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Household dietary diversity and associated factors in rural and peri-urban areas of Mbale District, Eastern Uganda

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Abstract

Background Globally, the importance of dietary diversity in addressing malnutrition and promoting overall health is increasingly being recognized. However, increasing urbanization has led to shifts in dietary preferences, food consumption patterns, and a greater reliance on less nutritious processed foods. Efforts to address these challenges have been futile, as nutrition in peri-urban areas often receives less attention, with food and nutrition insecurity typically seen as a rural issue. This study, therefore, examined dietary diversity (DD) and its socio-economic and demographic predictors in rural and peri-urban households.

Methods A cross-sectional study of 221 households in rural and peri-urban Eastern Uganda collected data on DD, socio-economic and demographic factors using the Household Dietary Diversity Score (HDDS) and structured questionnaires, respectively. The data were analyzed in SPSS using descriptive statistics, and independent sample t-tests compared mean DD scores between rural and peri-urban areas. Pearson Chi-square tested differences in food group consumption, while binary logistic regression in STATA identified socio-economic and demographic predictors of household dietary diversity.

Results There was no significant difference in dietary diversity (DD) between rural and peri-urban households, with mean DD scores of 6.64 ± 1.60 and 6.55 ± 1.30 , respectively, indicating a medium level in both areas. However, significant differences were observed in the consumption of cereals and roots/tubers/plantains ($p < 0.05$), while intake of animal-source foods and fruits remained generally low across both settings. In rural areas, household DD was significantly influenced by the education levels of the household head ($\beta: -1.276$) and spouse ($\beta: -1.123$), as well as access to credit ($\beta: 1.136$), while in peri-urban areas, average monthly income ($\beta: -0.801$) was a significant predictor of household DD.

Conclusion The study showed that dietary diversity was similar and at a medium level in both rural and peri-urban households, and mainly consisted of plant-based foods, with limited consumption of fruits and animal-sourced foods. Socio-economic factors, including level of education, access to credit, and income, significantly influenced DD. These results highlight the role of socio-economic and demographic factors in shaping household diets and underscores the need for targeted interventions to improve dietary diversity and address nutritional gaps in the study area.

Keywords Dietary diversity, Rural, Peri-urban, Malnutrition, Eastern Uganda

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Background

Globally, the importance of dietary diversity in addressing malnutrition and promoting overall health is increasingly being recognized [1]. It is not surprising that the significance of dietary diversity is emphasized by the Sustainable Development Goals (SDGs) of the United Nations, especially SDG 2 (Zero hunger) and SDG 3 (Good health and well-being), which emphasize the need to improve nutrition and achieve food security for all by 2030 [2]. Dietary diversity is an essential aspect of the broader concept of food security, which focuses on not only access to food but also the variety and quality of diets within households [3, 4]. Household dietary diversity (HDD) measures the range and quality of foods consumed in a household over a specific period [5]. This is commonly assessed using the Household Dietary Diversity Score (HDDS), which serves as a proxy for both household food security and nutritional status [6–8]. Research shows that more diverse diets are associated with better caloric and protein intake, increased consumption of animal-based proteins, higher household income, and improved health outcomes, such as enhanced birth weight, child growth, and hemoglobin levels [9–11].

Previous studies in low-income countries, including Sub-Saharan Africa, have demonstrated that most rural households have low to median dietary diversity [12–14]. In these regions, households often face malnutrition-related health challenges, such as stunting, wasting, and micronutrient deficiencies, due to diets that lack variety [15, 16]. The limited diversity in diets is typically a result of dependence on staple crops like maize, millet, and cassava, which are mainly sourced from subsistence farming in rural communities [14, 17, 18]. This reliance on traditional staple foods contributes to food insecurity, a problem that has long been associated with rural areas [19].

In Uganda, many rural households rely on produce from their own gardens, leading to monotonous diets primarily composed of staple foods [20–22], which makes them vulnerable to food insecurity, particularly during periods of high food prices, declining soil fertility, low income, and economic shocks caused by adverse weather events [23, 24]. Urbanization in Uganda, which is currently around 21% and projected to reach 30% (20 million people) by 2030 [25, 26], has resulted in the emergence of many peri-urban areas. Peri-urban areas can be described as the transition zone between urban and rural areas characterized with low population densities, limited infrastructure and amount of agricultural and natural land as compared to urban areas and are therefore not “urban” or “rural” [27, 28]. As urban populations grow, land for peri-urban agriculture becomes increasingly scarce, compromising the ability of these areas to meet caloric needs and sustain local economies, thereby

