



AN EXPLORATION OF MATERNAL DIETARY DIVERSITY AND HOUSEHOLD FOOD SECURITY IN UNDERNOURISHED PREGNANT WOMEN LIVING IN NORTHERN BANGLADESH

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ABSTRACT

Purpose: Inadequate dietary intake during pregnancy is a major problem in many low-income countries. This study aimed to investigate dietary diversity of pregnant women in first, second or third trimester of pregnancy, and associations with household food security in a rural district of northern Bangladesh.

Design: In September 2012, skilled community nutrition volunteers ($n = 8$) interviewed undernourished pregnant women ($n = 10$) using a questionnaire which consisted of three components

1. demographics
2. household food security and
3. dietary diversity.

The Household Food Insecurity Access Scale (HFIAS) was adapted to explore household food access and the individual dietary diversity questionnaire to explore women's dietary diversity. Data were analysed using HFIAS and dietary diversity validated methodology.

Findings: This study found that half of households were identified as food insecure, and two thirds of women had inadequate dietary diversity, which may contribute to the burden of undernutrition and micronutrient deficiencies. There appeared to be no relationship among women with low dietary

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diversity scores and household food security. Study findings indicate that additional research is required to identify the relationship between maternal nutrition status, dietary diversity scores and household food security.

Keywords: maternal undernutrition; Bangladesh; low-income country; individual dietary diversity scores; Household Food Insecurity Access Scale; HFIAS.

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INTRODUCTION

Inadequate dietary intake during pregnancy is a major problem in many low-income countries (World Bank, 2013). The causes of maternal undernutrition are multifaceted. Maternal nutritional status is influenced not only by dietary preferences, but also by underlying conditions that affect household food security, care practices and access to health services such as political, economical, cultural and environmental structures (UNICEF, 1990). Dietary diversity over a reference period provides information on household food access and dietary quality (Hoddinott, 1999; Kennedy et al., 2007, 2011). Dietary diversity scores have been positively associated with nutrient adequacy (Arimond et al., 2011), household per capita energy intake (Hoddinott and Yohannes, 2002), and household food security in developing countries (Hoddinott and Yohannes, 2002; Kennedy et al., 2007). These associations have not yet been explored among undernourished pregnant women living in rural areas of northern Bangladesh.

Bangladesh has among the highest rates of maternal and child undernutrition globally (UNICEF, 2009). Low birth weight (<2500 g) affects one in five newborns (Ahmed et al., 2012); stunting affects one in three children 6 to 59 months (NIPORT, 2012); and maternal undernutrition affects one in three women (defined as a Body Mass Index <18.5 kg/m²) (NIPORT, 2009). Maternal undernutrition (defined as a Body Mass Index <18.5 kg/m²) increases the risk of low birth weight (Black et al., 2008) and Small for Gestational Age (SGA) (Black et al., 2013). A fifth of childhood stunting may be attributable to poor foetal growth, as shown by being born SGA (Black et al., 2013). In rural Bangladesh extreme poverty (defined as earning <\$1.25 per day by the World Bank) is three times higher than in urban areas, women

are less likely to access antenatal and postnatal services, and children suffer from higher rates of chronic malnutrition at 43% and 36% in rural and urban areas, respectively (NIPORT, 2012).

In Bangladesh, traditional practices strongly influence maternal food consumption (Shannon et al., 2008). Bangladeshi society features resilient social and cultural structures, is steeped in traditional beliefs, and is staunchly patriarchal. Dietary taboos and food aversions are widely practiced, limiting the dietary consumption of pregnant women (Shannon et al., 2008). Women traditionally eat last at a meal, resulting in the smallest share (Shannon et al., 2008). While the purdah system of confining a woman to the home appears no longer common (Sobehart, 2009), women generally remain voiceless in household decision-making. Despite moderate levels of nutrition knowledge, the patriarchal society limits foods consumed, access to healthcare, access to community events and livelihood activities for women (Shannon et al., 2008).

