




Factors Affecting Food Security in Women Enrolled in a Program for Vulnerable Group Development

Mansura Khanam,¹ Gulshan Ara,¹ Ahmed Shafiqur Rahman,¹ Zahirul Islam,¹ Shahriar Farhad,¹ Sihan Sadat Khan,¹ Kazi Istiaque Sanin,¹ Mohammad Mahbobor Rahman,² Herma Majoor,² and Tahmeed Ahmed¹ 

¹International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh and ²World Food Programme, IDB Bhaban, IDB Bhaban 14th, 16th and 17th Floor E/8-A, Rokeya Sharani Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh

ABSTRACT

Background: Food security is defined as physical and economic access to sufficient food to meet the dietary requirements for a productive and healthy life. Evidence from the literature suggests that >800 million people worldwide are food insecure. Vulnerable Group Development (VGD) is the largest social safety net of the Government of Bangladesh targeting ultra-poor women to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture.

Objectives: The objective of this study is to explore the factors associated with food security among VGD women in Bangladesh.

Methods: A total of 870 women (435/group) participated in the baseline survey and another 800 women (400/group) participated in the endline survey. Participants in the intervention group received monthly rations of 30 kg fortified rice (FFR) and the control group received 30 kg of non-FFR for 12 mo. Multiple logistic regression analysis was used to establish both crude and confounder-adjusted relations between the primary outcome and response variables. Written consent was proved by study participants. This study (PR-14091) was approved by the Research Review Committee and Ethical Review Committee.

Results: Severe food insecurity in the endline survey decreased from ~50% to 6.3% in both groups. The hunger scale also improved between the baseline and endline survey. More than 97% of respondents at endline reported no hunger compared with 80% at baseline; only 3% of women in both groups reported moderate hunger at endline. Multivariable regression model showed that ownership of a house and land for agriculture, wealth index (richest quintile), and absence of fever were significantly associated with food security ($P < 0.05$).

Conclusions: Our analysis shows that the VGD rice distribution program significantly improves the food security status of vulnerable women; however, ownership of a house and land for agriculture were the most significant factors associated with household food security in VGD program areas of Bangladesh. *Curr Dev Nutr* 2020;4:nzaa037.

Keywords: food security, women, food insecurity, assessment, social safety net

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Address correspondence to GA (e-mail: gulshan.ara@icddr.org).

Abbreviations used: aOR, adjusted OR; FCS, food consumption score; FFR, fortified rice; HFI, household food insecurity; HFIAS, Household Food Insecurity Access Scale, HHS, household hunger scale; SDG, Sustainable Development Goal; SES, socioeconomic status; VGD, Vulnerable Group Development; WFP, World Food Program.

Introduction

Food security is defined as physical and economic access to sufficient food to meet the dietary requirements for a productive, healthy life (1). The World Food Summit of 1996 proposed that food security involves food availability, food access, and food utilization (2, 3), and that all of these factors are interrelated (4). On other hand, food insecurity is defined as inadequate physical, social, or economic access to food (5). Achieving food security, one of the vital Sustainable Development Goals (SDGs; SDG-2), along with adequate nutrition, is a basic necessity since an undernourished or hungry population hampers economic

productivity (6). Undernutrition has a profound effect on growth, development of acute and chronic diseases, survival, and economic productivity (7).

Global data suggested that >800 million people around the world were considered food insecure in 2012–2014 (8). Asians, sub-Saharan Africans, and the Pacific Islanders constitute the majority of the world's population, with 30% of the food-insecure population (276 million) living in South East Asia (9). Multiple factors are responsible for food insecurity worldwide, including population growth, climate change, increasing cost of food, unemployment, poverty, and loss of biodiversity (10). In South

East Asia, women of reproductive age and children are most vulnerable to food insecurity. Women living in rural areas often mostly consume rice, the staple food. Due to social and cultural norms, women frequently reduce their own food intake to provide for their husband and children, which, in turn, reduces their dietary diversity and leads to micronutrient deficiencies (10).

