

## ORIGINAL RESEARCH ARTICLE

# The impact of Knowledge, attitudes and practices (KAP) of dietary diversity on maternal and child malnutrition among pregnant and lactating women in Ngozi province, Burundi

DOI: 10.29063/ajrh2026/v30i3.7

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## Abstract

This study explored nutritional awareness, perceptions and feeding behaviors among pregnant and lactating women in Ngozi province, Burundi, and identified determinants influencing these outcomes. A community-based cross-sectional survey of 1,620 women was conducted using a structured questionnaire adapted from FAO guidelines. Data analysis involved descriptive statistics and logistic regression to determine associations between KAP and socio-demographics. Results showed that less than half of participants had good knowledge on infant feeding (44.6%), with even lower knowledge for young child feeding (30.2%) and malnutrition (28.5%). Positive attitudes toward dietary diversity were noted in 63.7% of respondents, but only 57% practiced adequate dietary diversity. Significant predictors of better knowledge and attitudes included economic engagement, education levels, marital status, and age. The study highlights the need for integrated interventions addressing education, economic empowerment, and food access to improve dietary diversity and reduce maternal and child malnutrition in this setting. (*Afr J Reprod Health* 2026; 30 [3]: 77-94).

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**Keywords:** Pregnant and Lactating women; Nutrition knowledge

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## Résumé

Cette étude visait à évaluer les connaissances, attitudes et pratiques (CAP) en matière de diversité alimentaire chez les femmes enceintes et allaitantes dans la province de Ngozi, au Burundi, ainsi qu'à identifier les facteurs associés. Une enquête transversale communautaire a été réalisée auprès de 1 620 femmes à l'aide d'un questionnaire structuré fondé sur les directives de la FAO. Les données ont été analysées à l'aide de statistiques descriptives et de régressions logistiques pour examiner les relations entre les CAP et les caractéristiques sociodémographiques. Moins de la moitié des participantes avaient une bonne connaissance de l'alimentation du nourrisson (44,6 %), avec des niveaux encore plus faibles pour l'alimentation du jeune enfant (30,2 %) et la malnutrition (28,5 %). Si 63,7 % des répondantes affichaient une attitude positive envers la diversité alimentaire, seules 57 % déclaraient des pratiques adéquates. Les principaux déterminants d'une meilleure connaissance et d'attitudes positives étaient le niveau d'éducation, l'activité économique, le statut matrimonial et l'âge. Les résultats soulignent la nécessité d'interventions intégrées combinant éducation nutritionnelle, autonomisation économique des femmes et amélioration de l'accès aux aliments diversifiés, afin de renforcer la diversité alimentaire et de réduire la malnutrition maternelle et infantile dans la province de Ngozi et dans des contextes similaires. (*Afr J Reprod Health* 2026; 30 [3]: 77-94).

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**Mots-clés:** Femmes enceintes et allaitantes ; Connaissances nutritionnelle

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## Introduction

Dietary diversity refers to the consumption of a variety of food groups, which provides essential nutrients such as protein, carbohydrate, fat, minerals, vitamins and water required for maternal health and fetal development.<sup>1,2,3</sup> Adequate nutrition

during pregnancy and lactation plays a critical role in determining the health of both the mother and child, especially during the first 1,000 days, a crucial period extending from conception to the child's second birthday.<sup>4</sup> During this window, nutritional deficiencies can cause irreversible damage to health, growth, and development.<sup>4</sup> Low

dietary diversity among pregnant and lactating women has been linked to numerous adverse outcomes, including intrauterine growth retardation, preterm birth, low birth weight, maternal anemia, and impaired cognitive and physical development in children.<sup>5,6</sup> Globally, maternal and child undernutrition remains a major development challenge, contributing to nearly half of child mortality worldwide and responsible for millions of deaths annually.<sup>7,8</sup> Undernutrition during pregnancy and early childhood manifests as stunting, wasting, micronutrient deficiencies, and suboptimal breastfeeding practices, all of which have lasting health, educational and economic consequences.<sup>9,10,11</sup> In developing countries, low dietary diversity is a major problem among poor populations and has various consequences for the health and well-being of families, communities and the nation as a whole.<sup>12</sup> In sub-Saharan Africa, including Burundi, women remain particularly exposed to inadequate micronutrient intake, resulting in various types of malnutrition and its complications; and lack of dietary diversity is a challenge among poor populations with limited resources.<sup>13</sup> Factors such as poverty, low education levels, cultural practices, and limited nutritional knowledge have been identified as determinants contributing to poor dietary habits among pregnant and lactating women.<sup>14,15</sup>

Beyond issues of food availability, women's nutritional behaviours during pregnancy and lactation are strongly shaped by their knowledge, attitudes, and practices (KAP) related to diet and nutrition.<sup>16,17</sup> These dimensions influence how women perceive their nutritional needs, make food choices, and prioritize dietary diversity within their households.<sup>17</sup> However, research has consistently shown significant discrepancies between nutrition-related knowledge and actual dietary behaviours, largely driven by socioeconomic, cultural, and environmental constraints.<sup>17</sup> Understanding these dynamics is therefore essential to improving maternal and child health outcomes in resource-limited settings.

The Ngozi Province of Burundi continues to face persistent challenges in food and nutrition security, particularly among vulnerable groups such as pregnant and lactating women.<sup>18</sup> Chronic malnutrition, micronutrient deficiencies, and low

dietary diversity remain persistent public health concerns.<sup>18,19</sup> To effectively address malnutrition, it is essential to understand the underlying drivers of food choices, along with existing knowledge, attitudes, and beliefs regarding nutrition. The Food and Agriculture Organization (FAO) advises evaluating nutrition-related knowledge, attitudes, and practices to identify gaps and inform the design of targeted nutrition education interventions.<sup>17</sup> Assessing knowledge helps identify misinformation or limited awareness; exploring attitudes reveals the motivational and cultural factors that influence decision-making; and analysing practices offers insight into actual dietary behaviors.<sup>17</sup> In this context, the aim of this study was to investigate nutritional KAP and determine their correlation with sociodemographic factors among pregnant and lactating women in Ngozi province. Further, multiple regression sought to determine predictors of nutritional knowledge, attitude, and practices. The findings from this study are expected to inform local health and nutrition interventions as well as contributing to the development of targeted strategies to improve maternal and child nutrition in the study area as well as in other similar areas.