reducing the resilience of regional food systems [27, 29–31]. Urbanization has a substantial impact on food and nutrition security in peri-urban areas by leading to the loss of farmland, soil degradation, declining water quality, and limited access to sanitation [32]. Moreover, continued urban expansion is linked to nutritional challenges such as obesity, overweight, and non-communicable diseases, which are driven by factors like rising food prices, climate change, and shifts in dietary patterns toward nutrient-poor, processed foods [33–36]. These issues may also affect peri-urban households, which are often economically disadvantaged, marginalized, and heavily reliant on urban employment and services [27, 37]. Considering the fact that, food and nutrition insecurity has been a constant challenge in rural areas [38, 39], transformation of rural households to peri-urban households also occurs simultaneously with little understanding of dietary parameters. The situation could even be worse for the peri-urban households due to persistent expansion of urban areas and cities which have resulted in the rampant sale and destruction of land meant for peri-urban agriculture [40]. Despite growing urbanization in Uganda as evidenced from the above literature, research on dietary diversity within peri-urban contexts remains limited. Existing studies on HDD in Sub-Saharan Africa tend to focus on rural and urban settings [14, 41, 42], overlooking the unique challenges and opportunities faced by peri-urban households. Furthermore, numerous studies in low-income areas, particularly Sub-Saharan Africa, have consistently shown that socio-economic and demographic factors such as sex of household head, household income, education level, occupation, household size and marital status are critical determinants of dietary diversity [12, 39, 43–49]. While these studies conducted in other regions give insights on the influence of socio-economic and demographic factors on HDD, there is limited information on dietary diversity and associated factors in rural and peri-urban areas in the Mbale District of Uganda. This study sought to fill the above gaps by investigating dietary diversity in both rural and peri-urban areas of Mbale District in Eastern Uganda. Specifically, it addressed two main questions: Is there a significant difference in dietary diversity between rural and peri-urban households in the district? Do socio-economic and demographic factors affect the dietary diversity of these households? Our study contributes to existing literature by focusing on peri-urban areas, a setting often overlooked in dietary studies, and by providing a detailed analysis of how urbanization affects dietary diversity, thus addressing a critical gap in the understanding of nutritional challenges in rapidly urbanizing regions. Additionally, it analyzes socio-economic and demographic influences on dietary diversity, aiming

to inform targeted interventions for improving nutrition in marginalized peri-urban communities in Uganda and similar contexts.

Methods

The current study employed a cross-sectional design and was quantitative in nature. The study took place in Mbale district, Eastern Uganda, in both rural and peri-urban areas. Mbale district is bordered by Manafwa and Bududa districts in the East; Sironko in the North; Bukedeza in the Northwest; Budaka and Pallisa in the West, Tororo and Butaleja in the Southwest [50] (Fig. 1). The district is largely inhabited by the Bagisu tribal communities that speak Lumasaaba dialect. Agriculture is the main economic activity in Mbale district whereby different crops such as bananas, Irish potatoes, maize, millet, cassava, sweet potatoes, fruits, coffee and cotton among others. Mbale district has for long been a food basket supplying most parts of Uganda and neighbouring markets outside like Kenya. Despite that, it has a high rate of food and nutrition insecurity. For instance, in

2017, Uganda Bureau of Statistics reported that 15.5% of households in Mbale district had less than two (2) meals per day [50].

The study was conducted in households within the rural and peri-urban areas of Mbale district. The respondents were household heads (male or female) who consented to be enrolled for the study. The number households were 201 calculated using a standard formula by Taherdoost [51].

$$\text{Sample size } n = \frac{p(100 - p)Z^2}{E^2} \tag{1}$$

Where n is required sample size, p is the proportion of households (15.5%) in Mbale district that consumed fewer than two meals (2) daily [43], Z is the confidence level at 95% (standard value=1.96), and E is the margin of error at 5%. The number of households was increased by 10% to 221 to account for non-responses, resulting in 111 households in rural areas and 110 households in peri-urban areas being enrolled. The households were chosen through a multi-stage sampling process. In the first stage,