Despite making economic progress, Bangladesh ranked 88th out of the 117 countries for serious hunger (11). Bangladesh has been very effective in taking a multifaceted approach to overcome the burden of severe hunger (12). Bangladesh has had substantial improvement in food availability, although one-third of the population are living below the poverty level with insufficient food accessibility, which indicates that food insecurity is still notable in Bangladesh (13). Similarly, in terms of food production, 26% of the whole population are chronically food insecure (14). The Household Food Insecurity Access Scale (HFIAS) indicated that 19% of the urban population and 25% of the rural population in Bangladesh were food insecure (15). According to the World Food Program (WFP), food insecurity mostly affects the people living below the poverty line, especially due to economic factors (15), such as rising food prices and unemployment. Poor people mostly depend on markets for their food and spend 70% of their income purchasing food from markets (5).

The concept of food security can be assessed at the macro- and microeconomic levels. The macroeconomic level indicates global, regional, or national food security, with a focus on agricultural availability, rather than consumers' access to food. The WFP provides technical assistance to the government of Bangladesh in delivery of the Vulnerable Group Development (VGD) program. VGD is the largest social safety net of the government of Bangladesh, which exclusively targets ultra-poor women and their households. The overall objective of the government's VGD program is to contribute to national initiatives toward ending hunger, achieving food security and improving nutrition, and promoting sustainable agriculture (SDG-2). Under the VGD program, food transfers (a monthly ration of 31.25 kg wheat/30 kg rice over 2 y) and a complementary package of development services are delivered to rural ultra-poor women to ensure food security in their households. The WFP provides technical assistance to the government of Bangladesh to strengthen its VGD program. Women are provided with cards upon acceptance into the VGD program. The VGD program beneficiaries are selected in a 2-step process. The national VGD committee distributes VGD cards to all women complying with VGD criteria in all subdistricts. The subdistricts and union (the smallest rural administrative and local government unit in Bangladesh) -level local committees select a minimum of the 30 most vulnerable women from each union of the subdistricts based on the VGD selection criteria. The selection criteria for VGD women include functional landlessness, extremely low or no income, status of day laborer, and lack of household productive assets. Preference is given to female heads of household (widowed, separated, deserted, or with disabled husbands) and to women who are physically fit to train and work. Women who receive assistance from other programs or who have participated in the previous cycle of the VGD program were not selected for VGD support (16). Studies found that VGD activity made a significant difference in the food and livelihood security of extremely poor households in Bangladesh. The present study aimed to determine the factors affect-

ing food security in women enrolled in a program for vulnerable group development.

Methods

Study design

A controlled before–after study design was used. Baseline and endline surveys were carried out in 10 subdistricts in 5 districts of Bangladesh. The study population was VGD beneficiaries, who received either fortified rice (FFR group) or non-FFR rations (non-FFR group). The micronutrient fortificants used to fortify the rice include vitamin A, vitamin B-1, vitamin B-12, folic acid, iron, and zinc. The 5 FFR subdistricts were selected by the WFP from 5 districts in different geographic locations across the country, where fortified rice would be distributed during the initial phase of the VGD fortified-rice program. VGD beneficiaries with similar socioeconomic backgrounds in non-FFR subdistricts of the same districts were selected using a subdistrict-level poverty map (proportion of population below the upper poverty line). A systematic random-sampling method was employed to enroll the required number of participants for the baseline and endline surveys from the overall list of VGD women in both the FFR and non-FFR subdistricts. During the endline evaluation, a similar sampling approach was employed, and participants were allocated to FFR and non-FFR groups from the same sampling frame. However, the participants of the baseline and endline survey were different. Baseline data collection commenced from December 2014 to April 2015. After 12 mo of FFR/non-FFR consumption, the endline data were collected from December 2016 to April 2017 (17).

Study area

FFR participants were drawn from the same list of 15,000 VGD beneficiaries (who received fortified rice) in 40 unions (the smallest rural administrative and local government unit in Bangladesh) under the 5 subdistricts. Similarly, participants in the non-FFR group were selected from the ~15,000 enlisted VGD beneficiaries in 53 unions of 5 subdistricts who received a ration of normal rice. Participants for the FFR were drawn from the total list of ~11,914 VGD beneficiaries who received fortified rice (Figure 1).

