International Journal of Nutrition Sciences

Journal Home Page: ijns.sums.ac.ir

ORIGINAL ARTICLE

Factors Affecting Women's Dietary Diversity in Cumilla District of Bangladesh: A Community-based Cross-Sectional Study

Md. Jarif Mahbub*

Institute of Nutrition and Food Science (INFS), University of Dhaka, Dhaka-1000, Bangladesh

ARTICLE INFO

Keywords:
Dietary diversity
Women
Nutrition
Food security
Bangladesh

**Corresponding author:*
Md. Jarif Mahbub, BSc;
Institute of Nutrition and Food Science (INFS), BSc;
University of Dhaka, Dhaka-1000, Bangladesh.
Tel: +880 1521416218
Email: jarifmahbub@gmail.com
Received: May 1, 2023
Revised: August 1, 2023
Accepted: August 6, 2023

ABSTRACT

Background: Dietary diversity indicates diet quality and can be linked to health and nutritional outcomes. Minimum dietary diversity for women (MDD-W) is a proxy indicator for food security and micronutrients in diets of women aged 15-49. This study assessed dietary diversity and its determinants among semi-urban Bangladeshi women of reproductive age in Cumilla District.

Methods: In a cross-sectional survey, 391 households (372 estimated sample size) were randomly enrolled. A semi-structured questionnaire collected demographic, socioeconomic, and dietary data. Within each household, a married woman (15-49 years) provided the data on nutrition knowledge and dietary practices. Dietary quality was assessed using the minimum dietary diversity for women (MDD-W).

Results: The average MDD-W score was 5.2±1.9. About 56.5% of women fulfilled adequate MDD-W. Regression analysis showed that the monthly household income and having knowledge about a balanced diet were the determinants of MDD-W. Women in households that had a monthly income of BDT 10,000 to 20,000 were 75% less likely (aOR 0·25, CI 0·11, 0·61) to meet the MDD-W than the households that had a monthly income more than BDT 30,000, while women who had knowledge about a balanced diet were 1.57 times more likely (aOR 1.57, CI 1.02, 2.44) of achieving the MDD-W than who had no knowledge about a balanced diet.

Conclusion: It was shown that having knowledge about a balanced diet and higher household income increases the MDD-W.

Please cite this article as: Mahbub MJ. Factors Affecting Women's Dietary Diversity in Cumilla District of Bangladesh: A Community-based Cross-Sectional Study. Int J Nutr Sci. 2023;8(3):166-174. doi: 10.30476/IJNS.2023.99309.1239.

Introduction

The dietary intake of women serves as a prominent determinant of the nutritional status during gestation and is deemed a risk factor for child malnutrition (1, 2). The compromised nutritional status of mothers (which encompasses both chronic energy and micronutrient deficiencies) contributes greatly to child and maternal morbidity. This is especially evident in low and middle-income countries (LMICs) (1-3). Research indicates that the appropriate nutritional status of women is a significant element for child survival as a malnourished mother is expected to give birth to a low-birth-weight offspring and, therefore, a child

with reduced chances of survival (4, 5).

Dietary diversity is the variety or the number of different foods, people consume over time; that belong to different food groups, given the reference period, can vary; but it is most often the previous day or week (6). If the diet of an individual consists of foods from all the different food groups, their diet can be considered as "diverse". Dietary diversity is an important indicator of dietary quality and can be linked to health and nutritional outcomes (7-9). One of the proxy measures of household food security and/or micronutrient adequacy of diets of women of reproductive age can be minimum dietary diversity for women (MDD-W), as suggested by empirical evidence (10, 11).

There are lots of evidences in the scientific literature regarding minimum dietary diversity for women and factors associated with. Low household wealth, land ownership or assets and morbidity decrease dietary diversity of women, while low household size and high monthly income increase diversity (12-17). Higher educational level of women, her husband, and being beneficiary of social safety net programs helped to increase diversity in the women's diet (14-18). Home gardening, good nutritional knowledge, and food-secured households also contributed to high dietary diversity among women (15, 17). Women's access to media (radio, television, internet, etc.) and women empowerment (e.g. freedom to access the market) significantly increased their dietary diversity (17). Dietary diversity among women living in a semi-urban setting in Bangladesh was not evident in the literature. This study encapsulated the circumstances surrounding dietary diversity among the reproductive-age (15-49 years) semi-urban women of the Cumilla District of Bangladesh. The potential determining factors associated with dietary diversity were identified.

