Factors associated with dietary diversity and physical activity of pregnant women in Bangladesh: A cross-sectional study at an antenatal care setting

Satyajit Kundu1 | Dilruba Easmin Jharna1 | Md. Hasan Al Banna2 | Md Shafiqul Islam Khan 2

1 Department of Biochemistry and Food Analysis, Patuakhali Science and Technology University, Patuakhali, Bangladesh
2 Department of Food Microbiology, Patuakhali Science and Technology University, Patuakhali, Bangladesh

Abstract

Introduction: Both dietary diversity and physical activity during pregnancy are very important since they are known to affect pregnancy and birth outcomes. However, little is documented on dietary diversity and physical activity among pregnant women in Bangladesh. Accordingly, this study was designed to assess the dietary diversity and physical activity level, as well as their associated factors, among pregnant women at an antenatal care setting in Bangladesh.

Methods: An institution-based cross-sectional study was conducted with 96 randomly selected pregnant women who sought antenatal care at a hospital in Khulna City, Bangladesh in July 2020. Dietary diversity and physical activity were assessed using the 24-h dietary recall method of consuming seven food groups, and standardized Pregnancy Physical Activity Questionnaire (PPAQ), respectively. Simple and multivariable logistic regressions were conducted to determine the factors associated with dietary diversity and physical activity among pregnant women.

Results: Around 70% of participants had high dietary diversity and 58.3% were physically active. Being job holders, getting counseling on diet, and being from higher income and food-secured families were identified as potential determinants of the high dietary diversity of participants. Having higher secondary education, being job holders, and being from families with a size of below five were more likely to be physically active compared to others.

Conclusion: In light of these findings, there is a need to support existing policies and devise new policies targeting these variables. Improving awareness on the importance of dietary diversity during pregnancy, incorporating counseling services, ensuring household food security especially during this pandemic situation, and providing women with diet counseling are recommended to increase pregnant women’s dietary diversity and physical activity level.

KEYWORDS
Bangladesh, dietary diversity, physical activity, pregnant women

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1 | INTRODUCTION

1.1 | Dietary diversity during pregnancy

Nutritional requirements are higher during pregnancy than other periods of life in order to meet the metabolic and physiological needs of the mother and the growing fetus.1,2 Proper nutrition during pregnancy is crucial for healthy growth.1,2 Dietary diversity during pregnancy is a determinant of the growth and development of infants as well as the long-term health outcomes of mothers.3,4 However, pregnant women are more vulnerable to suffer from nutritional deficiency due to factors such as physiological vulnerability, inadequate education, social or cultural traditions, and household workloads.3–5 Malnutrition during pregnancy can permanently affect the physiological development of the fetus, increase the risk of intrauterine growth restriction, low birth weight, perinatal delivery, and maternal morbidity and mortality.6 Thus, nutritional improvement during pregnancy is necessary to decrease the global burden of maternal and child malnutrition, morbidity, and mortality.7 Previous scientific studies suggest that the adequacy of micronutrient intake through diet can be measured by the dietary diversity (DD) scores of pregnant women.8 Measuring DD score (DDS) is relatively simple, easy to apply, and can reflect the micronutrient intake of pregnant women.9 When a pregnant woman’s diet is not diversified, it will be deficient in essential nutrients and as a result, the fetus will not be provided the nutrition required for its healthy growth.10

Nutritional deficiency and poor nutritional status of pregnant women are widespread problems in lower- and lower-middle-income countries.11 The prevalence of undernutrition among females in Bangladesh is higher, and dietary intake from diversified food groups is lower, compared to other developing countries.12 In Bangladesh, the leading causes of lower DD include low family wealth index, lack of education, and inability to afford food due to periodic unemployment.13 A longitudinal study on maternal DD conducted in rural Bangladesh reported that the DDS declined with comparatively worse household food security, an association that can be best explained by the wealth index of the family.14 It has been reported that having a financial crisis is linked with lower intake of various micronutrients among pregnant women in Bangladesh.15