The purpose of this study is to investigate women's dietary diversity and food security status of pregnant women living in rural Bangladesh. It is anticipated that these findings will help to provide a deepened understanding of factors that influence the diet of pregnant women in this context, and will be used to inform future tailored nutrition interventions appropriate for this target audience.

METHODS

Setting

The study was conducted in September 2012 in three rural villages of Rangpur district in northern Bangladesh. The participating villages were earlier selected to participate in a larger maternal supplementation program, which started in

February 2013. The villages are typical of villages in northern Bangladesh that have dirt road access that is often inaccessible during the wet season. The communities have limited experience with foreign type foods and are largely dependent on subsistence farming.

Participant characteristics

Women were invited to participate in the study if

1. they suffered no illness requiring medical referral
2. were confirmed to be pregnant by midwife, skilled community health volunteer, or other health professional and
3. were undernourished as defined by a Mid-Upper-Arm Circumference (MUAC) ≤ 22.1 cm.

MUAC was the preferred indicator to identify acute malnutrition in pregnant women based on its association with low birth weight (Ververs et al., 2013; WHO, 1995). The cut-off was determined after a review of the evidence and a discussion with organisations conducting nutrition programs and research in Bangladesh (WHO, 1995).

Recruitment

Prior to the commencement of this study, eight females from the selected communities were trained on the basics of nutrition, the study purpose and design. The community nutrition volunteers had a minimum of a primary-level education and were aged between 21 and 49 years. The community nutrition volunteers compiled lists of all pregnant women in first, second or third trimester pregnancy, in the three villages. Pregnant women were identified through community discussions, door-knocking and snowballing. If interested, the community nutrition volunteer then verified that the woman met the inclusion criteria. Women were given a brief overview of the project and were invited to participate. Written consent to participate was obtained after participants heard the project information sheet read aloud. A copy in the local language was provided to participants for their further reference. From the lists compiled by the community nutrition volunteers, a total of ten pregnant women who met the inclusion criteria were identified. All ten women who met the inclusion criteria agreed to participate and completed the interview process.

Procedures

The community nutrition volunteers assisted participants to complete a questionnaire comprising of

1. demographics
2. household food security and
3. dietary diversity.

Authors were not engaged with the participants during the data collection process since being an outsider to the communities could have influenced volunteers' engagement with participants. To explore household food security, questions were included on the agro-ecological context, food supplies and livelihoods of participant households. The food security component of the survey was complemented with the nine-item validated Household Food Insecurity Access Scale (HFIAS) questionnaire (Coates et al., 2007) to explore household food insecurity in terms of access. This approach was similar to that reported in a recent study by Becquey et al. (2010) in West Africa.

Dietary diversity was explored using the Food and Nutrition Technical Assistance Project (FANTA; a cooperative agreement funded by USAID and managed by FHI 360) women's dietary diversity questionnaire; validated in Bangladesh as well as other low-income country population groups (Arimond et al., 2011).

Outcome measures

The primary outcome measures included household food security status, and dietary diversity score.

Data analysis

Characteristics of participants were summarised using Microsoft Excel © and SPSS Statistics 23.0 ©, descriptive statistics. Household food security status was determined using the HFIAS for Measurement of Food Access Indicator Guide (Coates et al., 2007) to analyse responses to the HFIAS questionnaire. With a recall period of 30 days, each woman answered questions on their experience of food insecurity in terms of feelings of uncertainty or anxiety over food; perceptions that food is of insufficient quantity and quality; reported reductions of food intake and the consequences of reduced food intake; and feelings of shame for resorting to socially unacceptable means to obtain food (Coates et al., 2007). Data were analysed to