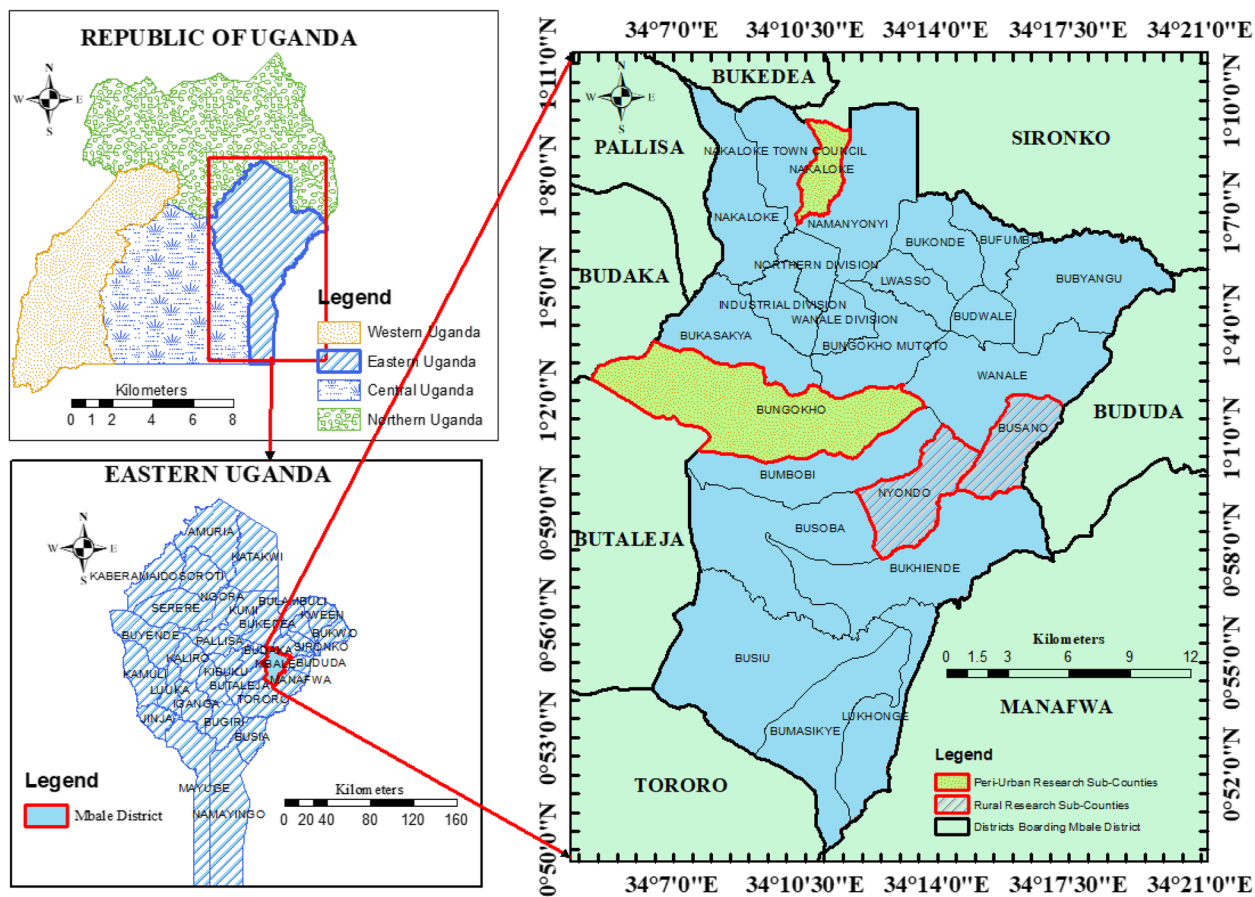


Fig. 1 Location of Mbale district indicating study areas

seven (7) sub-counties with peri-urban characteristics and eleven (11) sub-counties in rural areas were listed. From these, two (2) sub-counties from the rural areas (Nyondo and Busano) and two (2) from the peri-urban areas (Bunghokho and Nakaloke) were selected using simple random sampling. Following this, two (2) parishes within each sub-county and two (2) villages within each parish were also selected using the simple random sampling method.

In the fourth stage, with the assistance of the Local Council I (LC I) chairperson, a list of households was obtained from the local register. From this comprehensive list, systematic random sampling was used to select participating households. The process involved choosing a starting point at random on the list, and then every k th household was selected, where n represents the sampling interval [52]. The sampling interval (n) was determined by dividing the total number of households on the list by the required sample size. This method ensured that the sample was evenly distributed across the community, providing a representative selection of households for the study.

Data collection was conducted by four trained research assistants who interviewed the respondents in both the local language (*Lumasaaba*) and English. Data on household dietary diversity was collected using the Household Dietary Diversity Score Questionnaire (HDDSQ) adapted from the Food and Agricultural Organization guidelines but with modification to accommodate the commonly consumed local foods in the study area [9, 53]. The HDDS questionnaire comprised of 12 food groups: (i) cereals; (ii) roots and tubers; (iii) vegetables; (iv) fruits; (v) meat, poultry, offal; (vi) eggs; (vii) fish and seafood; (viii) pulses/legumes/nuts; (ix) milk and milk products; (x) oil/fats; (xi) sugar/ honey; (xii) beverages, spices [9, 52, 54]. The respondents were asked to list all the foods and beverages prepared and consumed in the home, purchased or gathered from outside and consumed at home in the previous 24 h. However, one limitation of the 24-h dietary recall method is the potential for recall bias [54]. Then all the foods and beverages mentioned were listed in the questionnaire. For any composite dishes mentioned, the respondents were asked to list all ingredients used in during preparation. After the respondents had completed mentioning the foods and beverages consumed, probing of the respondents was done by asking specific, detailed questions about meals and snacks consumed in the previous 24 h. This prompted the participants to remember and report their food intake more accurately. This was followed by ticking “1” in the column next to the food group which was consumed and “0” in the right-hand column of the questionnaire when it was certain that no foods in that group were eaten by any member in the household in the previous 24 h.

A structured questionnaire with both open and closed ended questions was used to collect household socio-economic and demographic data. These included; sex of household head, age of the household head, marital status of the household head, education level of household head, education level of the spouse, number of years spent in school by the household head and the spouse, occupation of household head, occupation of the spouse, household size, number of income earners in the household, average household monthly income, average household monthly expenditure, average household monthly expenditure on food, household access to credit, household means of obtaining food, household agricultural land ownership and location of households.