1.2 | Physical activity during pregnancy

Adequate physical activity (PA) during pregnancy is considered to be safe and beneficial for both the fetus and pregnant woman and may improve pregnancy outcomes.16,17 PA can reduce the risk of pre-eclampsia,17 pelvic pain and back pain,18 gestational weight gain during pregnancy,19 anxiety and depressive symptoms,20 and can improve sleep,21 health perception,22 and self-reported body image.23 It can increase the well-being of pregnant women, particularly those who are overweight or obese.24 The recommended levels of PA by the World Health Organization (WHO) for pregnant women aged 18–64 years are moderate-intensity aerobic PA for at least 150 min per week, vigorous-intensity aerobic PA for 75 min per week, or a combination of these.25 Although health care providers advise pregnant women to maintain or increase their PA, many women engage in less PA during pregnancy.26 Despite well-documented health benefits, around 60–80% of pregnant women,27 including those who are overweight or obese,28 do not participate in PA as recommended.29

1.3 | Rationale of the study

It is important to understand the DD and PA level of pregnant women as well as their associated factors, particularly among those who are at risk of having a diet with poor diversity and engaging in little or no PA during pregnancy. Such information may help policymakers to identify vulnerable groups and to facilitate the consumption of diversified foods, especially among those groups who are unable to afford such foods. In order to design interventions that increase women’s participation in PA (i.e., leisure-time PAs or structured exercise programs) during pregnancy, we need to understand the different socio-demographic risk factors affecting their PA. However, few studies have investigated the DD of pregnant women and its associated factors. Furthermore, as per our knowledge, no study has investigated pregnant women’s self-reported PA level and factors associated with PA in Bangladesh. Hence, it is not clear what factors are associated with PA during pregnancy.

1.4 | Objectives

The objectives of this study were (a) to assess the DD and its associated factors, and (b) to investigate the level of self-reported PA of pregnant women and factors that affect PA at an antenatal care setting in Khulna City, Bangladesh.

2 | METHODS

2.1 | Study design and setting

An institution-based cross-sectional study was conducted in a Mother and Child Welfare Centre of Khulna district, Bangladesh. It is 259 km from Dhaka, the capital city of Bangladesh. The study was conducted from July 2020 to September 2020. The Mother and Child Welfare Centre of Khulna City is an antenatal care center that provides outpatient services, emergency, and all antenatal and postnatal care services. Cereals, such as rice, maize, and wheat, are the main staple crops cultivated in the district. The main livestock reared in the district is poultry, cattle, and goats.

2.2 | Study participants

The study participants were pregnant women who visited the Mother and Child Welfare Centre of Khulna City, Bangladesh, for antenatal...
care. A systematic random sampling technique was used to select the participants as the study population, drawn from the source population of all pregnant women attending antenatal care at the Mother and Child Welfare Centre of Khulna district, Bangladesh. All pregnant women aged 18 years and older who lived in Khulna district for at least 6 months before the study and agreed to participate in the study were included. Pregnant women who had chronic diseases or other comorbidities were excluded from the study. Pregnant women who had been seriously ill or had difficulty communicating were also excluded from the study.

### 2.3 Sampling and data collection procedures

Over 3 months, a total of 96 pregnant women who attended the care center for antenatal care were interviewed. Pretested and structured self-administered interview questionnaires were used in order to collect data by trained interviewers (research staff). First, the questionnaire was prepared in English and then translated to Bengali (local language) and translated back to English again to maintain its consistency. To ensure the quality of data, a pretest was done and modifications were made accordingly. The questionnaire contained three main parts. The first part included socio-demographic characteristics (age, educational qualification, educational qualifications of husband, occupation, religion, family size, number of living rooms, and household food security status), and health-related characteristics (pregnancy duration, dietary counseling, and antenatal care during pregnancy). The second part of the questionnaire included questions on DD, and the third part included questions on the PA of pregnant women.

### 2.4 Measures

#### 2.4.1 DD of pregnant women

The DDS for pregnant women was assessed using 24-h recall, a method that was also used by another study among Bangladeshi women. Participants were asked about consumption status (consumed or not consumed) of the seven following food groups over the past 24 h: (a) grains, roots, and tubers; (b) legumes and nuts; (c) milk or other dairy products; (d) eggs; (e) meat, poultry, and fish; (f) vitamin A-rich fruits and vegetables; and (g) other fruits and vegetables. The DDS was determined by summing up the number of food groups consumed by each participant. Scores were categorized into two groups: high DD (for participants who consumed more than 4 food groups), and low DD (for participants who consumed 4 or fewer food groups).