Materials and Methods

A community-based cross-sectional survey was designed to obtain information about women's dietary diversity as per the study's objective in Cumilla, a southeastern district of Bangladesh. The study area was five villages of Cumilla Sadar South Upazilla: Kalir Bazar, Ujirpur, Joshpur, Gohinkhali, and Joypur. Households were selected randomly with the inclusion criteria in mind. From each household, one married female (15-49 years) was asked about nutrition-related knowledge and dietary practices. The total number of households was 391, and therefore, the number of women was equal to the number of households. The households included in the study were those who (i) had at least one under 5 children, (ii) had at least one adolescent girl (11-19 years), (iii) had married women, and (iv) presented consent to participate in the survey

A self-administered semi-structured questionnaire was developed. To gather information on dietary habits, the 24-hour recall method was used, and the Food and Agriculture Organization (FAO) of the United Nations (UN) recommended food groups regarding MDD-W were presented using regional Bangladeshi names for the foods (19). The questionnaire underwent translation from English to Bengali by a bilingual researcher, followed by another bilingual researcher translating it back to English to ensure consistency and eliminate bias. To validate the questionnaire, the Item Objective Congruence (IOC) index and Cronbach's Alpha analysis were conducted. Each question on the survey achieved an index of IOC value above 0.75, meeting the minimum threshold for item acceptance (20). To ensure its reliability, a pilot test with 40 mothers was conducted, making necessary changes based on the results. The pilot test demonstrated strong internal consistency (Cronbach's Alpha, 0.83) (21). The questionnaire was divided into three parts. The first section collected personal consent from the respondents to participate. The second section covered socio-demographic data, including the respondent's age, educational qualifications for both respondents and the husband, monthly household income, involvement in any income-generating activities, occupation of the husband, religion, and household size. The third part inquired about dietary habits over the last 24 hours.

The minimum sample size was calculated using the formula of

$$n = \frac{t^2 \times \mathrm{p}\,(1-\mathrm{p})}{m^2}$$

,

where n is the required sample size, t is the statistical uncertainty chosen=1·96 at a confidence level (C.I.) of 95%, and p was the estimated proportion of malnourished women in the rural area of Bangladesh=58·8% (22) and m is the margin of error at 5% (standard value of 0.05). The total required sample size had to be large enough to offer a reliable smallest difference and the relationship among the variables tested in the study. This value was estimated to be 372. Totally, 391 women were included in the study, similar to the estimated sample size.

Thirty-three final-year undergraduate students from the Institute of Nutrition and Food Science (INFS), University of Dhaka, diligently gathered the data for this study. Before the data collection process began, they underwent rigorous training for seven days, guided by an experienced Professor

from the INFS. Throughout the four-day data collection period, each student conducted interviews with only three respondents per day, ensuring the highest possible data quality. Consequently, each student recorded a total of 12 interviews in four days, resulting in a combined 396 interviews. To maintain the accuracy and reliability of the collected data, a dedicated team of three members supervised and inspected the enumerators during the entire process. The data collection took place from February 24 to 27, 2020. Ultimately, this study included data from 391 interviews, as five interviews were excluded due to their misalignment with the study's objectives.

Evaluation of the overall dietary quality of respondents was done using MDD-W as it is widely known to be associated with adequate nutrient intake (6, 10) and can serve as a proxy indicator for measuring nutrient adequacy among women (19). The MDD-W indicator was based on a 10-food group women's dietary diversity score (WDDS-10). These food groups were (i) Starch staples (grains, white roots and tubers, and plantains); (ii) Vitamin A-rich vegetables and fruits; (iii) Dark green leafy vegetables; (iv) Other vegetables; (v) Other fruits; (vi) Flesh foods (meat, fish, poultry, and liver/organ meats); (vii) Eggs; (viii) Pulses/legumes; (ix) Nuts and seeds; and (x) Dairy products.

The women were asked to recall all foods consumed from the above food groups on the previous day (24-hour dietary recall). Responses were recorded as 'yes' or 'no'. A 'yes' response was recorded as '1', and a 'no' response was recorded as '0'. The scores were summed up to create the women's DD score. Available evidence suggested that WDDS was an acceptable measure of household micronutrient adequacy and household nutrition insecurity. The dietary scores were split into categories such as "diversified diet" and "not diversified diet" based on the MDD-W. Women having a diversity score of less than 5 were classified as having a "not diversified diet" and scores between 5 and 10 were classified as having a "diversified diet".

Participants were asked to define a balanced diet. They were asked to tell the sources of carbohydrates, proteins, fats, vitamins (A, C, and D), and minerals (iron and calcium). Participants able to provide satisfactory answers were marked as "Having knowledge about balanced diet" and others were marked as "Do not have knowledge about balanced diet". Similarly, participants were asked to define malnutrition and the reason behind it along with the signs or symptoms of malnutrition. Participants able to provide satisfactory answers were marked as "Having knowledge about malnutrition" and others were marked as "Do not have knowledge about malnutrition". A study conducted in Sri Lanka followed a similar approach (23). This study was looking for determinants associated with women's dietary diversity. Therefore, dietary diversity was considered to be the outcome variable (dependent variable). Dietary diversity was categorized into "diversified diet" and "not diversified diet" based on the MDD-W.