All the collected data were entered into Microsoft Excel and SPSS version 20 software [55] where preliminary cleaning and exploration was done. Data were analyzed using descriptive statistics including frequencies, percentages, means, and standard deviations. The sum of the food groups consumed was calculated for each household. The value of this variable ranged from 0 to 12. Finally, HDDS was categorized based on [56], in which a five or less (0–5) food groups, six to seven (6–7) food groups and greater than or equal to eight (8–12) food groups were classified as lowest dietary diversity, medium dietary diversity and high dietary diversity respectively [56]. Independent sample t-test was performed to compare the mean dietary diversity score of households in the rural and peri-urban areas. In addition, Pearson Chi-square was performed to test the difference in the consumption of the various food groups in the rural and peri-urban households. The socio-economic and demographic predictors of household dietary diversity were determined by binary logistic regression in STATA software version 13 [57] on a total of 14 socio-economic and demographic variables (Table 1). We catered for multicollinearity by omitting all a total of five (5) variables with very high Variance Inflation Factor (VIF) of above 5. These included occupation of the household head, occupation of the spouse, number of income earners in the household, average household monthly expenditure on food and household means of obtaining food. The relationship is predicted by the following equations:

$$\text{General mode : } Y = \beta_0 + \beta X + E \tag{2}$$

$$\text{Therefore : } Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots \dots \dots \beta_{15} X_{14} \tag{3}$$

Dietary diversity score (1, if household has “high” dietary diversity; 0, if household has “medium” or “low” dietary diversity). β_0 is the vector of unknown parameters (intercept), E is the error term. $\beta_1, \beta_2, \beta_3, \beta_4, \dots \dots \dots \beta_{14}$ are the regression coefficients indicating the magnitude of change (increased or decreased risk) in the independent variable.

Table 1 Independent variables, description/measurement and the priori expected sign

Independent variables	Description	Variable type	Variable coding/Definition	Expected priori sign
X ₁	Sex of household head	Dummy	"Male" = 1, "Female" = 0	+ or -
X ₂	Age of the household head	Continuous	Continuous	+ or -
X ₃	Education level of household head	Dummy	"Secondary" and "Tertiary" = 1 (higher education), while "Primary" and "No formal education" = 0 (lower education)	+ or -
X ₄	Education level of spouse	Dummy	"Secondary" and "Tertiary" = 1 (higher education), while "Primary" and "No formal education" = 0 (lower education)	+ or -
X ₅	Marital status of household head	Dummy	"Married" = 1, and all other categories (single, divorced, widow, widower, separated) = 0	+ or -
X ₆	Occupation of the household head	Dummy	"Employed (salaried)" = 1, and all other categories (Not employed, Small scale trading, Casual labor, Farming, and Retired Pension earner) = 0	+ or -
X ₇	Occupation of spouse	Dummy	"Employed (salaried)" = 1, and all other categories (Not employed, Small scale trading, Casual labor, Farming, and Retired Pension earner) = 0	+ or -
X ₈	Household access to credit	Dummy	"Yes" = 1 (has access to credit), "No" = 0 (does not have access)	+ or -
X ₉	Average household monthly income	Dummy	"160,000–200,000" and "Above 200,000" = 1 (higher income) and "Below 50,000" and "50,000–150,000" = 0 (lower income)	+ or -
X ₁₀	Number of income earners in a household	Dummy	"3–5" and "Above 5" = 1 (higher number of income earners) and "None" and "1–2" = 0 (low number of income earners)	+ or -
X ₁₁	Average household monthly expenditure	Dummy	"160,000–200,000" and "Above 200,000" = 1 (higher income), while "Below 50,000" and "50,000–150,000" = 0 (lower income)	+ or -
X ₁₂	Average household monthly expenditure on food	Dummy	"60,000–100,000," "110,000–200,000," and "Above 200,000" = 1 (higher expenditure), while "Below 20,000" and "20,000–50,000" = 0 (lower expenditure)	+ or -
X ₁₃	Household size	Dummy	"6–10 persons" and ">10 persons" = 1 (large household), while "1–5 persons" = 0 (small household)	+ or -
X ₁₄	Household means of obtaining food	Dummy	"Purchase" = 1 (purchasing food as the primary means), while "Own production" and "Gifts/donations" = 0 (other means of obtaining food)	+ or -

Results

Socio-economic and demographic characteristics of respondents

The results (Tables 2 and 3) show that majority of the households were male-headed ($p > 0.05$) (rural, 90.1%; peri-urban, 82.7%). A significantly higher proportion of household heads ($p < 0.05$) in rural areas (68%) than in peri-urban areas (40%) were occupied in farming. Similarly, a significantly higher ($p < 0.05$) proportion of spouses from rural households (84.4%) were occupied in farming compared to those in peri-urban areas (63.7%). More households in peri-urban areas (67.3%) than in rural areas (46.8%) obtained their food through purchase ($p < 0.05$) while 51.4% of rural households obtained their food from own production compared to the 32.7% of households in peri-urban $p < 0.05$). Ownership of

agricultural land accounted for 40.5% and 0.9% ($p < 0.05$) by inheritance in rural and peri-urban households, respectively. On the other hand, a significantly higher ($p < 0.05$) proportion of peri-urban households acquired agricultural land through borrowing (34.9%) and renting (36.8%) compared to their rural counterparts (0.9%). Regarding education level, the mean number of years spent in school by a household head from rural areas (8.7 ± 4.37 years) was significantly higher ($p < 0.05$) than that of peri-urban areas (7.2 ± 3.97 years).