create frequency of occurrence variables for each question; frequencies for each food insecurity access domain (anxiety, food quality and food quantity); and household food insecurity access scores to identify the prevalence of different levels of household food insecurity. Dietary diversity was analysed using the FANTA Project guidelines for measuring women's dietary diversity (Kennedy et al., 2011). The questionnaire measured a woman's dietary diversity over a 24-hr period on an average day. The 16-item questionnaire was aggregated to form nine food groups which were calculated to create women's dietary diversity scores; starchy staples, dark green leafy vegetables, vitamin A rich fruits/vegetables, other fruits/vegetables, organ meats, meat/fish, eggs, legumes/nuts/seeds and milk/milk products. While information on oil/fat; sweets; and spices/condiments/beverages was collected, these data were not considered for the calculation of dietary diversity scores. To explore consumption of vitamin A and iron rich food, indicators from specific food groups were created. Dietary diversity was summarised as

a proportion of women consuming individual food groups; proportion of women consuming specific micronutrient rich food groups; and as a dietary diversity score for each participant. Dietary diversity scores were divided into tertiles to distinguish diets of high, medium and low diversity. Dietary diversity scores below five food groups indicated a lower probability of adequate nutrient intake, while dietary diversity scores above five food groups indicated a higher probability of adequate nutrient intake (Kennedy et al., 2010). The study lead author contextualised the HFIAS and women's dietary diversity questionnaires to reflect Bangladeshi locally available foods and context. Questionnaires were translated into local terminology, back translated and field-tested prior to use, as recommended by Coates et al. (2007).

Ethics

This project had human research ethical approval from the James Cook University (Australia) Ethics committee (H4498) and the Bangladesh Medical Research Council.

Table 1 Background characteristics of women that participated in the study

<i>Characteristics (IQR, Interquartile range)</i>	<i>Women (n = 10)</i>
Age (year, median, IQR)	23 [19.5–27]
Month of pregnancy (month, median, IQR)	5.5 [5.0–6.25]
Lived at village since birth (%)	100
Married (%)	100
Average household size	4.4
Male head of household (%)	100
Education (year, median, IQR)	2.5 [0–5.75]
Religion: Islam/Hinduism (%)	60/40
Husbands or father in-laws make financial decisions (%)	100
Husbands or father in-laws make decisions on food purchases (%)	100
Make own healthcare decisions (%)	20
First pregnancy (%)	30
Number of births (median, IQR)	1 [1–4]
Number of children alive (median, IQR)	1 [0–2]
Accessed skilled antenatal services (%)	0
Received nutritional intervention during pregnancy (iron-folic acid) (%)	20

RESULTS

Background characteristics

Background information is summarised in Table 1. All eligible women identified by the community nutrition volunteers participated in the study ($n = 10$).

The median age of participants was 23 years and education levels at 2nd grade. All women reported that they were born, raised and married in their current village. Women shared that the head of household was a male, either their husband or their father in-law. These heads of the household made all financial decisions including decisions on food purchases. At the time of this study, three of the ten women experienced pregnancy for the first time. Of the women that had previously given birth to a child, four of seven women had a child that later died, one experienced a stillbirth and one experienced a miscarriage. No women reported having accessed skilled antenatal services however, two women reported receiving iron-folic acid supplementation.

Household food security

Table 2 illustrates household food security. All women reported that they take care of the household and do not work outside of the house. The main income earner of every household was a male (husband: $n = 8$; father in-law: $n = 2$) and their occupations included crop farming ($n = 6$) and waged labour ($n = 4$). Of households that owned their land ($n = 4$), the majority ($n = 3$) owned less than one acre, and all cultivated their land for rice. While six households owned live stock that included cows, goats and chickens; three grew fruit and vegetables; three households reported running out of food stores each year from November to March; and seven reported that their main source for obtaining food for the household was through market purchase. The majority of households were constructed of bamboo (bamboo: $n = 8$; iron/wood: $n = 2$), and do not have electricity ($n = 8$).

