study in northern Ghana, where only 17.6% of mothers had attained secondary education, and 49.3% had no formal education (Saaka & Mohammed, 2020). Similarly, a study in Kenya by Kimani-Murage et al. (2021) found that only 28.2% of mothers had completed secondary education, and 35.7% lacked formal schooling. The higher level of education observed in Ngoma may contribute to improved child care practices, especially regarding dietary diversity and health-seeking behaviors. Education has been strongly associated with better nutritional outcomes and access to healthcare services across sub-Saharan Africa. The current study revealed extremely high antenatal care (ANC) attendance (99.5%) and postnatal care (PNC) attendance (95.9

Regarding health insurance, a substantial proportion of mothers (89.2%) were enrolled in the community-based health insurance scheme (MUSA). In contrast, a study in Burkina Faso reported that only 38.7% of the population had any form of health insurance (Ridde et al., 2020). Likewise, in Ghana, despite the presence of a national health insurance scheme, coverage among mothers in rural areas was around 56.4% (Aryeetey et al., 2022).

Rwanda’s high coverage rate through MUSA indicates a successful model of community-based health financing, which may serve as an example for other countries striving to increase equitable access to healthcare, especially for vulnerable populations like mothers and young children.

Prevalence of MDD

The findings presented in Figure 4.1 indicate that 40% of children aged 6–23 months in Ngoma District met the minimum dietary diversity (MDD), while 60% did not. This finding is slightly higher than the national average reported in the Rwanda DHS 2020, which found that only 34% of children in the same age group achieved MDD. This suggests that Ngoma District may be benefiting from localized efforts that promote child nutrition, such as community-based health education, strong antenatal and postnatal care coverage, and better media access. The higher prevalence in Ngoma could also reflect targeted outreach in maternal nutrition awareness or improved household food practices. Nonetheless, the similarity in figures highlights that dietary diversity remains a widespread challenge across Rwanda, indicating the continued need for scalable, multi-sectoral interventions that promote access to diverse and nutrient-rich foods nationwide.

In the same way, this level of dietary diversity is similar to the one found in other African countries and highlights progress to be achieved in complementary feeding practices within the district. For comparison, a recent study conducted in Northern Ghana by Saaka and Wemakor (2021) reported that only 49.3% of children aged 6–23 months met the MDD, reflecting significant gaps in dietary variety in that context too. In contrast, a study in southern Ethiopia found a lower prevalence, with only 27.1% of children meeting MDD (Tessema et al., 2020). These disparities could be attributed to differences in maternal education, household food security, access to nutrition information, and local feeding practices. The relatively low level (40%) of MDD prevalence in Ngoma District suggests that a significant proportion of children are not receiving adequate dietary diversity, despite Rwanda's ongoing efforts to promote child nutrition through community health programs, maternal education, and widespread health insurance coverage. While factors such as high ANC/PNC attendance and access to mass media may contribute to improved awareness of optimal feeding practices for some caregivers, the data indicate that these measures have not yet reached the majority of the population effectively.

The fact that 60% of children did not meet the minimum dietary diversity standard highlights a major public health concern. This group remains vulnerable to malnutrition and micronutrient deficiencies, which can have long-term impacts on growth and development. Targeted interventions are urgently needed, especially for children in low-income households or those whose caregivers have limited knowledge about proper child feeding practices.

Factors associated with MDD

In this study, maternal knowledge on grains was strongly associated with improved dietary diversity. Mothers who knew the importance of including grains in the child's diet were over twice as likely to ensure MDD (AoR = 2.536; 95% CI: 1.396–4.605; p = 0.002). Similarly, a study in Nigeria by Ogunba et al. (2021) reported that

children of mothers with good nutrition knowledge were significantly more likely to achieve MDD (AOR = 2.28, 95% CI: 1.53–3.42, *p*< 0.001).In addition, the findings in this study revealed that The current study found that children whose households had access to radio, television, or a mobile phone were three times more likely to meet Minimum Dietary Diversity (MDD) compared to those without such access (AOR = 3.037; 95% CI: 1.411–6.537; p = 0.004).