Dietary diversity of rural and peri-urban households

The results (Table 4) indicate that food groups of plant origin were mostly consumed by most households in both rural and peri-urban areas accounting for 80–100%. These food groups include beverages/condiments and or spices;

Table 2 Socio- economic and demographic characteristics of respondents

Characteristics	Rural		Peri-urban		p-value
	n	%	n	%	
Sex of Household Head					0.110
Male	100	90.1	91	82.7	
Female	11	9.9	19	17.3	
Marital Status of the household head					0.935
Single	1	0.9	3	2.7	
Divorced	1	0.9	1	0.9	
Married	96	86.5	91	82.7	
Widower	1	0.9	1	0.9	
Widow	11	9.9	13	11.8	
Separated	1	0.9	1	0.9	
Education level of household head					0.163
No formal education	6	5.4	8	7.3	
Primary	52	46.8	57	51.8	
Secondary	34	30.6	37	33.6	
Tertiary	19	17.1	8	7.3	
Education level of spouse					0.510
No formal education	12	12.5	9	9.9	
Primary	47	49.0	50	54.9	
Secondary	28	29.2	28	30.8	
Tertiary	9	9.4	4	4.4	
Occupation of household head					0.000
Not employed	1	0.9	3	2.7	
Employed (salaried)	24	21.6	9	8.2	
Small scale trading	8	7.2	12	10.9	
Casual labor	8	7.2	40	36.4	
Farming	68	61.3	44	40.0	
Retired Pension earner	2	1.8	2	1.8	
Occupation of spouse					0.000
Not employed	1	1.0	5	5.5	
Employed (salaried)	10	10.0	4	4.4	
Small scale trading	3	3.1	16	17.6	
Casual labor	1	1.0	8	8.8	
Farming	81	84.4	58	63.7	
Household size					0.823
1—5 persons	45	40.5	41	37.3	
6—10 persons	58	52.3	53	48.1	
> 10 persons	8	7.2	16	14.6	

n: number of households; n = 111 (Rural), n = 110 (Peri-urban)

pulses/legumes/nuts (except in peri-urban households), vegetables and cereals. Oils/fats were consumed by 77.5% of rural households and 75.5% of the peri-urban households. Fruits were not commonly consumed (rural area 41.4% and peri-urban area 40%). In both rural and peri-urban areas, animal sourced food groups (meat/poultry/offals, eggs, fish and sea foods, milk and milk products) were consumed by less than 20% of the households. Among all the food groups

there were significant differences in consumption of cereals and roots/tubers/plantains between the rural and peri-urban households ($p < 0.05$).

Dietary diversity was not significantly different ($p > 0.05$) between rural and peri-urban households (Table 5). Only 24.3% and 20.9% of the rural and peri-urban households respectively had high dietary diversity. The household dietary diversity score status generally showed medium dietary diversity in both the rural and peri-urban households as indicated by the mean of 6.64 ± 1.60 in rural areas and 6.55 ± 1.30 in peri-urban areas. Medium dietary diversity accounted for 46.0% in rural areas and 58.2% in peri-urban areas, while low dietary diversity was prevalent among 29.7% and 20.9% of the rural and peri-urban areas respectively.

Predictors of household dietary diversity

The results in Table 6 show that having at least secondary or tertiary education (compared to primary or no formal education) for both the household head ($p = 0.018$) and the spouse ($p = 0.041$), along with access to credit ($p = 0.023$), were significant predictors of household dietary diversity in rural areas. In contrast, in peri-urban areas, only the average monthly income (Below 50,000 and 50,000–150,000 Uganda shillings) was a significant predictor of household dietary diversity ($p = 0.007$).

Discussion

Based on the results in Table 4, more than 70% of the food groups consumed in both rural and peri-urban areas were plant-based, with the exception of roots, tubers, and plantains in peri-urban areas. Our finding is in agreement with [22, 58–60] that reported a high consumption of starchy staple foods by households. Additionally, the findings are consistent with previous studies [20, 21] which posited that majority of both rural and peri-urban households derived most of their energy from starchy staples. This dietary pattern may be influenced by cultural preferences, availability, or financial limitations, as many staple foods like maize, matooke, cassava root, and sweet potatoes are significantly less expensive and more accessible than fruits and nutrient-rich animal products such as meat, milk, dairy products, and eggs [6, 22]. The significant difference in cereal and roots/tubers consumption between the rural and peri-urban households ($p < 0.05$) (Table 4) may be attributed to the varying means of food accessibility between the two areas. For instance, majority of rural households relied more on foods from own production, whereas peri-urban households who had to meet their food needs through purchase (Tables 2 and 3), leading to different consumption patterns.

In contrast, less than 20% of households in both settings consumed foods derived from animal sources.