## Methods

### *Area and study population selecting criteria*

A community-based cross-sectional study was conducted to evaluate the Knowledge, Attitudes and Practices (KAP) of dietary diversity among pregnant and lactating women in Ngozi province, Burundi. Ngozi province is located in the northern region of Burundi and the most densely populated province in the country.<sup>20</sup> It is predominantly characterized by a high number of smallholder farms that subsist on agriculture as a source of income and diet.<sup>21</sup> Ngozi province was chosen for this study because it is one of the most affected provinces, with a chronic malnutrition rate of 71.2% in 2010, changing to 60% in 2017 and 55% in 2021.<sup>22</sup> The study population was pregnant and lactating women aged 15-49 years in the study area during the study period. To be included in the study, pregnant women aged 15-49 years and lactating women aged 15-49 years who have children aged 6-23 months must have resided in Ngozi Province for

at least 6 months. Estimation of sample size was done using the formula by *Snedecor and Cochran (1989)*<sup>23</sup> for a single population proportion, with the following assumptions: 50% of the proportion of maternal dietary diversity among pregnant and lactating mothers, at 95% of the confidence interval and 0.05 marginal error with an additional 5% for non-response. The formula is:  $n = z^2 * p * (1-p) / d^2$  with  $n$  = sample size,  $Z = Z$  statistic for a level of confidence of 95%,  $P$  = proportion of the population and  $d$  = marginal error. The estimated sample size was 405. The Ngozi province comprises three health districts which include Ngozi, Kiremba, and Buye. Among these, two districts including Kiremba and Buye were purposively selected for this study due to their low prevalence of dietary diversity (3.7% and 1.1%, respectively) among women of reproductive age (15–49 years), as well as their high rates of chronic malnutrition (67.3% and 62.1%, respectively) among children aged 0–5 years<sup>24</sup>. From these two districts, four communes were randomly selected for inclusion in the study. Consequently, the final sample size was estimated at 1,620 participants.

### **Study design and data collection**

A multi-stage cluster sampling approach was adopted to select study participants. In the first stage, two health districts were purposively selected. In the second stage, two communes were randomly selected from each of the selected health districts. At the third stage, seven hills (collines) were randomly chosen from each commune. At the hill level, a list of households with pregnant or lactating women was provided by the hill representative, in collaboration with community health workers and the “maman lumière”.

A structured questionnaire was developed for this study based on the FAO guidelines for assessing nutrition-related knowledge, attitudes, and practices (FAO/WHO, 2014) and was pre-tested in the study area to ensure clarity and relevance. The questionnaire collected information on socio-demographic characteristics (sex, age, marital status, education, occupation, household size), administrative location (province, commune, ward, village/street), household facilities, and knowledge of hygiene practices (including sources and storage of drinking water, handwashing,

sanitation, and hygiene, etc). In addition, household and individual dietary diversity practices were assessed. To evaluate participants' knowledge, attitudes, and practices related to dietary diversity, a total of 1,620 pregnant and lactating women were randomly selected from household lists at the hill level and interviewed face-to-face. Data were collected by experienced enumerators fluent in the local language, using smartphones equipped with the ODK/KoboCollect application. This digital platform was selected for its ability to optimize data quality through real-time monitoring, and validation, thereby ensuring the accuracy, consistency, and completeness of information throughout the data collection process. Prior to data collection, enumerators underwent intensive training, including mock interviews and practical field exercises, to ensure consistency and reliability. The data collection process was completed over a two-week period, with supervisors monitoring fieldwork closely and reviewing submitted questionnaires daily to ensure data quality and accuracy. Nutrition knowledge was assessed at both the household and individual levels to evaluate understanding, attitudes, and practices related to general nutrition and dietary diversity.

### **Data analysis**

The collected data were initially entered into Microsoft Excel spreadsheets for data cleaning to ensure accuracy and completeness. Cleaned data were then exported to the Statistical Package for the Social Sciences (SPSS) version 25 for statistical analysis. SPSS was selected for its robust data management capabilities and comprehensive suite of analytical tools suitable for handling complex survey data. Descriptive statistics including frequencies, proportions, and percentages were computed to summarize participants' socio-demographic characteristics and key variables related to knowledge, attitudes, and practices (KAP) of dietary diversity.

To identify factors associated with KAP outcomes, bivariable logistic regression analyses were performed. In these analyses, key outcome variables including knowledge (categorized as good or poor), attitude (positive or negative), and practice (adequate or inadequate) were individually regressed against socio-demographic predictor

variables including age, marital status, occupation, education level, household size and household education. Cut-off point for qualification into multivariable logistic regression was set at 0.2. The multivariable logistic regression analysis was performed using the backward stepwise elimination method, allowing for the sequential removal of non-significant variables, while checking for confounders. Statistical significance was set at a p-value of 0.05. Model adequacy and goodness of fit were assessed using likelihood ratio tests. Interactions between variables in the final model was assessed. Knowledge scores were derived based on the proportion of correct responses to nutrition-related questions, with participants scoring >50% classified as having good knowledge. Attitudes were assessed using a three-point Likert scale, where participants agreeing with more than half of the positive statements were categorized as having a positive attitude. Dietary diversity practices were evaluated by summing the number of different food groups consumed within the 24 hours preceding the survey. Classification into low or high dietary diversity followed FAO dietary diversity scoring guidelines. The average score was calculated with mean food groups consumption of 3 and Std. Deviation of 1. Respondents with < 3 mean food groups consumed were considered as having lower dietary diversity whereas those with  $\geq 3$  mean food groups consumed were considered as having high dietary diversity.