Sample size

The sample size was calculated to detect a minimum statistically significant difference ($P < 0.05$) in the prevalence of anemia between the intervention and control groups in the endline survey after 1 y of the intervention (17):

$$n = \frac{[Z_{\alpha} \sqrt{2PQ} - Z_{1-\beta} \sqrt{P_1 Q_1 + P_2 Q_2}]^2}{(P_2 - P_1)^2} \times \text{factor to adjust for drop out} \quad (1)$$

However, we did the power calculation based on these objectives and the sample size was powered enough to achieve this objective.

Inclusion and exclusion criteria

The inclusion criteria were women aged 15–45 y who were cardholders of the VGD program, who provided written consent, and for whom ver-

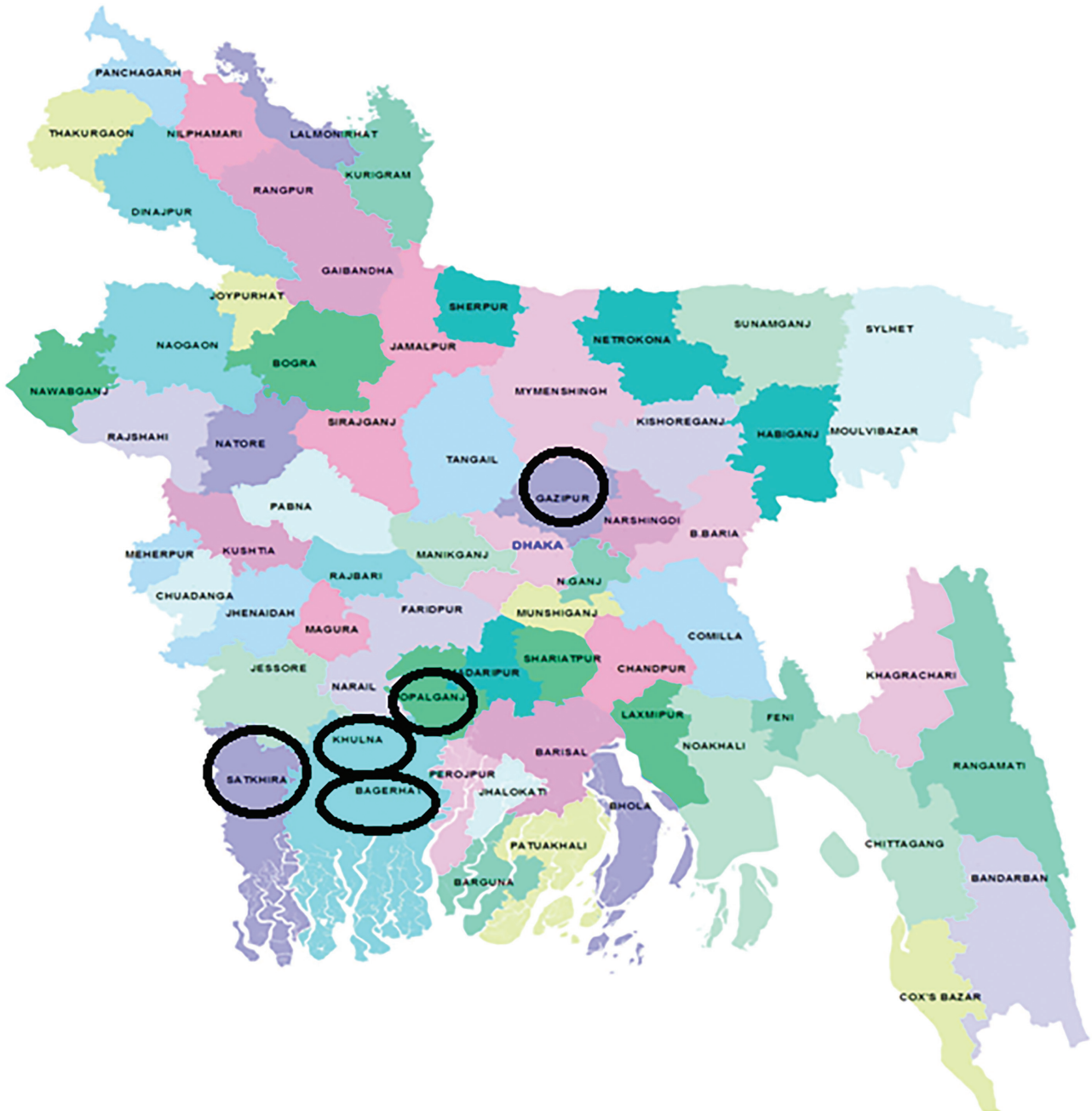


FIGURE 1 Map of the study/program area in Bangladesh.