Table 3 Socio- economic and demographic characteristics of respondents

Characteristics	Rural		Peri-urban		p-value
	n	%	n	%	
Number of income earners in the household					0.212
None	0	0.0	1	0.9	
1–2	109	98.2	103	93.6	
3–5	1	0.9	5	4.5	
Above 5	1	0.9	1	0.9	
Average household monthly income					0.195
Below 50,000	21	18.9	10	9.1	
50,000–150,000	35	31.5	41	37.3	
160,000–200,000	16	14.4	15	13.3	
Above 200,000	39	35.1	44	40.0	
Average household monthly expenditure					0.561
Below 20,000	9	8.1	4	3.6	
20,000–50,000	19	17.1	20	18.2	
60,000–100,000	36	32.4	32	29.1	
110,000–200,000	27	24.3	28	25.5	
Above 200,000	20	18.0	26	23.6	
Average household monthly expenditure on food					0.535
Below 20,000	16	14.4	11	10.0	
20,000–50,000	36	32.4	31	28.2	
60,000–100,000	29	26.1	38	34.5	
110,000–200,000	20	18.0	17	15.5	
Above 200,000	10	9.0	13	11.8	
Means of obtaining food					0.005
Own production	57	51.4	36	32.7	
Purchase	52	46.8	74	67.3	
Gifts/donation	2	1.8			
Household access to credit					0.940
Yes	50	45.0	49	44.5	
No	61	55.0	61	55.5	
Household agricultural land ownership					0.001
Allocated	11	9.9	8	7.5	
Inherited	45	40.5	21	19.8	
Borrowed	3	2.7	1	0.9	
Rented	17	15.3	37	34.9	
Bought	35	31.5	39	36.8	
		Mean (Standard Deviation)		Mean (Standard Deviation)	
Age of the household head		42.5 (12.04)		44.9 (11.27)	0.444
Years spent in school by household head		8.7 (4.37)		7.2 (3.97)	0.041
Years spent in school by spouse		7.5 (4.25)		6.4 (3.57)	0.086

n: number of households; n = 111 (Rural), n = 110 (Peri-urban)

P-value significant at ≤ 0.05 level

While plant-based foods provide essential nutrients, the low consumption of animal-sourced foods indicates a risk of nutrient deficiencies, especially in vitamins like B12, iron, and quality protein that are more readily

available in animal products and are particularly vital for proper child development and maternal health [1, 11, 61, 62]. Additionally, the low consumption of fruits (41.4% in rural areas and 40% in peri-urban areas) aligns with

Table 4 Proportion of households consuming various food groups in the previous 24 h segregated between rural and peri-urban areas

Food groups consumed	Rural		Peri-urban		p-value
	n	%	n	%	
Cereals	94	84.7	103	93.6	0.032
Roots, tubers and plantains	81	73.0	53	48.2	0.000
Vegetables	99	89.2	99	90.0	0.844
Fruits	46	41.4	44	40.0	0.827
Meat, poultry, offal	17	15.3	20	18.2	0.568
Eggs	1	0.9	2	1.8	0.556
Fish and sea foods	9	8.1	18	16.4	0.061
Pulses/legumes/nuts	92	82.9	84	76.4	0.229
Milk and milk products	17	15.3	8	7.3	0.059
Oils/fats	86	77.5	83	75.5	0.723
Sweet/honey	89	80.2	97	88.2	0.103
Beverages, condiments, spices	108	97.2	110	100.0	0.083

n: number of households, % proportion of households

P-value significant at ≤ 0.05 level

findings from [6, 14, 22, 63], which indicated low levels of fruit and animal source food intake among Ugandan households. Moreover, besides providing essential micro-nutrients [64, 65], sufficient fruit consumption among household members is linked to a lower risk of non-communicable diseases, including cancer, diabetes, obesity, and hypertension, contributing to overall health [66, 67]. These findings suggest potential deficits in vitamins and minerals such as vitamin C and potassium [5, 63, 68]. Therefore, nutrition education and increasing access to and affordability of these food groups should be prioritized in future interventions.

The results (Table 4) further, indicate that a large proportion of households in both rural and peri-urban areas consumed sweets, particularly sugar. This is likely because most households in these areas added sugar to their tea, either in the morning, evening,

or both. This observation aligns with studies by [59, 69], which reported a high level of sugar consumption among households. In addition, the findings indicate that a large share of households in rural and peri-urban areas consumed oils and fats, beverages, condiments, and spices. These results are consistent with previous studies [69, 70], which identified these food groups as the most commonly consumed by households. This pattern may be explained by the widespread use of oils, fats, condiments, and spices in cooking, as they are affordable and readily available in local shops.

The results of the present study also showed that there was no significant difference in dietary diversity between rural and peri-urban households, as evidenced by a *p*-value greater than 0.05 (Table 5). This suggests that despite differences in geographic location and access to resources, both rural and peri-urban households face similar challenges in maintaining dietary diversity, likely due to shared socio-economic or cultural factors influencing food choices and accessibility. For instance, only a small percentage of households (24.3% in rural and 20.9% in peri-urban) achieved high dietary diversity, underscoring that the majority are not meeting optimal nutritional standards. This aligns with the medium dietary diversity scores reported for both groups (6.64 ± 1.60 for rural and 6.55 ± 1.30 for peri-urban) (Table 5). Our findings differ from those reported in 2017 [71], which indicated a high mean household dietary diversity score (7.6 to 8.2 food groups consumed). However, the mean scores from the current study are generally lower than those reported by [56, 60, 69], but higher than those from other earlier studies [58, 60, 72]. Similarly, a considerable proportion of households had medium (46% rural, 58.2% peri-urban) or low (29.7% rural, 20.9% peri-urban) dietary diversity. Our findings are consistent with previous studies where majority of rural households had low to medium dietary diversity [12–14]. On the contrary,