A literature review was executed to discern the variables that can be the probable determinants of the dietary diversity of women (independent variables (13, 17, 24-28) and some were self-selected. From the dataset, the following variables were selected to examine for the possible determinants of dietary diversity of women including age, religion, formal education level, total monthly household income, total monthly household expenditure on food, knowledge about malnutrition, knowledge about a balanced diet, food security status, family size, the food source for family consumption, and presence of fruit and/or vegetable garden in the household.

All analyses were executed using IBM SPSS Statistics software (version 26, Chicago, IL, USA). Descriptive analyses (frequency distribution and percentage) were performed initially to report socioeconomic, demographic, nutritional knowledge and status, and dietary information of the women (15-49 years). Since all the explanatory variables were categorical, contingency tables of different categories of them were constructed with the outcome variable. The $\chi 2$ test statistic was used to assess the statistical significance of the univariate associations. All tests were two-tailed and a p value of $<0{\cdot}25$ was considered statistically significant. A multivariate logistic regression model was utilized to assess the impact of multiple independent variables simultaneously at a time on the categorical dependent variable. Explanatory variables that were not associated with the outcome ($p \geq 0.25$) were not included in the multivariate logistic regression model. The crude odds ratio (cOR), adjusted odds ratio (aOR), and 95% CI of OR were estimated, and a p value of <0.05 was considered statistically significant (Figure 1).

Results

As Table 1 shows, 391 women from 391 households were chosen. The majority of the samples were Muslims (96.9%), and the rest were Hindus (3.1%). There were women of different ages in the study area. For the study purpose, only women of reproductive age (15-49 years) were included. Of the 391 respondents studied, the mean age was 28.4±6.1 years. Most of the women were between the ages of 20 to 29 years (57.8%). The least number of women were at the age of 15-19 (3.3%).

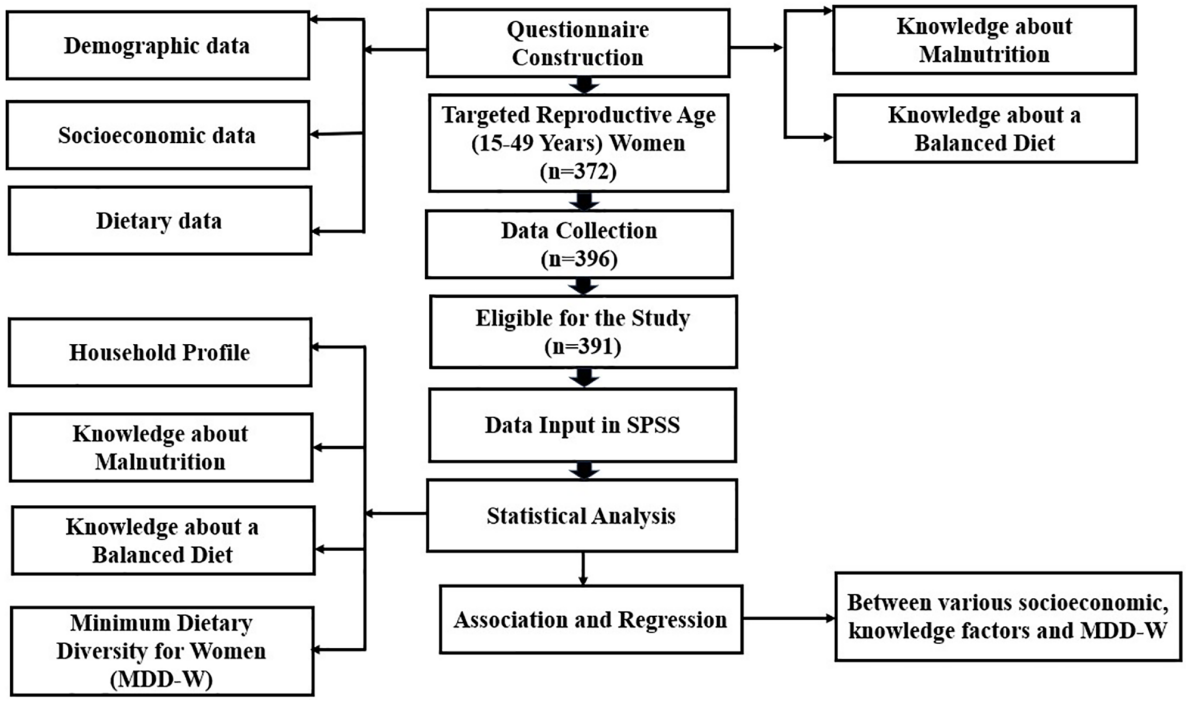

Figure 1: Flow Diagram of the Study.