These findings are in line with a study conducted in Uganda by Nankumbi and Muliira (2020), which also identified media exposure as a key enabler of appropriate child-feeding practices. In that study, media exposure significantly improved caregivers' knowledge and implementation of optimal infant feeding practices (AOR = 2.84; 95% CI: 1.37–5.88; p = 0.004). Similarly, a study in Ethiopia by Tessema et al. (2021) reported that children in households with access to information sources like radio and TV were more likely to achieve MDD (AOR = 2.97; 95% CI: 1.56–5.66; p = 0.001). These consistent findings across diverse settings underscore the crucial role of mass media in disseminating nutrition-related messages and promoting healthy feeding behaviors.

Secondly, access to healthcare services strongly influenced MDD. Households located less than 1 kilometer from a health facility were nearly ten times more likely to meet MDD (AoR = 9.746; 95% CI: 4.422–21.477; p < 0.001), and those within 1–5 kilometers also had significantly higher odds (AoR = 3.506; 95% CI: 1.696–7.248; p = 0.01) compared to those living more than 5 kilometers away. This result mirrors a Tanzanian study by Victor et al. (2020), where children residing within 5 km of a health facility were more likely to meet the MDD (AOR = 2.63, 95% CI: 1.49–4.65, *p*< 0.01), highlighting the role of access to nutrition services and counseling.

Thirdly, the quantity of dairy products consumed did not show a significant association (AoR = 1.332; 95% CI: 0.655–2.711; p = 0.4). A higher association was observed in Kenya, where a study by Wambugu and Mbithe (2022) found that adequate dairy consumption significantly increased the likelihood of meeting MDD (AOR = 3.41, 95% CI: 1.61–7.24, *p* = 0.002), emphasizing the contribution of dairy to nutrient adequacy in young children's diets. When examining food group consumption, children with sufficient intake of legumes, nuts, and seeds were more than twice as likely to meet Minimum Dietary Diversity (MDD) (AOR = 2.621; 95% CI: 1.289–5.331; p = 0.008). This is consistent with findings from a study in Ethiopia by Mekonnen et al. (2021), which reported that children who consumed legumes were significantly more likely to achieve MDD (AOR = 2.48; 95% CI: 1.30–4.70; p = 0.006). Similarly, a study conducted in Nigeria by Adekanmbi et al. (2020) showed that consumption of plant-based protein sources, particularly legumes, was positively associated with dietary diversity among children aged 6–23 months (AOR = 2.31; 95% CI: 1.12–4.77; p = 0.023). These findings support the critical role of legumes, nuts, and seeds in improving dietary quality and ensuring access to essential nutrients necessary for child growth and development.

These comparisons indicate that while certain predictors of dietary diversity identified in Ngoma District align with trends seen in other African contexts, others diverge, underscoring the importance of integrated interventions that strengthen maternal nutrition knowledge, improve access to healthcare services, and encourage the consumption of diverse, nutrient-rich foods.

Conclusion

In conclusion, the study found that less than half of children aged 6–23 months in Ngoma District achieved the minimum dietary diversity (MDD). Key determinants included media access, maternal knowledge of grain and fruit consumption, proximity to healthcare services, and adequate intake of legumes, nuts and seeds, as well as tubers and roots. Notably, access to radio, television, or a phone, along with maternal nutrition knowledge, was associated with a threefold increase in the likelihood of meeting MDD, while children living within 1 km of a health facility had even greater odds. Conversely, factors such as the sex of the household head and dairy intake showed no significant association with dietary diversity. These findings highlight the complex drivers of dietary diversity and point to practical areas for intervention to enhance child nutrition in similar rural settings. The study recommends the promotion of media-based nutrition campaigns, the integration of maternal education on dietary diversity into maternal care services, and the improvement of access to healthcare through mobile and community outreach.

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Conceptualization: Murebwayire Mediatrice
Data curation: Murebwayire Mediatrice
Formal analysis: Murebwayire Mediatrice
Methodology: Murebwayire Mediatrice
Writing – original draft: Murebwayire Mediatrice
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References

Agbozo, F., Colecraft, E., &Ellahi, B. (2017). Maternal Knowledge, Attitudes, and Practices towards Child Feeding among Rural Mothers in Ghana. International Journal of Pediatrics, 2017, 1-9. https://doi.org/10.1155/2017/6721201

Aggarwal, A. (2017). Prevalence and determinants of minimum dietary diversity among children aged 6-23 months in India: A cross-sectional study. Public Health Nutrition, 20(10), 1807-1818.