Table 5 Proportion of rural and peri-urban household dietary diversity status segregated by cut-offs for the number of food groups consumed

Number of food groups consumed	Status	Household Location				p-value
		Rural		Peri-urban		
		n	%	n	(%)	
0–5	Low dietary diversity	33	29.7	23	20.9	1.68
6–7	Medium dietary diversity	51	46.0	64	58.2	
8–12	High dietary diversity	27	24.3	23	20.9	
HDDS mean score (SD)		(6.64±1.60)		(6.55±1.30)		

n: number of households, % proportion of respondents

P-value significant at ≤ 0.05 level

Table 6 Socio-economic and demographic predictors of household dietary diversity in rural and peri-urban areas

Household Location				
Socio-economic and demographic factors	Rural		Peri-urban	
	β	P-values	β	P-values
Sex of household head	14.020	0.991	0.879	0.655
Age of household head	-0.037	0.104	0.030	0.228
Marital status of the household head	126.237	0.917	-88.576	0.120
Education level of household head	-1.276	0.018**	-0.594	0.264
Education level of the spouse	-1.123	0.041**	0.895	0.118
Household size	0.064	0.458	-0.158	0.148
Average household monthly income	-0.165	0.748	-0.801	0.007**
Average household monthly expenditure	-0.448	0.434	0.214	0.772
Household access to credit	1.136	0.023**	-0.451	0.431
Constant	-139.309	0.954	86.483	0.128

β : regression coefficient

** *p*-value significant at < 0.05. Occupation of the household head, occupation of the spouse, number of income earners in a household, average household monthly expenditure on food and household means of obtaining food were eliminated during the regression analysis due to multicollinearity

our findings differ from those in South Africa, where rural households exhibited a high dietary diversity status, with an average HDDS of 80.8% for food consumption [73]. In the current study, the higher proportion of rural households with low dietary diversity may suggest greater obstacles to accessing diverse foods, possibly due to lower income, restricted market access, or agricultural limitations [74, 75]. In peri-urban areas, while a higher percentage achieved medium diversity, the low proportion of high diversity households indicates that urbanization does not automatically translate to better nutrition, possibly due to reliance on inexpensive, less nutritious foods [76]. The high prevalence of low to medium dietary diversity in both rural and peri-urban households suggests inadequate access to a variety of nutrient-rich foods, which could have long-term health implications such as malnutrition or diet-related non-communicable diseases [1, 77]. This is concerning since dietary diversity is a crucial indicator of diet quality, which influences overall health and development, especially in vulnerable groups like children and pregnant women [78–80]. The findings of this study highlight critical areas for nutrition interventions that focus on increasing access to nutrient-rich foods in rural and peri-urban Uganda and other resource-limited settings. Further research is also needed to explore cultural practices and economic factors influencing dietary choices, such as food pricing, agricultural practices, and market access could help design more targeted nutrition programs in both rural and peri-urban areas. Additionally, studies on the impact of nutrition education programs on changing dietary behaviors in these areas could be beneficial.

The results of the present study (Table 6) indicated that the education levels of both the household head and the spouse had a significant negative association ($p < 0.05$) with household dietary diversity scores in rural areas, whereas no such association was observed in peri-urban areas. The findings show that when both the household head and the spouse had at least secondary or tertiary level of education (as opposed to primary or no formal education), dietary diversity was reduced by 1.276 ($p = 0.018$) and 1.123 ($p = 0.041$), respectively. The results suggest that education level of least secondary or tertiary level, in this context, does not necessarily translate into practical knowledge or skills related to diverse dietary choices. The significant negative impact of education levels for both the household head and the spouse on dietary diversity in rural households in the current study is not surprising, as similar findings have been reported elsewhere. For instance, a study conducted among Spaniards born between the 1940s and 1960s revealed that education level was negatively associated with dietary diversity [81]. Similarly, in Bangladesh, mothers who attained secondary and above had inadequate dietary diversity [82]. In contrast, the findings of this study do not align with earlier studies which identified the education level of the household head [48, 70, 83, 84] and the spouse [85–89] as significant positive predictors of dietary diversity. Higher education is often associated with increased awareness of nutritional requirements and the benefits of a balanced diet, leading to a more diverse food selection [12–14, 62]. Additionally, higher education can also be linked to higher income, better employment opportunities [46, 73, 90], and the ability to make informed food choices, which in turn may provide households with more resources to

afford a variety of foods. The unexpected negative association suggests that the relationship between education and dietary diversity may be context-specific and influenced by other potential factors such as limited market access, cultural food preferences, or time constraints. For instance, rural areas might not have consistent access to markets that stock a wide range of fresh and varied foods. Therefore, without adequate market access, educated individuals who reside in areas with poor infrastructure or limited availability of diverse and nutritious foods, such as fruits, vegetables, or protein-rich options may rely on staple foods that are easy to source, thus reducing dietary diversity [91, 92]. Similarly, education levels do not always override cultural norms or deeply ingrained dietary habits. In some contexts, certain food groups may be culturally undervalued or avoided, even if individuals are aware of their nutritional benefits. For example, some communities may emphasize staple grains or root crops while limiting the inclusion of fruits, vegetables, or animal protein, which are essential for dietary diversity. Furthermore, educated individuals often engage in professional jobs or roles that demand long working hours, leaving little time for meal preparation or planning. As a result, they may rely on quick, convenient, and often less diverse food options. For instance, they might opt for fast food, processed meals, or repetitive meal choices due to convenience, which inherently limits the variety of nutrients consumed [34–36]. Furthermore, the time constraints may reduce their ability to engage in household activities like gardening or shopping for fresh, diverse ingredients. Therefore, future research should explore these mediating factors in greater depth, particularly in similar settings, to provide clearer insights into the observed phenomenon.