Table 1: Demographic and socioeconomic characteristics of the studied women.

Characteristics	Frequency (%)
Religion	
Muslim	379 (96.9)
Hindu	12 (3.1)
Age group (years)	
15-19	13 (3.3)
20-29	226 (57.8)
30-39	127 (32.5)
40-49	25 (6.4)
Families headed by women	
Yes	16 (4.1)
No	375 (95.9)
Family members	
4 or less	161 (41.2)
More than 4	230 (58.8)
Formal education	
Uneducated	51 (13)
Up to primary level	56 (14.3)
Up to secondary level	245 (62.7)
Up to higher secondary and graduation level	39 (10)
Monthly household income (BDT)	
Less than 10,000	37 (9.5)
10,000-20,000	238 (60.9)
20,001-30,000	74 (18.9)
Higher than 30,000	42 (10.7)
Household monthly Expenditure on Food (BDT)	
Less than 5,000	87 (22.2)
5,000-10,000	254 (65)
Higher than 10,000	50 (12.8%)
Age at first marriage (years)	
15 or less	97 (24.8)
Higher than 15	294 (75.2)

The head of the family referred to the person who leads and maintains the family in terms of economic support, decision-making, etc. Only 16 (4.1%) families were found where the household head was a female. Most of the households (95.9%) were found to have a male person who was leading the family. The mean number of family members was 4.9±1.2. Among the households, 41.2% of households had 4 or a smaller number of persons, while 58.8% of households had more than 4 persons.

A total of 0, 1-5, 6-10, 11, and higher years of schooling were considered as uneducated, primary level, secondary level, higher secondary, and graduation level respectively. The mean years of schooling were 7.1±3.6. 13% of the women were found to be uneducated. Around 14.3%, 62.7%, and 10% of women had their education up to primary, secondary, and higher secondary, and graduation level respectively. The mean household monthly income of the study households was 19521±11291 BDT. Most of the households (60.9%) had a total monthly income of about 10,000-20,000 BDT. Only 37 households (9.5%) had a total monthly income of less than 10,000 BDT. Totally, 74 households (18.9%) had monthly income of about 20,001-30,000 BDT and 42 households (10.7%) had a higher monthly income (higher than 30,000 BDT).

The mean household monthly expenditure on food was 7214±3743 BDT. Here, 22.2% of households had less than 5,000 BDT monthly spending on food, and 12.8% of households had higher than 10,000 BDT. Most of the households (65%) had a monthly expenditure on food between 5000-10,000 BDT. The mean age of the women at their first marriage

Table 2: Nutritional knowledge of the studied women.

Indicator	Frequency (%)
Knowledge about a balanced diet	
Yes	196 (50.1)
No	195 (49.9)
Knowledge about malnutrition	
Yes	224 (57.3)
No	167 (42.7)

Table 3: Dietary diversity status of the studied women.

Indicator	Frequency (%)
Diet Quality	
Diversified	221 (56.5)
Not diversified	170 (43.5)
Presence of fruit and/or vegetable garden in the households	
Yes	302 (77.2)
No	89 (22.8)

was 17±2.2 years. The age of marriage of maximum women in the study area was more than 15 years which covered about 75.2% of the total women studied. The remaining 24.8% of women were married at 15 years or less.

A balanced diet is a complete menu that provides all nutrients in adequate proportion to meet nutrition requirements for health, and well-being. Among 391 women, 50.1% had knowledge about a balanced diet and 49.9% had not (Table 2). The ratio of these two categories of women was almost 1:1. Table 2 also shows that 57.3% of women had nutritional knowledge about malnutrition and the rest 42.7% had no idea about malnutrition.

Table 4: Chi-Square test for association of variables with studied minimum dietary diversity for women (MDD-W).