### **Ethics approval**

The protocol for this study was reviewed and approved by Burundi National Ethics committee for the Protection of Human Subjects of Biomedical and Behavioral Research (Approval Number: CNE/29/2024).

## **Results**

### ***Socio-demographic characteristics of participants***

A total of 1,620 participants were included in the study. The majority of respondents (87.2%) were

married, with most (80.6%) identified as spouses within their households, and 15% serving as household representatives. Nearly half of the participants (48%) were aged 20–29 years, followed by 38.7% aged 30–39 years. Approximately two-thirds of households (66.2%) comprised five or fewer members, while 32.3% had between six and nine members.

In terms of education, 48.5% of participants had completed primary school, whereas 43.2% had no formal education. Farming was the predominant occupation, reported by 94.4% of respondents (Table 1).

### ***Nutrition-related KAP assessment***

Regarding knowledge related to infant feeding, only 44.6% of respondents demonstrated good knowledge, with scores ranging from a minimum of 3 to a maximum of 13, a mean of 8.96 (SD=1.65), and a median of 9. This indicates that less than half of the participants have adequate understanding of key infant feeding practices, highlighting a significant knowledge gap in this area. For knowledge about feeding young children, only 30.2% showed good knowledge, with scores ranging from 2 to 9, a mean of 5.7 (SD=1.37), and median of 6, reflecting even lower awareness on optimal feeding for young children.

For knowledge of micronutrient intake, 47.8% of respondents demonstrated good knowledge, with scores ranging from 0 to 5, a mean of 1.84 (SD=1.32), and median of 1, revealing substantial deficiencies in understanding micronutrient sources and roles. Knowledge concerning malnutrition was the lowest, with only 28.5% demonstrating adequate knowledge, scores ranging 0–4, mean 1.32 (SD 0.68), and median 1, pointing to critical gaps in recognizing malnutrition causes and consequences. Despite these knowledge limitations, 63.7% had a positive attitude toward dietary diversity, and 57% exhibited adequate dietary diversity practices, indicating favourable dispositions and some behavioural adherence that could be leveraged in nutrition interventions. (Table 2).

**Table 1:** Sociodemographic characteristics of participant

Characteristics	Category	Frequency	%
Marital status	Single	102	6.3
	Married	1413	87.2
	Divorced	54	3.3
	Widow	51	3.1
Role within the household	Household Representative	243	15
	Spouse	1305	80.6
	Ordinary member	72	4.4
Age of respondent	<20	98	6.0
	20–29	778	48.0
	30–39	627	38.7
	≥40	117	7.2
Household size	≤5	1072	66.2
	Between 6-9	524	32.3
	≥10	24	1.5
Education of the respondent	No formal education	700	43.2
	Primary	786	48.5
	Secondary	130	8
	University and above	4	0.2
Education of the household representative	No formal education	719	44.4
	Primary	728	44.9
	Secondary	164	10.1
	University and above	9	0.6
Occupation of the respondent	Agriculture-Livestock	1530	94.4
	Small business	25	1.5
	Arts and crafts	36	2.2
	Employed	29	1.8

**Table 2:** Summary of frequencies and percentages for DD-related practice, knowledge and attitudes

Category		Frequency	%
Attitude	Negative attitude	717	36.3
	Positive attitude	903	63.7
Knowledge related to Feeding infants	Poor knowledge	897	55.4
	Good knowledge	723	44.6
Knowledge related to Feeding young children	Poor knowledge	1130	69.8
	Good knowledge	490	30.2
Knowledge related to micronutrient	Poor knowledge	845	52.2
	Good knowledge	775	47.8
Knowledge related to malnutrition	Poor knowledge	1158	71.5
	Good knowledge	462	28.5
Practice	Inadequate diversity	697	43
	Adequate diversity	923	57
	Total	1620	100

**Association between knowledge on infant feeding and socio-demographic characteristic**

Understanding the relationship between dietary diversity-related knowledge on infant feeding and

socio-demographic factors is crucial to identify how social determinants influence dietary habits and health outcomes. The study results reveal statistically significant associations between knowledge of infant feeding and several socio-

demographic variables, including respondent's occupation ( $p < 0.01$ ), marital status ( $p = 0.015$ ), respondent's education level ( $p < 0.01$ ), education of the household representative ( $p < 0.01$ ), respondent's age ( $p < 0.01$ ), and age of the household representative ( $p = 0.026$ ) (Table 3).

Participants engaged in small business were about 2.5 times more likely to possess good knowledge on infant feeding compared to those in agriculture, while those that are employed are about 1.9 times more likely to have good knowledge. This suggests that economic activity and employment outside traditional agriculture may provide greater access to information or resources related to infant nutrition. Age also significantly influenced knowledge levels: respondents aged 20–29 years were about twice as likely to have good knowledge, increasing to 2.6 times for those aged 30–39 and nearly 2.7 times for those aged 40 and above, indicating that older mothers may accumulate more experiential knowledge or have greater exposure to nutrition education over time. Respondents that have achieved primary education are about 1.4 times more likely to have good knowledge on infant feeding and those that achieved secondary education or high are about 1.9 times more likely to demonstrate good knowledge on infant feeding than those without formal education, emphasizing the critical role of education in empowering maternal health literacy. Widow respondents are about 2.9 times more likely to have good knowledge on infant feeding, possibly reflecting unique socio-cultural dynamics or support networks influencing their nutrition awareness (Table 4).