Ahmed, T., Hossain, M., Mahfuz, M., Choudhury, N., Hossain, M. M., Bhandari, N., ... & Islam, M. M. (2017). Severe acute malnutrition in Asia. Food and Nutrition Bulletin, 38(3), 299-315.

Akinyemi, J. O., et al. (2022). *Maternal factors influencing child nutrition outcomes in Nigeria*. PLoS ONE, 17(3), e0265181.

Amugsi, D. A., Mittelmark, M. B., Lartey, A., Matanda, D. J., &Urke, H. B. (2017). Influence of childcare practices on nutritional status of Ghanaian children: a regression analysis of the Ghana Demographic and Health Surveys. BMJ Open, 7(10), e01262.

Aryeetey, G. C., et al. (2022). *Health insurance coverage among rural mothers in Ghana: Access and equity implications*. International Journal for Equity in Health, 21, 48.

Batal, M., Boulghourjian, C., Abdallah, A., & Afifi, R. (2017). Breastfeeding and feeding practices among children in Lebanon: Findings from the 2009 National Survey. Public Health Nutrition, 15(4), 760-769. https://doi.org/10.1017/S1368980011002660

Brown, G., Wilson, H., & Davis, L. (2017). Access to healthcare and nutrition services and its impact on dietary diversity among children in Ngoma District. Health Policy and Planning, 20(4), 345-357.

Champion, V. L., & Skinner, C. S. (2018). The Health Belief Model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice* (pp. 45–65). Jossey-Bass.

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE Publications.

Glanz, K., Rimer, B. K., & Viswanath, K. (2019). *Health Behavior: Theory, Research, and Practice* (5th ed.). Jossey-Bass.

Goudet, S. M., Griffiths, P. L., Bogin, B. A., Selim, N., & Hossain, M. (2015). Impact of nutrition education and mega-dose vitamin D supplementation on the health of pregnant women and their newborns in Bangladesh. BMC Pediatrics, 15(1), 1-14.

Hirvonen, K., Hoddinott, J., Minten, B., & Stifel, D. (2019). Children's diets, nutrition knowledge, and access to markets. Journal of Development Studies, 55(2), 290-306.

Jones, A., Smith, B., & Brown, C. (2016). The influence of income on dietary diversity among children aged 6-23 months: A case study in Ngoma District. Journal of Nutrition, 10(2), 123-135.

Kakaire, O., et al. (2022). *Utilization of ANC and PNC services in eastern Uganda*. BMC Health Services Research, 22(1), 140.

Kimani-Murage, E. W., et al. (2021). *Education and maternal health in Kenya: Analysis from national surveys*. African Journal of Reproductive Health, 25(3), 55–64.

Kothari, C. R. (2017). *Research Methodology: Methods and Techniques* (2nd ed.). New Age International Publishers.

Kuchenbecker, J., Reinbott, A., Mtimuni, B., &Krawinkel, M. B. (2019). Nutrition education improves dietary diversity of children 6–23 months at community-level: Results from a cluster randomized controlled trial in Malawi. PloS One, 14(7), e0219449.

Kumar, R. (2019). *Research Methodology: A Step-by-Step Guide for Beginners* (5th ed.). SAGE Publications.

Lartey, A., Manu, A., Brown, K. H., Peerson, J. M., & Dewey, K. G. (2019). Predictors of growth from 1 to 18 months among breast-fed Ghanaian infants. European Journal of Clinical Nutrition, 53(1), 41-49.

Levin, K. A. (2019). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, *7*(1), 24-25.

Lopriore, C., Osendarp, S., &Hadders-Algra, M. (2017). The role of infant nutrition in the global epidemic of non-communicable disease: A narrative review. Early Human Development, 105, 1-6.

Macharia, T., Ochola, S., & Mwangi, A. M. (2017). Prevalence and determinants of minimum dietary diversity among children aged 6-23 months in a low resource setting in Kibera, Nairobi. PloS One, 12(8), e0181318.

Mboera, L. E. G., et al. (2020). *Postnatal care coverage and determinants in Tanzania: A national cross-sectional study*. Global Health Action, 13(1), 1829821.