Variables	N	Minimum Dietary Diversity		Test statistic
		No n (%)	Yes n (%)	
Age				
15-19	13	5 (38.5)	8 (61.5)	$\chi2=0.398$
20-29	226	99 (43.8)	127 (56.2)	$p=0.941$
30-39	127	54 (42.5)	73 (57.5)	
40-49	25	12 (48)	13 (52)	
Religion				
Islam	379	166 (43.8)	213 (56.2)	$\chi2=0.518$
Hinduism	12	4 (33.3)	8 (66.7)	$p=0.564$
Formal education level of the women				
Uneducated	51	24 (47.1)	27 (52.9)	$\chi2=6.101$
Up to primary level	56	19 (33.9)	37 (66.1)	$p=0.107^*$
Up to secondary level	245	115 (46.9)	130 (53.1)	
Up to higher secondary and graduation level	39	12 (30.8)	27 (69.2)	
Number of family members				
4 or less	161	70 (43.5)	91 (56.5)	$\chi2=.001$
Higher than 4	230	100 (43.5)	130 (56.5)	$p=1.0$
Total monthly income of the households (BDT)				
Less than 10,000	37	17 (45.9)	20 (54.1)	
10,000-20,000	238	128 (53.8)	110 (46.2)	$\chi2=33.067$
20,001-30,000	74	16 (21.6)	58 (78.4)	$p<0.001^*$
Higher than 30,000	42	9 (21.4)	33 (78.6)	
Total monthly expenditure on food of the households (BDT)				
Less than 5,000	87	37 (42.5)	50 (57.5)	$\chi2=7.713$
5,000-10,000	254	120 (47.2)	134 (52.8)	$p=0.021^*$
Higher than 10,000	50	13 (26)	37 (74)	
Women's knowledge about a balanced diet				
Yes	196	73 (37.2)	123 (62.8)	$\chi2=6.214$
No	195	97 (49.7)	98 (50.3)	$p=0.013^*$
Women's knowledge about malnutrition				
Yes	224	96 (42.9)	128 (57.1)	$\chi2=.082$
No	167	74 (44.3)	93 (55.7)	$p=0.774$
Presence of fruit and/or vegetable garden in the household				
Yes	302	128 (42.4)	174 (57.6)	$\chi2=0.646$
No	89	42 (47.2)	47 (52.8)	$p=0.421$

BDT:Bangladeshi Taka, *Significant at $p<0.25$

The average MDD-W score was 5.2±1.9. Among 391 women, 221 (56.5%) consumed foods from more than 4 types of food groups during the last 24 hours. Totally, 170 women (43.5%) did have a diversified diet as they consumed foods from 4 or fewer types of food groups. Table 3 shows that 77.2% of households had fruit and/or vegetable gardens and 22.8% of households had no gardens.

A Chi-Square ($\chi 2$) test was performed between the determinants and dietary diversity (Table 4). Variables with a p value of <0.25 were primarily considered to be associated with dietary diversity. Total monthly income ($\chi 2$=33.067; p<0.001), total monthly expenditure on food ($\chi 2$=7.713; p=0.021), a formal education level ($\chi 2$=6.101; p=0.107), and knowledge about balanced diet ($\chi 2$=6.214; p=0.013) met the criteria and included into the multivariate logistic regression model.

Regression analysis showed that the monthly household income (BDT: 10,000-20,000) and having knowledge about a balanced diet were the determinants of MDD-W (Table 5). Women in households that had a monthly income of 10,000 to 20,000 BDT were 75% less likely (aOR: 0·25, CI: 0·11, 0·61) to meet the MDD-W, while women who had knowledge about balanced diet were 1.57 times more likely (aOR: 1.57, CI: 1.02, 2.44) of achieving the MDD-W. The initial analysis using cOR revealed a significant association between total household monthly income (less than 10000 BDT) and MDD-W (p<0.05). Similarly, total monthly expenditure on food (5000-10000 BDT) showed a significant association with MDD-W based on COR (p<0.05). However, upon adjusting for potential confounders using multinomial logistic regression and calculating aOR, the significance of the association between total household monthly income and MDD-W diminished (p>0.05). Similarly, the association between total monthly expenditure on food and MDD-W lost significance after adjusting for potential confounding factors (p>0.05). Consequently, these two variables were excluded from the determining factors of MDD-W.

Discussion

In this study, 4.1% of the households were female and household head. But Bangladesh Demographic and Health Survey (BDHS) 17-18 revealed that 15.8% of the households were being led by females (22). The mean number of household members was 4.9±1.2. According to the BDHS 17-18 report, the mean number of household members was 4.3. About 13% of the women were found to be uneducated, which is less than the BDHS 17-18 report (17%). It was found that about 14.3% and 62.7% of the women completed primary and secondary education, respectively. According to the BDHS 17-18 report, 15.5% and 26.5% of women had their education up to primary and secondary level, respectively. This study showed a clear improvement in the number of women who have completed their education up to the secondary level. It was found that 24.8% of

Table 5: Multivariate logistic regression analysis on the possible determinants of dietary diversity among studied women.