#### ***Association between knowledge on feeding young children and socio-demographic characteristic***

Knowledge of appropriate feeding practices for young children is vital for promoting health growth and preventing malnutrition. However, this knowledge often varies across populations and may be influenced by socio-demographic factors. The analysis found significant associations between knowledge related to feeding young children and the occupation of the respondent ( $p < 0.01$ ), marital status ( $p = 0.01$ ), respondent's education level ( $p = 0.005$ ), education of the household representative ( $p$

$= 0.025$ ), and age of the respondent ( $p = 0.045$ ) (Table 5).

Respondents engaged in small business activities were 4.4 times more likely to demonstrate adequate knowledge of young child feeding practices compared to those in other occupations, reflecting a potential link between economic engagement and greater access to health and nutrition information. Employment in small business may provide increased social interactions, exposure to media, and resources that facilitate acquiring nutrition knowledge. Additionally, widowed respondents had approximately 2.4 times higher likelihood of possessing adequate knowledge than their counterparts, which may be influenced by unique social support networks or increased health service contacts in this group (Table 6).

#### ***Association between knowledge related on micronutrients intake and socio-demographic characteristic***

Adequate knowledge about the role of micronutrients in health is essential for promoting appropriate dietary practices and preventing related deficiencies. The analysis revealed significant association between knowledge related to micronutrients intake and the respondent's occupation ( $p < 0.01$ ), their own education level ( $p < 0.01$ ), and the education level of the household representative ( $p < 0.01$ ) (Table 7). Although the analysis indicated that respondents engaged in small business activities were approximately 2.2 times more likely to have good knowledge related to micronutrient intake, this association did not reach statistical significance ( $p = 0.09$ ).

Similarly, employed respondents were about 1.7 times more likely to demonstrate adequate knowledge, though this finding was also not statistically significant ( $p = 0.207$ ). In contrast, educational attainment emerged as a stronger predictor of micronutrient knowledge: household representatives with secondary school education or higher were nearly 2.2 times more likely to possess good knowledge, and respondents with secondary school or higher education showed similar increased likelihoods, compared to those without formal education.

**Table 3:** Bivariate analysis of the association between knowledge of infant feeding and socio-demographic characteristics

		Knowledge related on infant feeding			Chi-square	Sig.
		Poor	Good	n		
Occupation of the respondent	Agriculture-Livestock	848	682	1530	17.94	<0.01*
	Small business	8	17	25		
	Arts and crafts	29	7	36		
	Employed	12	17	29		
Marital status	Single	66	36	102	10.416	0.015*
	Married	782	631	1413		
	Divorced	30	24	54		
	Widow	19	32	51		
Education of respondent	No formal education	419	281	700	17.566	<0.01*
	Primary	423	363	786		
	Secondary and above	55	79	134		
Household size	≤5	592	480	1072	1.291	0.524
	6-9	289	235	524		
	≥10	16	8	24		
Age of the household representative	≤24	105	56	161	7.311	0.026*
	25-34	399	329	728		
	≥35	393	338	731		
Education of the household representative	No formal education	419	300	719	18.96	<0.01*
	Primary	405	323	728		
	Secondary and above	73	100	173		
Age of the respondent	<20	73	25	98	19.28	<0.01*
	20–29	438	340	778		
	30–39	326	301	627		
	≥40	60	57	117		

**Table 4 :** Multivariable logistic regression of knowledge predictors for infant feeding

	Coef	S.E.	Sig.	OR	95% C.I. for OR	
					Lower	Upper
<b>Occupation of the respondent</b>			<b>0.009</b>			
Agriculture-Livestock						
Small business	0.931	0.447	0.037	2.537	1.056	6.098
Arts and crafts	-1.139	0.433	0.009	0.32	0.137	0.748
Employed	0.171	0.407	0.674	1.187	0.535	2.633
<b>Education of the respondent</b>			<b>0.003</b>			
No formal education						
Primary	0.342	0.123	0.005	1.408	1.107	1.791
Secondary and above	0.68	0.24	0.005	1.973	1.233	3.158
<b>Marital status</b>			<b>0.034</b>			
Single						
Married	0.242	0.234	0.3	1.274	0.806	2.016
Divorced	0.209	0.362	0.564	1.232	0.606	2.507
Widow	1.069	0.379	0.005	2.914	1.386	6.127
<b>Age of the respondent</b>			<b>0.009</b>			
<20						
20–29	0.716	0.262	0.006	2.047	1.225	3.421
30–39	0.961	0.286	0.001	2.613	1.491	4.579
≥40	0.986	0.339	0.004	2.681	1.378	5.214

**Table 5:** Bivariate analysis of the associations between Knowledge on feeding young children and socio-demographic characteristics

		Knowledge related on feeding young children			Chi-square	Sig.
		Poor	Good	n		
Occupation of the respondent	Agriculture-Livestock	1074	456	1530	28.308	<b>&lt;0.01*</b>
	Small business	9	16	25		
	Arts and crafts	33	3	36		
	Employed	14	15	29		
Marital status	Single	73	29	102	11.325	<b>0.01*</b>
	Married	998	415	1413		
	Divorced	34	20	54		
	Widow	25	26	51		
Education of respondent	No formal education	484	216	700	10.496	<b>0.005*</b>
	Primary	568	218	786		
	Secondary and above	78	56	134		
Household size	≤5	741	331	1072	1.467	0.48
	6-9	370	154	524		
	≥10	19	5	24		
Age of the household representative	≤24	125	36	161	5.804	0.055
	25-34	497	231	728		
	≥35	508	223	731		
Education of the household representative	No formal education	500	219	719	7.386	<b>0.025</b>
	Primary	524	204	728		
	Secondary and above	106	67	173		
Age of the respondent	<20	80	18	98	8.025	<b>0.045*</b>
	20–29	542	236	778		
	30–39	427	200	627		
	≥40	81	36	117		