On the other hand, access to credit significantly increased dietary diversity by 1.136 ($p=0.023$) in rural areas. Our finding is supported by [47, 84, 93] that reported access to credit as a significant predictor of consumption of diversified diet. This finding suggests that financial resources play a critical role in enabling households to access a variety of foods. Credit facilities may allow households to purchase diverse foods, invest in agricultural production, or cope with financial shocks, thereby improving dietary diversity [47, 84, 93]. It highlights the importance of financial empowerment initiatives in rural settings.

In peri-urban areas, only average monthly income (Below 50,000 and 50,000–150,000 Uganda shillings) significantly decreased household dietary diversity by 1.136 ($p=0.801$). This finding contradicts research from Nepal [94], which reported a positive link between household income and dietary diversity, supporting the notion that higher income levels improve access to diverse foods due

to increased purchasing power. Unlike rural areas, where subsistence farming may affect food consumption patterns, peri-urban households largely depend on markets for food, making income a key factor in dietary choices. Higher income likely provides more purchasing power, enabling households to buy a wider range of foods [62]. The negative coefficient may suggest that at lower income levels, peri-urban households struggle to afford a diverse diet, and as income rises, dietary diversity increases. This underscores the need for economic interventions, such as income-generating activities, job creation, and subsidies, to improve dietary diversity in peri-urban settings. In a nutshell, the findings of the current study contribute to the understanding of how socio-economic factors influence household dietary diversity in different geographic contexts. This distinction suggests that interventions aimed at improving dietary diversity must be context-specific, recognizing the unique challenges and opportunities present in rural and peri-urban areas. The current study emphasizes the need to integrate financial support mechanisms, such as microcredit and income-generating activities, into nutrition programs to enhance dietary outcomes of households in rural and peri-urban settings in other parts of Uganda and developing countries.

Limitations of the study

The study has several limitations. Being cross-sectional, it did not account for seasonal variations in food consumption, which future longitudinal studies could address by collecting data across different seasons to better understand temporal trends and their impact on the food consumption patterns of the rural and peri-urban households. Our study relied on self-reported 24-h dietary recall, which is prone to recall bias, and data were aggregated at the household level, potentially overlooking individual dietary habits. Furthermore, while our study provides valuable quantitative insights, future research could benefit from a mixed-methods approach, integrating qualitative methods like focus groups and interviews to capture deeper behavioral and cultural influences on dietary food choices.

Conclusion

The study found that dietary diversity was generally similar and at medium level in both rural and peri-urban households, predominantly consisting of plant-based foods, with limited fruits and animal-sourced foods. However, factors influencing dietary diversity levels were distinct across the two settings. For rural households, socio-economic factors like education and access to credit emerged as critical determinants, suggesting a need for interventions focused on agricultural diversification, community gardens, affordable

credit, and nutrition education. In contrast, for peri-urban households, average monthly income played a more significant role, underscoring the importance of initiatives to boost household income through employment opportunities, small business support, subsidized market access and vocational training. These findings suggest that future research should focus on the context-specific interventions and their impact in both rural and peri-urban areas. Additionally, longitudinal studies could be conducted to capture evolving dietary patterns in similar settings.

Abbreviations

DD	Dietary Diversity
FAO	Food and Agricultural Organization
HDDS	Household Dietary Diversity Score
HDDSQ	Household Dietary diversity Score Questionnaire
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Scientists

Acknowledgements

Authors acknowledge Mbale District Local Government for granting permission to conduct this study. Additionally, the authors thank all the research assistants who helped in the collection of data, namely; Doreen Makhame, Simon Peter Wambi, Evalyne Kusasila and Innocent Nangosha.

Authors' contributions

SMO: Conception and design, data collection, analysis and interpretation, drafting of the manuscript. RMK: Conception and design, analysis and interpretation, drafting of the manuscript. CM: Conceptualization, data curation, formal analysis, software, supervision, writing, review & editing. DO: Conceptualization, writing, review & editing IOU: Critical review of the concept, supervision, writing, review, editing and final approval of the draft manuscript for publication.

Funding

The authors acknowledge the part-funding for this research provided by TagDev Project supported by Regional Universities Forum (RUFORUM) for Capacity Building in Agriculture. The funder did not play any role in conception and design, analysis and interpretation, drafting of the manuscript.

Data availability

The data that support the findings of this study are available from the primary corresponding author (Sunday Mark Oyet) on reasonable request.

Declarations

Ethical approval and consent to participate

The study sought ethical approval from the Gulu University Research Ethical Committee (GUREC-104–19) on November, 17th, 2019. All participants provided written informed consent prior to enrolment in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 3 April 2024 Accepted: 15 January 2025

Published online: 24 January 2025

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