bal consent to participate in the study was provided by the head of their household. The exclusion criteria were women with any known or suspected chronic or congenital disease, women who were pregnant, and women known to have severe anemia or extreme pallor.

Variables of interest

Assessment of household food insecurity.

Household food insecurity (HFI) was quantified using the HFIAS, which was developed to assess food poverty (i.e., the inability to obtain healthy affordable food) in developing countries. These questions

capture 3 main domains of HFI: 1) anxiety and uncertainty about access (1 question), 2) insufficient quality (3 questions), and 3) insufficient quantity (5 questions). Each item starts with an occurrence question that identifies if the condition has been experienced in the household. An affirmative answer is then followed by a frequency-of-occurrence question to determine if the condition happened rarely (once or twice), sometimes (3–10 times), or often (>10 times) during the reference period. The responses were coded as 0 = never, 1 = rarely, 2 = sometimes, or 3 = often (18). A household was classified as “food secure” if the responses were “never” to all 9 items and

“food insecure” if the responses were “sometimes” or “always” to ≥ 1 of the 9 questions. Households were assigned a score ranging from 0 to 27 based on their responses to the 9 questions and frequency of occurrence over the past 30 d. A higher HFIAS score is indicative of poorer access to food and greater HFI. Data were collected based on the HFIAS; the household hunger scale (HHS) was used in most analyses as it enables easy comparison of results across different cultures and the reliability of the respondent’s responses is higher. The HHS is composed of 3 subsets of questions from the HFIAS that pertain to sufficient quantities of food (19). Scores of 0–1 are classified as “little to no household hunger,” 2–3 as “moderate household hunger,” and 4–6 “severe household hunger” (20). For logistic regression analyses, these 3 classes were regrouped into 2 classes (none/mild and moderate/severe HFI).

The frequency of consumption of food items was measured using the food consumption score (FCS) established by the WFP. The FCS is a well-defined indicator and its cutoffs are standardized. It is used across regions and livelihood groups. It is a composite score based on the dietary diversity, food frequency, and relative nutritional importance of different food groups. The respondents were asked about the frequency of consumption of different food items over a recall period of the last 7 d. Food items were grouped into 8 standard food groups with a maximum value of 7 d/wk. The frequency of consumption of each food group was multiplied by an assigned weight, which is based on its nutrient content. The values were then summed to get the total FCS.

The formula followed for calculating the FCS was as follows:

$$\begin{aligned} \text{FCS} = & a_{\text{staple}} x_{\text{staple}} + a_{\text{pulse}} x_{\text{pulse}} + a_{\text{veg}} x_{\text{veg}} \\ & + a_{\text{fruit}} x_{\text{fruit}} + a_{\text{animal}} x_{\text{animal}} + a_{\text{sugar}} x_{\text{sugar}} \\ & + a_{\text{dairy}} x_{\text{dairy}} + a_{\text{oil}} x_{\text{oil}}. \end{aligned} \quad (2)$$

where a_i = weight of each food-group; x_i = frequency of food consumption = number of days during which each food group was consumed during the past 7 d (7 d was designated as the maximum value of the sum of the frequencies of the different food items belonging to the same food group).

Following the FCS outline, the FCS for each household was calculated. The outcomes ranged from 0 to 106, which were further used to categorize the household into poor consumption (0–28), borderline consumption (28.5–42), and acceptable consumption (>42). This categorization was done according to the threshold of the Household Food Security and Nutrition Assessment Survey (21).

Determination of household economic status.