Variables	Minimum Dietary Diversity		Unadjusted			Adjusted		
	No (n)	Yes (n)	cOR	95% CI	*P* value	aOR	95% CI	*P* value
Total monthly income of the households (BDT)								
Less than 10,000	17	20	0.32	0.12, 0.86	0.023*	0.36	012, 1.15	0.084
10,000-20,000	128	110	0.23	0.11, 0.51	<0.001*	0.25	0.11, 0.61	0.002*
20,001-30,000	16	58	0.99	0.39, 2.49	0.981	0.99	0.38, 2.56	0.98
Higher than 30,000	9	33	1.00	Ref.	-	1.00	Ref.	-
Total monthly expenditure on food of the households (BDT)								
Less than 5,000	37	50	0.46	0.22, 1.02	0.055	1.11	0.45, 2.74	0.821
5,000-10,000	120	134	0.39	0.2, 0.77	0.007*	0.82	0.37, 1.8	0.614
Higher than 10,000	13	37	1.00	Ref.	-	1.00	Ref.	-
Formal education level								
Uneducated	24	27	0.50	0.21, 1.20	0.120	0.93	0.36, 2.45	0.887
Up to primary level	19	37	0.87	0.36, 2.08	0.747	1.39	0.53, 3.60	0.503
Up to secondary level	115	130	0.50	0.24, 1.04	0.063	0.73	0.34, 1.61	0.440
Up to higher secondary and graduation level	12	27	1.00	Ref.	-	1.00	Ref.	-
Women's knowledge about a balanced diet								
Yes	73	123	1.67	1.11, 2.47	0.013*	1.57	1.02, 2.44	0.043*
No	97	98	1.00	Ref.	-	1.00	Ref.	-

BDT:Bangladeshi Taka, *Significant at p<0.05, aOR:adjusted Odds Ratio, cOR:crude Odds Ratio, CI:Confidence Interval.

women were married at 15 years or less, which is slightly lower than what was reported in BDHS 17-18 (30%). It indicates a decrease in the prevalence of early marriage. In this study, about half of the women (49.9%) had no knowledge regarding a balanced diet. A study conducted in rural Sri Lanka found that about 57.2% of the women did not know about a balanced diet (23). About 42.7% of the women in this study had no idea about malnutrition. A case-control study on mothers (n=34) conducted in India found that 20.6% of the controls and 23.5% of the cases did not have ideas regarding malnutrition (29).

In this study, 43.5% of the women were found not to have a diversified diet. This distribution shows that dietary diversification status was not good since a huge number of women were not having a diversified diet. Several studies also found higher percentages of women with MDD-W (consuming five or more food groups) than this study (30-32). About 77.2% of households in this study had fruit and/or vegetable gardens. Household vegetable and fruit gardens normally improve household food consumption and add diversity to the diet (33).

In this study, the average MDD-W score was found 5.2±1.9. A study conducted in Ghana (26) found an average MDD-W score of 6.3±2.2, and another study conducted in Kenya (13) found 6.84±1.46. A study conducted in the northern region of Bangladesh found an average MDD-W score of 3.9±1.2 (16). The study found that having knowledge about a balanced diet and higher household income increased the MDD-W. Several studies support the findings of this study. There are a lot of studies declaring a higher household income increases the MDD-W. Knowledge about a balanced diet is similar to having nutritional knowledge. Research conducted in Belgium revealed that educational background and nutritional knowledge are independently associated with young and middle-aged women (18). Moreover, it has been highlighted in previous studies that having nutritional knowledge is essential for meeting the criteria of minimum dietary diversity (MDD) (12, 14, 15).

Strengths and limitations of the study were presented too. In contrast to the 7-day food frequency questionnaires commonly used, the study approach adopted the 24-hour dietary recall method, which may reduce recall biases. However, the author acknowledges one of the limitations of our study is that we only conducted one 24-hour recall, which may not fully represent women's dietary diversity throughout a year. To gain a more comprehensive understanding of women's actual dietary habits, it is recommended to undertake extensive and numerous days of recall, considering different seasons. Furthermore, it is essential to note that the study is a community-based cross-sectional study, and thus, it cannot establish any causal relationships between the factors examined. Additionally, the study population was confined to a semi-urban area in the southeastern region, which limits the generalizability of the results, especially for urban women. The Likert scale was not utilized to measure the knowledge level regarding a balanced diet and malnutrition. The Likert scale is a widely accepted and effective tool for gauging participants' opinions and attitudes, allowing for a more nuanced understanding of their knowledge and perceptions. Nevertheless, the findings from this study can serve as a valuable foundation for future research to identify the determinants of dietary diversity among women in various regions and contexts.