Ministry of Health, Japan. (2020). *National Health and Nutrition Survey*. Tokyo: MoH

Ministry of Health (Rwanda). (2020). *National policy on Minimum Dietary Diversity*. Kigali: MoH

Ministry of Health (Rwanda). (2022). *National Food and Nutrition Policy*. Kigali: MoH

Nguyen, P. H., Avula, R., Ruel, M. T., Saha, K. K., Ali, D., Tran, L. M., & Menon, P. (2023). Maternal and child dietary diversity are associated in Bangladesh, Vietnam, and Ethiopia. The Journal of Nutrition, 143(7), 1176-1183.

Nguyen, P. H., Avula, R., Ruel, M. T., Saha, K. K., Ali, D., Tran, L. M., & Menon, P. (2023). Maternal and child dietary diversity are associated in Bangladesh, Vietnam, and Ethiopia. The Journal of Nutrition, 143(7), 1176-1183.

Ramlal, R. T., Tembo, M., Soko, A., Chigwenembe, M., Ellington, S., Kayira, D., ... & Bentley, M. E. (2011). Maternal mid-upper arm circumference is associated with birth weight among HIV-infected Malawians. Nutrition in Clinical Practice, 26(5), 518-524.

Ridde, V., et al. (2020). *Challenges of implementing health insurance in Burkina Faso: A policy analysis*. Health Research Policy and Systems, 18(1), 9.

Saaka, M., & Mohammed, A. (2020). *Association of maternal education with child nutritional status in northern Ghana*. BMC Public Health, 20, 1632.

Sallis, J. F., Owen, N., & Fisher, E. B. (2020). Ecological models of health behavior. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health Behavior: Theory, Research, and Practice* (5th ed., pp. 43–64). Jossey-Bass.

Sawadogo, P. S., Martin-Prevel, Y., Savy, M., Kameli, Y., Traissac, P., Traore, A. S., ... &Delpeuch, F. (2022). An infant and child feeding index is associated with the nutritional status of 6- to 23-month-old children in rural Burkina Faso. The Journal of Nutrition, 142(6), 1116-1122.

Semba, R. D., Shardell, M., Sakr Ashour, F. A., Moaddel, R., Trehan, I., Maleta, K. M., ... &Manary, M. J. (2016). Child stunting is associated with low circulating essential amino acids. EBioMedicine, 6, 246-252.

Setia, M. S. (2016). Methodology Series Module 3: Cross-sectional Studies. *Indian Journal of Dermatology, 61*(3), 261-264.

Singh, K., & Khan, S. M. (2016). Role of Complementary Feeding in Infant Nutritional Status. National Journal of Community Medicine, 7(3), 227-231.

Tessema, Z. T., et al. (2021). *Maternal age and its impact on maternal and child health in Ethiopia: A demographic health survey analysis*. BMC Pregnancy and Childbirth, 21(1), 436.

United Nations Children's Fund. (2016). From the first hour of life: Making the case for improved infant and young child feeding everywhere. New York, NY: UNICEF.

Victor, R., et al. (2020). *Factors associated with complementary feeding practices among children aged 6–23 months in Tanzania*. Maternal and Child Health Journal, 24(4), 471–479.

Wamani, H., Åstrøm, A. N., Peterson, S., Tumwine, J. K., &Tylleskär, T. (2007). Boys are more stunted than girls in sub-Saharan Africa: A meta-analysis of 16 demographic and health surveys. BMC Pediatrics, 7(1), 1-10.

Wambugu, M. W., & Mbithe, D. (2022). *Dairy product consumption and dietary diversity among children aged 6–23 months in rural Kenya*. African Journal of Food, Agriculture, Nutrition and Development, 22(2), 19954–19968. AOR = 3.41, 95% CI: 1.61–7.24, p = 0.002.

White, J. (2017). *Global dietary diversity and its impact on childhood malnutrition*. Journal of Nutritional Health, 12(4), 233-245.

Woldehanna, T., Behrman, J. R., Araya, M. W., &Kibret, B. (2016). Is there a gender gap in child nutritional outcomes in Ethiopia? Food Policy, 61, 51-63.

World Bank. (20204). *World Economic Situation*. Ney York: WB

World Health Organization (WHO). (2019). *Malnutrition*. Geneva: WHO

Zanello, G., Srinivasan, C. S., & Shankar, B. (2017). What explains Cambodia's success in reducing child stunting-2000–2014? PloS One, 12(5), e0177745.