A household wealth index is a proxy indicator of socioeconomic status (SES), which is determined by household assets and housing quality. Additionally, household wealth index is determined by the information collected on housing materials (floor, walls, roof material), source of drinking water, type of toilet, the access to electricity, type of cooking fuel, and ownership of modern durable household goods and livestock (e.g., bicycle, television, radio, motorcycle, sewing machine, and mobile phone) (22).

The wealth index scores were added up to give a proxy household wealth index. The wealth index was used to categorize households into

SES groups to compare the prevalence of HFI between the lowest and highest SES groups.

Data collection and analysis

Trained field research staff collected data using a structured questionnaire. In each round, 18 team members were involved in data collection. Quality control was performed by randomly choosing and re-interviewing 10% of cases within 24 h of data collection. STATA version 15 (StataCorp) was used to conduct the analysis. The analysis primarily involved descriptive statistics using appropriate cutoff values for food security. To assess differences in mean values, the Student’s *t* test was used, and for categorical outcomes chi-square statistical comparisons of proportions with 95% CIs were calculated. Multiple logistic regression analyses were used to establish both crude and confounder-adjusted relations between the outcome and response variables. ORs and 95% CIs were calculated; variables were considered significant predictors if the *P* value was < 0.05.

Ethical considerations and consent procedure

This study was approved by the research review committee and ethical review committee, the 2 obligatory components of the institutional review board of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). Written consent was obtained from each of the household heads and informed written consent was provided by the participants. The participants were informed that their participation was completely voluntary and that they were allowed to withdraw their participation at any time.

Results

Demographic characteristics of the respondents

The national VGD program targets rural Bangladeshi citizens living in the lower socioeconomic strata. As shown in **Table 1**, the mean age of the VGD women was >32 y at baseline and 34 y at endline. Family size was found to be similar at baseline and endline. With regard to educational level of the VGD women, 26% of women at baseline and 29% women at endline were illiterate. More than half of the household had access to electricity and >80% of the households had access to mobile phones. Half of the households had 1 sleeping room during both survey periods, and 13.3% and 9.8% of households had >3 rooms for sleeping at baseline and endline, respectively. In addition, >80% of households had their own homestead land and >10% of the households had >15 decimals (1 decimal = 435.6 sq. feet) of agricultural land. Approximately 77% of baseline and 81% of endline respondents were housewives and most of the household heads were females. Half of the households drank water from a tube (an iron pipe with a solid steel point and lateral perforations near the end is driven into the earth until a water-bearing stratum is reached, when a suction pump is applied to the upper end) and one-third of households had access to sanitary latrines with and without flushing capacity during both baseline and endline.

Figure 2 shows the changes in the food security of the respondents’ households according to the HFIAS in the previous month. Only ~4% of households were food secure at baseline. The proportion of food-secure households increased to 23% at endline. On the other hand, 49.4% of households were significantly severely food insecure

TABLE 1 Sociodemographic characteristics

Characteristic	Baseline (n = 870)	Endline (n = 806)
Age of respondents, mean ± SD, y	32.50 ± 7.67	34.47 ± 7.65
Mean family size, n	4.60	4.30
Education of respondents, n (%)		
No education	228 (26.21)	60 (28.90)
Primary incomplete	244 (28.05)	170 (21.09)
Primary complete	160 (18.39)	155 (19.23)
Secondary incomplete	215 (24.71)	224 (27.29)
Secondary complete/above	23 (2.64)	24 (2.98)
Household assets, n (%)		
Electricity	503 (57.82)	543 (67.37)
Mobile phone	732 (84.14)	748 (92.8)
Number of rooms for sleeping, n (%)		
1	447 (51.38)	456 (56.58)
2	307 (35.29)	271 (33.62)
>3	116 (13.32)	79 (9.8)
Type of homestead, n (%)		
Own homestead	702 (80.69)	730 (90.57)
Land ownership, n (%)		
Homestead land	147 (16.90)	97 (12.3)
Agricultural land, n (%)		
Landless	723 (83.1)	709 (87.97)
1–15 decimals of land	83 (9.54)	40 (4.96)
>15 decimals of land	64 (7.36)	57 (7.07)
Occupation of the respondents, n (%)		
Professional	3 (0.34)	13 (1.61)
Unskilled worker	83 (9.54)	39 (4.84)
Agricultural day laborer	7 (0.8)	11 (1.36)
Home servant	0 (0.0)	35 (4.34)
Housewife	671 (77.13)	651 (80.77)
Others	106 (12.16)	57 (7.07)
Gender of household head, n (%)		
Male	27 (3.1)	15 (1.86)
Female	843 (96.9)	791 (98.14)
Source of drinking water, n (%)		
Own tube well	166 (19.08)	163 (20.22)
Others' tube well	267 (30.69)	243 (30.15)
Community tube well	114 (13.1)	139 (17.25)
Supply water (piped)	42 (4.38)	38 (4.71)
Pond/filtering of pond water	198 (22.76)	200 (24.82)
Others	83 (9.54)	23 (2.85)
Toilet facilities, n (%)		
Sanitary with flush (water sealed)	251 (28.85)	236 (29.28)
Sanitary without flush (water sealed)	464 (53.33)	505 (62.66)
Pucca/pit (not water sealed)	96 (11.03)	60 (7.44)
Kaccha/hanging (fixed place)	59 (6.78)	5 (0.62)