**Table 6 :** Multivariable logistic regression of knowledge predictors for feeding young children

	Coef	S.E.	Sig.	OR	95% C.I. for OR	
					Lower	Upper
<b>Occupation of the respondent</b>			<b>&lt;0.01</b>			
Agriculture-Livestock						
Small business	1.502	0.429	0.000	4.49	1.936	10.416
Arts and crafts	-1.62	0.61	0.008	0.198	0.06	0.655
Employed	0.679	0.394	0.085	1.971	0.911	4.266
<b>Marital status</b>			<b>0.012</b>			
Single						
Married	-0.042	0.241	0.86	0.958	0.597	1.538
Divorced	0.263	0.371	0.479	1.3	0.629	2.689
Widow	0.893	0.371	0.016	2.442	1.18	5.053

**Table 7:** Bivariate analysis of the associations between Knowledge related to micronutrients intake and socio-demographic characteristics

		Knowledge related on micronutrients intake			Chi-square	Sig.
		Poor	Good	n		
Occupation of the respondent	Agriculture-Livestock	799	731	1530	31.942	<0.01*
	Small business	7	18	25		
	Arts and crafts	31	5	36		
Marital status	Employed	8	21	29	4.886	0.18
	Single	56	46	102		
	Married	724	689	1413		
	Divorced	34	20	54		
Education of respondent	Widow	31	20	51	49.711	<0.01*
	No formal education	422	278	700		
	Primary	383	403	786		
Household size	Secondary and above	40	94	134	2.011	0.366
	≤5	572	500	1072		
	6-9	260	264	524		
Age of the household representative	≥10	13	11	24	0.018	0.991
	≤24	84	77	161		
	25-34	381	347	728		
	≥35	380	351	731		
Education of the household representative	No formal education	421	298	719	48.582	<0.01*
	Primary	373	355	728		
	Secondary and above	51	122	173		
Age of the respondent	<20	51	47	98	5.457	0.141
	20-29	410	368	778		
	30-39	335	292	627		
	≥40	49	68	117		

**Table 8:** Multivariable logistic regression of knowledge predictors for micronutrients intake

	Coef	S.E.	Sig.	OR	95% C.I. for OR	
					Lower	Upper
<b>Occupation of the respondent</b>			<b>0.002</b>			
Agriculture-Livestock						
Small business	0.777	0.459	0.09	2.175	0.886	5.343
Arts and crafts	-1.57	0.493	0.001	0.208	0.079	0.547
Employed	0.559	0.443	0.207	1.75	0.734	4.171
<b>Education of the household representative</b>			<b>0.002</b>			
No formal education						
Primary	0.109	0.117	0.348	1.116	0.888	1.402
Secondary and above	0.77	0.217	0.000	2.161	1.412	3.306
<b>Education of the respondent</b>			<b>0.002</b>			
No formal education						
Primary	0.319	0.117	0.006	1.376	1.095	1.729
Secondary and above	0.707	0.242	0.003	2.028	1.262	3.26

Those with only primary education were 1.4 times more likely to have adequate micronutrient knowledge. Overall, the findings suggest a positive trend between higher education levels and knowledge of micronutrients intake (Table 8).

### ***Association between knowledge on malnutrition and socio-demographic characteristic***

Malnutrition, in its various forms, remains a persistent challenge in many low- and middle-income countries, often exacerbated by limited awareness and misconceptions at the community level. Knowledge plays a foundational role in shaping attitudes and practices related to nutrition, and disparities in this knowledge frequently reflect underlying socio-demographic inequalities. Understanding the association between knowledge of malnutrition and socio-demographic characteristics is essential for addressing global malnutrition burdens. The analysis found significant association between knowledge related to malnutrition and occupation of the respondent ( $p = 0.001$ ), marital status ( $p = 0.002$ ), education of the respondent ( $p = 0.028$ ), and education of the household representative ( $p = 0.029$ ). These findings align with broader research showing that maternal literacy and educational attainment strongly influence awareness and management of malnutrition risks. (Table 9). Respondents engaged in small business activities were approximately 2 times more likely to have good knowledge of malnutrition; however, this association was not statistically significant ( $p = 0.07$ ). Similarly, divorced respondents were about 1.5 times more likely, and widowed respondents about 1.8 times more likely to possess adequate knowledge of malnutrition, though neither of these associations reached statistical significance. These findings, while indicative of potential trends, suggest that further investigation is needed to confirm the influence of marital status and economic engagement on malnutrition knowledge (Table 10).

### ***Dietary diversity-related attitude assessment***

Assessing attitudes toward dietary diversity Provides valuable insight into individuals'

willingness, motivation, and perception in eating a varied diet. While knowledge plays a foundational role, attitudes often influence the adoption of healthy eating behaviors in practice.

Understanding these attitudes helps identify potential behavioral barriers or enablers to achieving adequate dietary diversity, which is essential for optimal nutrition and the prevention of micronutrient deficiencies.

The subsequent section provides findings on attitudes of the respondents toward dietary diversity, which reflects common beliefs and their likely impact on nutrition education and intervention programs.

### ***Association between attitude and socio-demographic characteristic***

Investigating the relationship between attitude and socio-demographic characteristics is essential for designing effective public health and social interventions. It helps identify vulnerable groups, informs targeted programming, and enhances the impact of behavior change efforts. This study found significant associations between attitude toward dietary diversity and both the occupation of the respondent ( $p = 0.001$ ) and marital status ( $p = 0.034$ ) (Table 11). These findings suggest that socio-economic engagement and household structure may influence nutritional attitudes, possibly through differences in access to information, social support, and exposure to health promotion activities.