Conclusion

The study found that having knowledge about a balanced diet and higher household income increases the MDD-W. Policymakers should give importance to the inclusion of nutritional knowledge, more specifically knowledge about a balanced diet, in the formal education system. They should also take necessary innovative strategies to ensure extra income generation for rural households. Future research should focus on finding other determinants of MDD-W that have more ability to increase the dietary diversity of women.

Acknowledgment

The author received no funding for this research work. The author remains indebted to Professor Dr. Md. Nazrul Islam Khan, Institute of Nutrition and Food Science, University of Dhaka, for keeping the enumerators under his watchful eyes during the study. His support, supervision, and constructive criticism were paramount to seeing the study through. Unfortunately, he is no longer with us, and the author hopes he finds peace in the Afterlife. The deepest gratitude goes to Dr. Md. Ruhul Amin, Professor, Institute of Nutrition and Food Science, University of Dhaka, for his tremendous guidance. Bangladesh Academy for Rural Development (BARD) offered incredible assistance in conducting the study, and the privileges they provided were pivotal to the success of the study.

Conflict of Interest

None declared.

References

1 Smith LC, Ramakrishnan U, Ndiaye A, et al. The Importance of Women's Status for Child Nutrition in Developing Countries.

Food Nutr Bull. 2003;24:287–8. DOI: 10.1177/156482650302400309. PMID: 14564934.
2 Lartey A. Maternal and child nutrition in Sub-Saharan Africa: challenges and interventions. *Proc Nutr Soc*. 2008;67:105–8. DOI: 10.1017/S0029665108006083. PMID: 18234138.
3 Rahman M, Roy SK, Ali M, et al. Maternal Nutritional Status as a Determinant of Child Health. *J Trop Pediatr.* 1993;39:86–8. DOI: 10.1093/tropej/39.2.86. PMID: 8492369.
4 Yasmin S, Osrin D, Paul E, et al. Neonatal mortality of low-birth-weight infants in Bangladesh. *Bull World Health Organ*. 2001;79:608–14. PMID: 11477963.
5 Karim MR, Mondal MNI, Rana MM, et al. Maternal factors are important predictors of low birth weight: Evidence from Bangladesh demographic & health survey-2011. *Malays J Nutr.* 2016;22:257-65.
6 FAO. Guidelines for measuring household and individual dietary diversity. Rome, Italy; 2010.p.60.
7 Ali F, Thaver I, Khan SA. Assessment of dietary diversity and nutritional status of pregnant women in Islamabad, Pakistan. *J Ayub Med Coll Abbottabad.* 2014;26:506–9.
8 Nithya DJ, Bhavani R V. Dietary Diversity and Its Relationship with Nutritional Status Among Adolescents and Adults in Rural India. *J Biosoc Sci.* 2018;50:397–413. DOI: 10.1017/S0021932017000463.
9 Sié A, Tapsoba C, Dah C, et al. Dietary diversity and nutritional status among children in rural Burkina Faso. *Int Health.* 2018;10:157–62. DOI: 10.1093/inthealth/ihy016. PMID: 29579204.
10 Becquey E, Martin-Prevel Y. Micronutrient Adequacy of Women's Diet in Urban Burkina Faso Is Low. *J Nutr.* 2010;140:2079S-2085S. DOI: 10.3945/jn.110.123356. PMID: 20881079.
11 Gómez G, Nogueira Previdelli Á, Fisberg RM, et al. Dietary Diversity and Micronutrients Adequacy in Women of Childbearing Age: Results from ELANS Study. *Nutrients.* 2020;12:1994. DOI: 10.3390/nu12071994. PMID: 32635544.
12 Saaka M, Oladele J, Larbi A, et al. Dietary Diversity Is Not Associated with Haematological Status of Pregnant Women Resident in Rural Areas of Northern Ghana. *J Nutr Metab.* 2017;2017:1-10. DOI: 10.1155/2017/8497892. PMID: 28168052.
13 Kiboi W, Kimiywe J, Chege P. Determinants of dietary diversity among pregnant women in Laikipia County, Kenya: a cross-sectional study. *BMC Nutr.* 2017;3:12. DOI: 10.1186/s40795-017-0126-6.
14 Aliwo S, Fentie M, Awoke T, et al. Dietary diversity practice and associated factors among pregnant women in North East Ethiopia. *BMC Res Notes*. 2019;12:123. DOI: 10.1186/s13104-019-4159-6. PMID: 30845950.
15 Dehghanpisheh S, Daryanoosh F, Jafari H, et al. Effect of 8 weeks of aerobic training on serum level of visfatin and TNF-α in non-athletic young women. *J Gorgan Univ Med Sci.* 2014;16:40-4.
16 Shaun MMA, Nizum MWR, Shuvo MA, et al. Determinants of minimum dietary diversity of lactating mothers in rural northern region of Bangladesh: A community-based cross-sectional study. *Heliyon* . 2023;9:e12776. DOI: 10.1016/j.heliyon.2022.e12776. PMID: 36632115.
17 Harris-Fry H, Azad K, Kuddus A, et al. Socio-economic determinants of household food security and women's dietary diversity in rural Bangladesh: a cross-sectional study. *J Heal Popul Nutr.* 2015;33:2. DOI: 10.1186/s41043-015-0022-0. PMID: 26825273.
18 De Vriendt T, Matthys C, Verbeke W, et al. Determinants of nutrition knowledge in young and middle-aged Belgian women and the association with their dietary behaviour. *Appetite.* 2009;52:788–92. DOI: 10.1016/j.appet.2009.02.014. PMID: 19501783.
19 FAO, FHI 360. Minimum Dietary Diversity for Women: A Guide for Measurement. Rome; 2016.
20 Turner RC, Carlson L. Indexes of Item-Objective Congruence for Multidimensional Items. *Int J Test.* 2003;3:163–71. DOI: 10.1207/S15327574IJT0302_5.
21 Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Res Sci Educ.* 2018;48:1273-96. DOI: 10.1007/s11165-016-9602-2.
22 National Institute of Population Research and Training (NIPORT), ICF. Bangladesh demographic and health survey 2017-18. Dhaka, Bangladesh, and Rockville, Maryland, USA; 2020.
23 Weerasekara PC, Withanachchi CR, Ginigaddara GAS, et al. Food and Nutrition-Related Knowledge, Attitudes, and Practices among Reproductive-age Women in Marginalized Areas in Sri Lanka. *Int J Environ Res Public Health.* 2020;17:3985. DOI: 10.3390/ijerph17113985. PMID: 32512750.
24 Thorne-Lyman AL, Valpiani N, Sun K, et al. Household Dietary Diversity and Food Expenditures Are Closely Linked in Rural Bangladesh, Increasing the Risk of Malnutrition Due to the Financial Crisis. *J Nutr.* 2010;140:182S-188S. DOI:

10.3945/jn.109.110809. PMID: 19923385.
25 Shamim AA, Mashreky SR, Ferdous T, et al. Pregnant Women Diet Quality and Its Sociodemographic Determinants in Southwestern Bangladesh. *Food Nutr Bull.* 2016;37:14–26. DOI: 10.1177/0379572116632137. PMID: 27004969.
26 Saaka M, Mutaru S, Osman SM. Determinants of dietary diversity and its relationship with the nutritional status of pregnant women. *J Nutr Sci*. 2021;10:e14. DOI: 10.1017/jns.2021.6. PMID: 33889397.
27 Morseth MS, Grewal NK, Kaasa IS, et al. Dietary diversity is related to socioeconomic status among adult Saharawi refugees living in Algeria. *BMC Public Health.* 2017;17:621. DOI: 10.1186/s12889-017-4527-x. PMID: 28673263.
28 Kundu S, Al Banna MH, Sayeed A, et al. Determinants of household food security and dietary diversity during the COVID-19 pandemic in Bangladesh. *Public Health Nutr.* 2021;24:1079-87. DOI: 10.1017/S1368980020005042. PMID: 33317657.
29 Saito K, Korzenik JR, Jekel JF, et al. A case-control study of maternal knowledge of malnutrition and health-care-seeking attitudes in rural South India. *Yale J Biol Med.* 1997;70:149–60. PMID: 9493847.
30 Sultana M, Hasan T, Shaheen N. Dietary Diversity and Nutritional Status of Female Residential Students in University of Dhaka, Bangladesh. I*ndian J Public Heal Res Dev*. 2019;10:644. DOI: 10.12944/CRNFSJ.7.1.24.
31 Seiermann AU, Al-Mufti H, Waid JL, et al. Women's fasting habits and dietary diversity during Ramadan in rural Bangladesh. *Matern Child Nutr*. 2021;17. DOI: 10.1111/mcn.13135.
32 Nguyen PH, Huybregts L, Sanghvi TG, et al. Dietary Diversity Predicts the Adequacy of Micronutrient Intake in Pregnant Adolescent Girls and Women in Bangladesh, but Use of the 5-Group Cutoff Poorly Identifies Individuals with Inadequate Intake. *J Nutr.* 2018;148(5):790–7. DOI: 10.1093/jn/nxy045. PMID: 30053285.
33 Rammohan A, Pritchard B, Dibley M. Home gardens as a predictor of enhanced dietary diversity and food security in rural Myanmar. *BMC Public Health*. 2019;19:1145. DOI: 10.1186/s12889-019-7440-7.