($P = 0.001$) at baseline compared with only 6.3% at endline. Mild food insecurity also increased from baseline to endline.

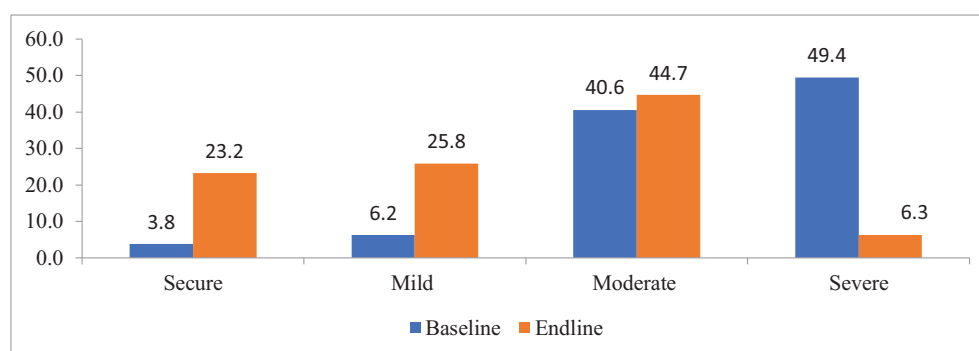
Figure 3 shows the prevalence of hunger among the respondents' households according to the HHS. More than 97% of respondents reported no hunger at endline, which was an improvement from 78.5% at baseline. There was a significant reduction in moderate hunger from 19.5% at baseline to 2.5% at endline ($P = 0.001$). A minimal proportion of households had severe hunger at endline.

Figure 4 shows the FCS for each group. At baseline, 67.5% of households had an acceptable FCS compared with 68.1% at endline. The percentage of households with a borderline FCS decreased between baseline and endline. However, the percentage of households with a poor FCS increased from 5.7% at baseline to 8.2% at endline.

Table 2 presents the unadjusted and adjusted multivariable logistic regression analysis of the associations between various factors and food security factors. The adjusted analysis showed that owning a house and land for agriculture, purchasing poultry, and control over purchasing small animals like ducks and chickens were associated with food security. The adjusted odds of being food insecure was 42% lower [adjusted OR (aOR): 0.58; 95% CI: 0.35, 0.96; $P = 0.036$] for households that owned agricultural land. Ownership of a house had a lower risk of getting food insecurity than women who had no house ownership (aOR: 0.44; 95% CI: 0.21, 0.96; $P = 0.031$). Furthermore, when adjusted for other variables, the odds of a household being food insecure were 47% lower (aOR: 0.47; 95% CI: 0.28, 0.78; $P = 0.004$) if the respondent had power over purchases such as poultry. A higher household asset index (highest quintile) was associated with a lower risk of food insecurity (aOR: 0.38; 95% CI: 0.22, 0.66; $P = 0.001$) compared with households in the lowest wealth quintile.