Participants engaged in small business were about 4.4 times more likely to have a positive attitude towards dietary diversity, and those employed were about 2.3 times more likely, suggesting that economic engagement correlates with greater favourable perceptions of diverse diets. Additionally, marital status influenced attitudes, with married (OR=1.2), divorced (OR=1.4), and widowed (OR=3.4) respondents more likely to hold positive attitudes toward dietary diversity compared to their counterparts. These findings indicate that occupational and marital contexts shape attitudes toward nutrition, likely through variations in social exposure, economic capacity to access diverse foods, and support networks (Table 12).

**Table 9:** Bivariate analysis of the associations between knowledge on malnutrition and socio-demographic characteristics

		Knowledge on malnutrition			Chi-square	Sig.
		Poor	Good	n		
Occupation of the respondent	Agriculture-Livestock	1086	444	1530	15.482	<b>0.001*</b>
	Small business	14	11	25		
	Arts and crafts	33	3	36		
Marital status	Employed	25	4	29	14.944	<b>0.002*</b>
	Single	69	33	102		
	Married	1031	382	1413		
	Divorced	31	23	54		
Education of respondent	Widow	27	24	51	7.142	<b>0.028*</b>
	No formal education	479	221	700		
	Primary	586	200	786		
Household size	Secondary and above	93	41	134	0.01	0.995
	≤5	767	305	1072		
	6-9	374	150	524		
Age of the household representative	≥10	17	7	24	2.974	0.226
	≤24	117	44	161		
	25-34	534	194	728		
Education of the household representative	≥35	507	224	731	7.073	<b>0.029*</b>
	No formal education	490	229	719		
	Primary	541	187	728		
Age of the respondent	Secondary and above	127	46	173	4.242	0.236
	<20	72	26	98		
	20-29	572	206	778		
	30-39	436	191	627		
	≥40	78	39	117		

**Table 10:** Multivariable logistic regression of knowledge predictors on malnutrition

	Coef	S.E.	Sig.	OR	95% C.I. for OR	
					Lower	Upper
<b>Occupation of the respondent</b>			<b>0.003</b>			
Agriculture-Livestock						
Small business	0.732	0.413	0.076	2.08	0.926	4.672
Arts and crafts	-1.642	0.61	0.007	0.194	0.059	0.639
Employed	-1.009	0.554	0.069	0.364	0.123	1.08
<b>Marital status</b>			<b>0.012</b>			
Single						
Married	-0.194	0.226	0.389	0.823	0.529	1.282
Divorced	0.403	0.352	0.252	1.496	0.751	2.982
Widow	0.574	0.358	0.108	1.776	0.881	3.581

**Table 11:** Bivariate analysis of the associations between attitude and socio-demographic characteristics

		DD-related attitude			Chi-square	Sig.
		Negative	Positive	n		
Occupation of the respondent	Agriculture-Livestock	558	972	1530	17.01	<b>0.001*</b>
	Small business	3	22	25		
	Arts and crafts	21	15	36		
Marital status	Employed	6	23	29	8.703	<b>0.034*</b>
	Single	41	61	102		
	Married	520	893	1413		
	Divorced	18	36	54		
Respondent education	Widow	9	42	51	5.639	0.06
	No formal education	271	429	700		
	Primary	279	507	786		
Household size	Secondary and above	38	96	134	5.91	0.052
	≤5	369	703	1072		
	6-9	207	317	524		
HH age	≥10	12	12	24	0.113	0.945
	≤24	59	102	161		
	25-34	261	467	728		
HH education	≥35	268	463	731	4.265	0.234
	No formal education	267	452	719		
	Primary	268	460	728		
	Secondary	52	112	164		
Respondent age	University and above	1	8	9	1.047	0.79
	<20	39	59	98		
	20-29	285	493	778		
	30-39	225	402	627		
	≥40	39	78	117		

**Table 12:** Multivariable logistic regression of positive attitude predictors towards dietary diversity

Variable	Coef	S.E.	Sig.	OR	95% C.I. for OR	
					Lower	Upper
<b>Occupation of the respondent</b>			<b>0.001</b>			
Agriculture-Livestock						
Small business	1.476	0.618	0.017	4.377	1.303	14.699
Arts and crafts	-0.895	0.344	0.009	0.409	0.208	0.801
Employed	0.825	0.462	0.074	2.281	0.923	5.639
<b>Marital status</b>			<b>0.033</b>			
Single						
Married	0.184	0.211	0.384	1.202	0.795	1.817
Divorced	0.310	0.354	0.382	1.363	0.681	2.727
Widow	1.212	0.421	0.004	3.360	1.473	7.663

**Dietary diversity-related practice assessment**

Assessing dietary diversity-related practices is essential for understanding actual food consumption behaviors within households or among individuals. While knowledge and attitudes influence decision-making, it is the observed

dietary practices that directly impact nutritional outcomes.

Evaluating these practices helps to determine the extent to which individuals or households consume a mix of different food groups, which is an important measure of diet quality and micronutrient adequacy.

**Table 13:** Minimum dietary diversity score for women

MDD-W	Frequency	Percent
Inadequate	1471	90.8
Adequate	149	9.2
Total	1620	100.0

In this study, the mean Dietary Diversity Score (DDS) was 3, with only 57% achieving at least the median score. Cereals and tubers were the most commonly consumed food group, with 98.3% of respondents reporting intake within the previous 24 hours. Legumes were also widely consumed, reported by 70.3% of participants, while vitamin A rich vegetables were consumed by 65.7%. In contrast, the intake of nuts and seeds was notably low, at only 1.2%. Dairy products were consumed by just 2.4% of respondents, while meat was reported by 11.0%. Egg consumption was rare, with only 1.7% reporting intake. The consumption of vitamin A-rich fruits remained limited at 14.3%, and the intake of other vegetables and other fruits was similarly low, reported at 10.7% and 15.9%, respectively. These findings indicate a reliance on staple foods, which may be with limited diversity across key nutrient-rich food groups.