Table 3 highlights the findings on household food security using the HFIAS tool. Of the women, six were identified as food insecure, with three reporting severe food insecurity. At some stage

Table 2 Household food security

<i>Food security</i>	<i>Mothers (%) (n = 10)</i>
<i>Main income source</i>	
Crop farmer	60
Waged labour	40
<i>Own land for cultivations</i>	
If yes, less than 1 acre	75
Rice crop grown last year	100
<i>Grow fruit and vegetables at household</i>	
If yes, household consumption	33
<i>Own livestock; If yes,</i>	
Cows	100
Goats	67
Chickens	100
Reportedly run out of food stores each year (Nov-Mar)	30
<i>Main source for obtaining food for household</i>	
Own produce	30
Market purchase	70

Table 3 Household food insecurity using the HFIAS

<i>Household Food Insecurity</i>	<i>Women (%) (n = 10)</i>
<i>Household Food Insecurity Access Score</i>	
Food secure	40
Mildly food insecure	10
Moderately food insecure	20
Severely food insecure	30
<i>Food insecurity concerns</i>	
Anxiety and uncertainty about the household food supply	50
Insufficient quality (includes variety and preferences of the type of food)	60
Insufficient food intake and its physical consequences	30

over the last 30 days, half of households reported that they worried about sourcing food for the household, were unable to eat preferred foods, and ate foods that they did not enjoy. In addition, two households reported going to sleep hungry or having no food of any kind in the household, and three reported cutting down on the size of their meals. When indicators were aggravated by HFIA domain (representing a percentage), the findings illustrated that half of women reported having felt anxious and uncertain about their household food supplies, 60% reported having insufficient quality food (including variety and food-type preference), and 30% of women reported insufficient food intake resulting in physical consequences such as hunger.

Dietary diversity

Women's dietary diversity ranged from three ($n = 2$) to five food groups ($n = 3$), over nine possible groups. The median number of food groups was at 4.0 (IQR = 3.75–5.0), indicating low probability of adequate dietary intake (Kennedy et al., 2010). The main food groups consumed by all women in the lowest dietary diversity tertile were starchy staples; other fruits/vegetables; and dark green leafy vegetables. The main food groups consumed by 50% or more of women in the highest dietary diversity tertile included those consumed by the lowest tertile with the addition of legumes nuts/seeds and milk /milk products. No women reported consuming organ meats or eggs.

The consumption of vitamin A rich foods was high with almost all women consuming at least one vitamin A rich food on an average day ($n = 9$), however less than half consumed animal-based foods, resulting in a low intake of haeme-iron and animal-source vitamin A rich foods.

Household food security and dietary diversity

Of women with low dietary diversity scores ($n = 2$), none were from severely food insecure households, whereas three of eight women with moderate dietary diversity scores were from severely food insecure households.

DISCUSSION

This study found that on average, undernourished pregnant women had an inadequate dietary intake, and were from households identified as food insecure. While most women consumed animal or plant-based vitamin A food groups, only half consumed haeme-iron rich foods. Current research indicates that women with lower dietary diversity scores are more likely to belong to the lowest quintiles of poverty indices (Rah et al., 2010). Due to the small sample size, no investigation was conducted to explore the association between dietary diversity and household food security status. However, there appeared to be no relationship among the women with low dietary diversity scores and household food insecurity.

Household food security consists of three pillars: access, availability and utilisation of food (FAO, 2008). This study explored household food security in terms of access (financial). The study findings identified that more than half of women were from food insecure households, with a third severely food insecure who reportedly reduced the frequency or quantity of meals. A third of the women were from households that reportedly ran out of food stocks annually. These findings align with findings reported by the 2012 Bangladesh Demographic Health Survey (2012). While nutrition education is of utmost importance to ensure that women know which foods to eat during pregnancy, consideration must be given to the accessibility to these food items. Programs need to incorporate nutrition sensitive approaches that address the root causes of undernutrition; household income and homestead food production (Black et al., 2013).

Dietary diversity questionnaires and scores assisted with identifying which nutrient-rich food groups were being consumed by the target population. Women reported to consumed an average of four food groups of a possible nine per day, indicating low probability of adequate dietary intake, which may contribute to the burden of undernutrition and micronutrient deficiencies (Kennedy et al., 2010; World Health, 2004). Almost all women consumed either a plant or animal-source vitamin A rich food, however only half of women consumed haeme-iron rich foods. Findings on low dietary diversity align to those reported in a similar study conducted in Bangladesh.