Discussion

This study explored the factors associated with HFI among beneficiary households of the VGD program. At baseline, only 4% of households were food secure. On other hand, over half of households in both groups were severely food insecure. However, severe food insecurity decreased from ~50% at baseline to only 6.3% at endline. Owning a house, owning land for agriculture, purchasing power for poultry, and the household asset index were significantly associated with food security.

**FIGURE 2** Proportion of households with food insecurity according to the HFIAS scale. HFIAS, Household Food Insecurity Access Scale.

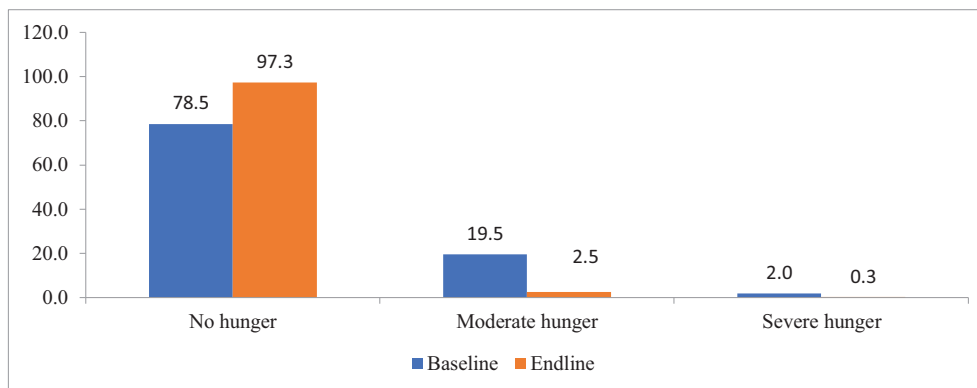


FIGURE 3 Prevalence of hunger among respondents' households according to the household hunger scale at baseline and endline.

In agreement with previous observational studies in Ethiopia and Zambia (23–25), we found that food insecurity was associated with a number of household characteristics, including family size. Ownership of a house was significantly associated with household food security among the VGD beneficiaries. An econometric assessment of household food security in Bangladesh found that 60% of homeowners and 62% of households with electricity had higher food security than non-homeowners and households without electricity (26). Bangladesh is an agricultural country, and access to agricultural land was previously associated with better food security. For example, 27% of households with ownership of land (≥ 2.5 acres) were food insecure compared with 48% of households with no land (26). We also found that ownership of a house and agricultural land was positively associated with household food security (27).

We observed a significant association between purchasing poultry and food security. According to the FAO, livestock provide a source of income for farmers in developing countries and contribute to food security. Money can be generated through selling the products of livestock, such as eggs and milk, to ensure food security (28). In Africa, ownership of poultry by rural families reduced poverty, improved food security, and promoted gender equality, especially among unprivileged house-

holds in rural areas (29). We also observed that combined ownership of poultry was significantly associated with food security.

The wealth index is a determining factor in food insecurity. The present study found that households in the highest wealth quintile were significantly less likely to experience food insecurity than households in lower quintiles. Similarly, low food insecurity was associated with both the middle and highest wealth quintile in Bangladesh and Zambia (30, 31). Moreover, comparative studies conducted in Kenya, the Philippines, and Bangladesh found that the wealth index was associated with food security (32). Furthermore, the household asset index is widely associated with hunger (33). In Nigeria, SES was an important contributing factor for food insecurity, especially among rural households, as higher income increased access to food and improved food security (34). Households with a low dietary diversity owned fewer assets than those with a higher dietary diversity. Similar findings were observed in the study of Hatloy et al. 2000 (35).