However, the prevalence of minimum dietary diversity for women (MDD-W) defined as the consumption of at least five out of ten food groups, was significantly lower with only 9.2%. This gap indicates that while some women may consume a limited variety of foods, very few reach the minimum standard recommended for adequate dietary intake, showing that there is a large deficiency in quality and variety of diets among the study population (Table 13).

***Association between dietary diversit-related practice and socio-deographic characteristic***

Socio-demographic factors significantly dietary diversity by affecting both access to and the consumption of a variety of foods. This study found that dietary diversity-related practices were significantly associated with the respondent’s occupation ( $p < 0.01$ ), marital status ( $p = 0.015$ ), education of the respondent ( $p = 0.006$ ), and education of the household representative ( $p < 0.01$ ) (Table 14). These findings underscore that individuals engaged in certain occupations and

those with higher education levels tend to have better dietary diversity, likely due to greater economic capacity, nutrition knowledge, and access to diverse food sources.

Our study found that employed participants were about 1.7 times more likely to have a high dietary diversity score, indicating that employment may enhance access to diverse foods through increased income, exposure to information, and autonomy in food choices. Additionally, households with a representative who achieved primary or secondary education were about 1.4 times more likely to report high dietary diversity, while those with a household representative holding a university degree or higher were about 1.8 times more likely to have high dietary diversity scores (Table 15). These results underscore the strong positive influence of education on diet quality, likely due to better knowledge about nutrition and the economic means to diversify food intake.

***Association between good knowledge and positive attitude towards dietary diversity***

Respondents with good knowledge of infant feeding were significantly more likely to exhibit a positive attitude ( $\chi^2 = 47.145, p < 0.01$ ). Similarly, good knowledge of feeding young children was strongly associated with a more favorable attitude ( $\chi^2 = 71.226, p < 0.01$ ). A strong positive correlation was also observed between knowledge of malnutrition and attitude ( $\chi^2 = 98.588, p < 0.01$ ).

In addition, knowledge of micronutrient intake showed a statistically significant association with positive attitude ( $\chi^2 = 4.860, p = 0.027$ ). These findings suggest that individuals with higher levels of nutrition-related knowledge are substantially more likely to adopt a positive attitude towards dietary diversity (Table 16).

However, no statistically significant association was found between a high Dietary Diversity Score (DDS) and good knowledge of nutrition-related domains within the study population. Women who demonstrated strong knowledge in nutrition-related domains such as infant and young child feeding, malnutrition, and micronutrient intake did not necessarily translate this knowledge into more diverse dietary practices (Table 17).

**Table 14:** Bivariate analysis of the associations between dietary diversity practices and socio-demographic

		Dietary diversity related-practice			Chi-square	Sig.
		Lower	Higher	n		
Occupation of the respondent	Agriculture-Livestock	648	882	1530	30.45	<0.01*
	Small business	10	15	25		
	Arts and crafts	31	5	36		
	Employed	8	21	29		
Marital status	Single	52	50	102	10.396	0.015*
	Marries	587	826	1413		
	Divorced	29	25	54		
	Widow	29	22	51		
Respondent education	No formal education	332	368	700	10.37	0.006*
	Primary	316	470	786		
	Secondary and above	49	85	134		
Household size	≤5	470	602	1072	5.415	0.067
	6-9	212	312	524		
	≥10	15	9	24		
HH age	≤24	81	80	161	3.873	0.144
	25-34	307	421	728		
	≥35	309	422	731		
HH education	No formal education	359	360	719	26.036	<0.01*
	Primary	275	453	728		
	Secondary	61	103	164		
	University and above	2	7	9		
Respondent age	<20	52	46	98	5.857	0.119
	20–29	325	453	778		
	30–39	264	363	627		
	≥40	56	61	117		

**Table 15:** Multivariable logistic regression of high dietary diversity score predictors among respondents

	Coef	S.E.	Sig.	OR	95% C.I.for OR	
					Lower	Upper
<b>Occupation of the respondent</b>			<0.01			
Agriculture-Livestock						
Small business	-0.001	0.417	0.999	0.999	0.441	2.264
Arts and crafts	-1.992	0.489	0.000	0.136	0.052	0.356
Employed	0.502	0.479	0.294	1.652	0.647	4.221
<b>Marital status</b>			0.079			
Single						
Marries	0.367	0.211	0.081	1.443	0.955	2.181
Divorced	-0.031	0.341	0.927	0.969	0.497	1.892
Widow	-0.099	0.351	0.779	0.906	0.455	1.804
<b>Respondent education</b>			0.779			
No formal education						
Primary	0.074	0.118	0.532	1.077	0.854	1.357
Secondary and above	0.128	0.240	0.592	1.137	0.711	1.819
<b>Education of the household representative</b>			0.026			
No formal education						
Primary	0.357	0.119	0.003	1.430	1.131	1.807
Secondary	0.327	0.217	0.132	1.387	0.906	2.124
University and above	0.614	0.921	0.505	1.849	0.304	11.238

**Table 16:** Relationships between positive attitude and good knowledge towards dietary diversity among respondents

		Positive attitude		n	Chi-square	Sig.
		Negative	Positive			
knowledge on infant feeding	Poor	470	660	1130	47.145	<0.01*
	Good	118	372	490		
knowledge on feeding young children	Poor	406	491	897	71.226	<0.01*
	Good	182	541	723		
knowledge of malnutrition	Poor	504	654	1158	98.588	<0.01*
	Good	84	378	462		
knowledge of micronutrients intake	Poor	328	517	845	4.86	0.027*
	Good	260	515	775		

**Table 17:** Relationships between positive adequate practice and good knowledge towards dietary diversity among respondents