To address undernutrition during pregnancy, dietary diversification is recommended to help ensure adequate dietary intake. This can be achieved through food-based strategies, an approach which has been shown to improve dietary quality in general (Allen, 2008). Given the sub-optimal level of dietary diversity and high level of food insecure households, both household access and nutritional education on dietary diversification must be taken into consideration when designing nutritional strategies.

The study findings indicated a strict patriarchal society in the selected villages. Pregnant women in the selected communities had a low level of education, were born and raised in the village

that they currently resided in, and typically cared for the household. The men (husband or father in-law) were typically the household head, the main household income earners, and financial decision-makers for household members, including decisions on healthcare and purchase of food from the marketplace. Maternal nutrition interventions need to target the head of household in addition to pregnant woman, as men are typically the decision-makers on the selection and purchase of foods to be consumed by the household, and whether or not a household member is to receive healthcare. This information is particularly relevant when disseminating maternal nutrition education messages and when promoting antenatal and postnatal services.

LIMITATIONS

This study involved ten participants. While the sample size is small, this reflected the total number of identified undernourished pregnant women in the selected villages at the time of the study.

The two validated tools used (HFIAS and the dietary diversity questionnaire) provided a snapshot of the dietary diversity and household food access. The tools do not capture seasonal changes to food availability and household food security status, and subsequently do not identify dietary diversity and household food security at different times of the year.

Both tools have a recall period, which may have resulted in reporting bias. The dietary diversity questionnaires used a 24-hr recall period, whereas the HFIAS used a four-week recall period. Participants may forget items, and particularly for the 24-hr recall period, the time period may be insufficient to capture the typical dietary intake of the participant, and may capture episodic foods that are not typically consumed.

Respondent bias may also be an issue. In population groups where food assistance or humanitarian aid programmes are frequent, participants may over-report food insecurity and under-report dietary diversity with the expectation of receiving assistance. Further, participants may 'modify' their diet or household resources based on social desirability.

CONCLUSION

In three villages of Rangpur district, northern Bangladesh, more than half of undernourished pregnant women have an inadequate dietary intake and come from food insecure households. The study findings highlighted the need to improve diets for pregnant women living in rural areas of Bangladesh. Scaling up nutrition interventions to address household food access that include both men and women may assist to improve nutritional status of otherwise nutritionally vulnerable pregnant women. While the findings reflect the three villages included in this study, the findings may be generalised to similar villages in Bangladesh and inform the design of future maternal nutrition interventions. In addition, this study can inform future studies, with larger sample sizes, that aim to explore whether household food security status affects the dietary diversity of pregnant undernourished women in northern Bangladesh.

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BIOGRAPHICAL NOTES

Briony Stevens is a DrPH candidate and part of the Cohort Doctoral Studies Program within the School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Australia. He holds a Bachelors degree in Health Science majoring in nutrition, a Master's degree in International Public Health from the University of Sydney, and is a registered Public Health Nutritionist with the Nutrition Society of Australia. His area of research focuses on maternal nutrition and its role in the physical development of the child in low-income countries. Parallel to her research, he works with the United Nations Children's Fund (UNICEF) supporting nutrition in emergencies programs.

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Alan Clough is an epidemiologist and an associate professor within the College of Public Health, Tropical Medical and Rehabilitation Sciences at James Cook University, Australia. He is principally recognised in Australia and internationally for his work in the difficult and often neglected area of substance misuse in remote community populations. He has a background in applied community development, and much of his research and practice is in intervention research.

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Julie Brimblecombe is a senior research fellow with the Menzies School of Health Research and is nutrition team leader in the Wellbeing and Preventable Chronic Diseases Division. She also holds a Heart Foundation Future Leader Fellowship. Since being awarded a National Health and Medical Research Council Public Health Fellowship in 2009, she has developed a significant research program in the area of Indigenous nutrition and is contributing to the evidence base to inform policy and practice. Her research focuses on population dietary interventions, determinants of healthy eating and building capacity to support community-driven decision-making for nutrition improvement.