The VGD program aimed at improving the SES of the female beneficiaries, so that they can avoid extreme poverty and their households can achieve a sustainable economic condition. VGD social safety net programs that provide rice (normal and fortified) can improve food security, as shown by a study that assessed the effect of safety net programs

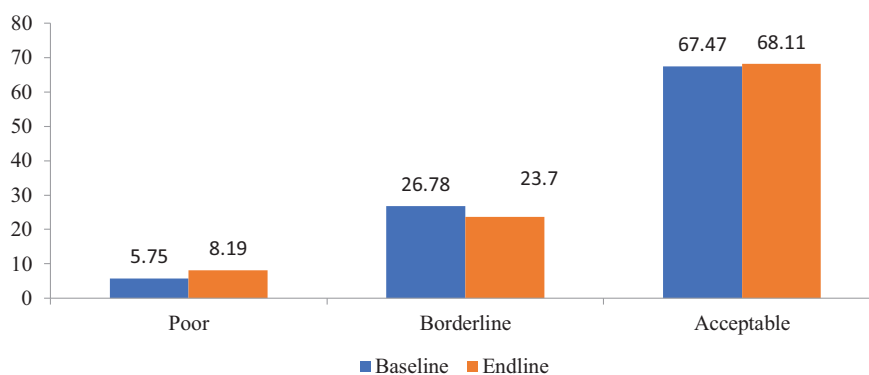


FIGURE 4 Profile of food consumption for the respondents' households according to the food-consumption score at baseline and endline.

TABLE 2 Factors associated with food insecurity¹

Variables	OR (95% CI)	P	Adjusted OR (95% CI)	P
Group				
Non-FFR	Ref		Ref	
FFR	0.92 (0.66, 1.28)	0.633	0.99 (0.69, 1.40)	0.958
Owner of the house				
No	Ref		Ref	
Yes	0.12 (0.02, 0.22)	0.019	0.44 (0.21, 0.96)	0.031*
Owner of agricultural land				
No	Ref		Ref	
Yes	0.13 (0.04, 0.23)	0.004	0.58 (0.35, 0.96)	0.036*
Poultry raising				
No				
Yes	0.56 (0.34, 0.91)	0.019	0.47 (0.28, 0.78)	0.004*
Household asset index				
Lowest quintile	Ref			
Second quintile	0.58 (0.35, 0.98)	0.044	0.59 (0.34, 1.00)	0.060
Middle quintile	0.76 (0.44, 1.31)	0.334	0.77 (0.45, 1.36)	0.381
Fourth quintile	0.93 (0.52, 1.66)	0.819	0.99 (0.55, 1.81)	0.987
Highest quintile	0.35 (0.21, 0.60)	0.000	0.38 (0.22, 0.66)	0.001*

¹Variables used in multivariable logistic regression.

on food insecurity among nonimmigrant, single-parent families in the United States with incomes 30% below the poverty line (36). However, a combination of cash stipends and food rations may also reduce food insecurity (36). The HFIAS, which measures food anxiety status as well as the quality and quantity of food consumed, revealed a significant increase (from 4% to 23%) in the percentage of food-secure households at endline compared with baseline. The largest change in severe food insecurity was observed in both groups, with a decrease from 49.4% at baseline to 6.3% at endline. Various studies have indicated that fortified crop rations can alleviate food security and poverty in developing countries (37–39). Although the VGD food distribution program significantly improved the household food security of the participating women, improved dietary diversity was not observed; mean dietary diversity remained unchanged over the study period in both groups (data not shown). There is growing evidence that a conditional cash transfer is positively associated with improving dietary diversity along with food security (40). Dietary diversity and nutrient adequacy are positively associated in many developing countries (41), as well as within the South African context (42).

Strengths and limitations of the study

The strength of this study involved a large sample size and a robust methodology (17). Another strength of our study was the response rate, which was >90%. However, we could not assess the nonresponder bias due to the study's cross-sectional nature. There is a possibility of recall bias related to the HFIAS data, as information for 1 mo preceding the survey was gathered through maternal recall. Moreover, the sample size for the original study was based on the prevalence of anemia. We have estimated the power of the study to examine the associated factors with food insecurity.

Conclusions

From these findings, we conclude that the VGD rice distribution program significantly contributed to achieving food security for vulnerable women but not dietary diversity. The ownership of household and agri-

cultural land, poultry raising and household size, and highest wealth quintile were positively associated with food security. Findings from the current study generate evidence that larger interventions are needed to alleviate HFI among vulnerable women. The social safety net program should include cash transfers along with food distribution. Furthermore, a strong emphasis should be given to incorporation of behavioral interventions along with food assistance to improve the dietary diversity of vulnerable groups.

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