			DD-adequate practices		n	Chi-square	Sig.
			Inadequate	Adequate			
knowledge on infant feeding	Poor		401	496	897	2.316	0.128
		Good	296	427			
knowledge on feeding young children	Poor		473	657	1130	2.068	0.15
		Good	224	266			
knowledge of malnutrition	Poor		486	672	1158	1.842	0.175
		Good	211	251			
knowledge of micronutrients intake	Poor		382	463	845	3.435	0.064
		Good	315	460			

**Table 18:** Relationships between positive attitude and dietary diversity score among respondents

		DDS		n	Chi-square	Sig.
		Inadequate	Adequate			
Positive attitude	Negative	266	322	588	1.842	0.175
	Positive	431	601			
Total		697	923	1620		

In addition, there is no statistically significant association between having a high DDS and having a positive attitude towards dietary diversity. Even if women have a positive attitude about the importance of dietary diversity, this does not necessarily translate into more diverse diets in practice. This suggests that knowledge alone does not guarantee better dietary habits, likely due to other barriers such as food availability, economic constraints, or environmental constraints that limit access to a diverse diet (Table 18).

## Discussion

This study assessed the knowledge, attitudes, and practices (KAP) related to dietary diversity among pregnant and lactating women in Ngozi

province, Burundi, and identified socio-demographic factors associated with these outcomes. The large community-based sample and robust data collection methods adapted from FAO guidelines constitute important strengths, enabling a reliable assessment of nutrition-related KAP and their socio-demographic determinants in this vulnerable population. The application of multivariable logistic regression further strengthened the analysis by identifying key predictors, thereby generating actionable evidence to inform targeted interventions. Overall, the findings provide critical insights into key determinants influencing maternal nutrition behaviors in this context. Less than half of the participants demonstrated good knowledge of infant feeding (44.6%), with even lower knowledge

levels for feeding young children (30.2%) and malnutrition (28.5%). Despite these knowledge gaps, a majority maintained positive attitudes toward dietary diversity (63.7%) and over half practiced adequate dietary diversity (57%). Our findings highlight a disconnect between knowledge and practice that likely reflects the influence of contextual barriers such as socioeconomic constraints and food availability.

The main strengths of this study include its large, community-based design, use of standardized FAO-based instruments, and rigorous analytical approach, which enhance the validity and generalizability of the findings. However, the cross-sectional nature of the data limits causal inference, and potential residual confounding such as seasonal variations in food availability may also have influenced the responses. In addition, it is important to note that self-reported dietary data based on 24-hour recall may not fully capture habitual intake and remain subject to recall and social desirability bias. Despite these limitations, the study provides robust and contextually relevant evidence to guide nutrition policy and program design in similar settings.

Significant associations were observed between KAP variables and key socio-demographic factors. Occupation, educational level (of both the respondent and the household representative), marital status, and age consistently emerged as strong predictors of nutrition-related knowledge and attitudes. In particular, women engaged in income-generating activities such as small businesses or formal employment demonstrated higher levels of knowledge and more positive attitudes toward dietary diversity. This finding highlights the close interplay between economic empowerment and nutritional awareness, suggesting that improved livelihood opportunities may contribute to better maternal nutrition outcomes. Higher educational attainment substantially increased the likelihood of demonstrating good knowledge across all assessed domains, reaffirming the pivotal role of education in enhancing maternal health literacy. The positive associations observed with marital status and age further suggest that social support networks and life experience may contribute to improved nutrition-related knowledge and attitudes. Notably, although

knowledge and attitude were strongly associated, adequate knowledge did not consistently translate into improved dietary diversity practices. This disconnect underscores that, beyond knowledge and motivation, structural and contextual constraints including food insecurity, limited access to diverse foods, and sociocultural dietary norms may hinder the practical adoption of diverse diets among women.

## Conclusion

In conclusion, this study identified significant socio-demographic determinants influencing maternal knowledge, attitudes, and practices related to dietary diversity in Ngozi province, Burundi. Economic engagement, particularly in small business and employment, strongly enhanced nutrition knowledge and positive attitudes. Education level, both of the respondent and household representative, consistently emerged as a key driver of better knowledge across infant feeding, child feeding, micronutrient intake, and malnutrition domains. Marital status and age were also significant predictors, reflecting complex social and experiential influences on nutrition behaviours. Despite a majority holding positive attitudes toward dietary diversity, actual dietary diversity practices were less prevalent, indicating that positive attitudes alone are insufficient to effect dietary change without addressing structural and economic barriers.

These findings highlight the need for integrated strategies that combine nutrition education with economic empowerment, improved food access, and social support. Enhancing maternal education and literacy remains foundational to improving nutrition-related knowledge, attitudes, and ultimately dietary behaviors. Tailoring interventions based on identified socio-demographic factors especially targeting younger mothers, those with low education, and women engaged in traditional agricultural work may enhance effectiveness. Multi-sectoral strategies involving health, agriculture, education, and social protection are essential to sustainably improve maternal and child nutrition outcomes in settings challenged by poverty and malnutrition.

## Authors contributions

L.I made substantial contributions to conception of the idea, design of the study, data collection, analysis and interpretation, as well as drafting the manuscript. A.NZ made substantial contributions to conception of the idea and design of the study, acquisition and interpretation of data and has been involved in manuscript drafting. A.NI made substantial contributions to conception of the idea and design of the study, acquisition and interpretation of data and has been involved in manuscript drafting. A.M.L made substantial contributions to conception of the idea and design of the study, acquisition and interpretation of data and has been involved in manuscript drafting. All authors proof read and approved the final version of the manuscript.

## Acknowledgment

The authors extend their sincere appreciation to the affected communities, community leaders, and health care workers of Ngozi Province for their valuable cooperation and support throughout this study. The authors also acknowledge with appreciation the financial support provided by the East Africa Nutrition Science Institute, without which this research would not have been possible

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