#### 2.4.2 PA of pregnant women

Data were collected using a standardized pregnancy PA questionnaire that was also used in another study of pregnant women. Structured recall of PA performed during the past 7 days was recorded to assess the level of PA of pregnant women. The questionnaire was designed to assess the frequency and duration of occupational, recreational, household, child and adult care, and transportation activities. Women were asked about the number of sessions, average duration per session, and perceived intensity level of all activities in those domains. The 2011 compendium-based metabolic equivalent (MET) values were used to estimate the intensity of each activity. The intensity of activities was multiplied by the duration of time spent on each activity in order to calculate the average weekly energy expenditure. Metabolic equivalent task (MET) values were used to classify each activity by intensity.

### 2.5 Statistical analysis

Data were checked, cleaned, and analyzed using SPSS version 23.0 and STATA version 16.0. The DDSs were dichotomized as category 1 for those who had high DD and category 2 for those who had low DD. Similarly, the PA variable was also dichotomized as category 1 for those who were physically active and category 2 for those who were physically inactive. Descriptive analyses were done to determine means, frequencies, and percentage distributions for the variables. Chi-square analysis was employed to identify the association between outcome variables (DD and PA) and factor variables. Simple and multivariable logistic regressions were carried out to assess the risk factors associated with high DD and PA of pregnant women. Variables were included in binary logistic regression (enter model method) when the chi-square analysis indicated statistical significance with a p-value < 0.2. Model fitness was checked using Hosmer and Lemeshow statistics. Multicollinearity among the factor variables was checked with the variance inflation factors. The strength of association between variables was demonstrated by the odds ratio (OR) with 95% confidence Interval (CI). Variables with a p-value < 0.05 were considered to be statistically significant.

### 2.6 Ethical approval

The research protocol was reviewed and approved by the Research Ethical Committee (REC) of the Department of Food Microbiology,
FIGURE 1  Participants getting dietary counseling and knowing about the antenatal care

3  |  RESULTS

3.1  |  Socio-demographic characteristics, DD, and PA status

Among the study participants, the mean age was 32.16 years (SD = 7.75). Of total, 36 participants (37.5%) had only primary or below primary education and roughly one-fourth (22.9%) had completed their higher secondary or above degree. Half of the women (50.0%) were housewives. Around two-thirds of the respondents’ families (66.7%) had five or more members and 54.2% of the respondents’ families earned below 20,000 Bangladeshi Taka (BDT) monthly. Most of the respondents (60.4%) were in their last trimester of pregnancy (Table 1).

Most of the respondents (70.8%) did not get any diet counseling during their pregnancy. A majority of participants (71.9%) knew about the antenatal checkup (Figure 1). Approximately three-quarters of the respondents’ households (71.9%) were food secured. Overall 69.8% of pregnant women had high DD, and more than half (58.3%) of the pregnant women were physically active (Figure 2).

| Characteristics                        | Categories                | N (%) |
|----------------------------------------|---------------------------|-------|
| Age (years)                            | ≤25 years                 | 26 (27.1) |
|                                       | 26 to 35 years            | 45 (46.9) |
|                                       | >35 years                 | 25 (26.0) |
| Religion                               | Muslim                    | 73 (76.0) |
|                                       | Hindu                     | 23 (24.0) |
| Educational qualification              | Primary or below          | 36 (37.5) |
|                                       | Secondary                 | 38 (39.6) |
|                                       | Higher secondary or above | 22 (22.9) |
| Occupation of pregnant women           | Housewife                 | 48 (50.0) |
|                                       | Job†                      | 30 (31.3) |
|                                       | Others†                   | 18 (18.8) |
| Occupation of husband                  | Job†                      | 26 (27.1) |
|                                       | Business                  | 35 (36.5) |
|                                       | Labor                     | 8 (8.3) |
|                                       | Others‡                   | 27 (28.1) |
| Family size                            | <5 members                | 32 (33.3) |
|                                       | ≥5 members                | 64 (66.7) |
| Family monthly income                  | <20,000 BDT               | 52 (54.2) |
|                                       | ≥20,000 BDT               | 44 (45.8) |
| Pregnancy duration                     | 1st trimester            | 4 (4.2) |
|                                       | 2nd trimester             | 34 (35.4) |
|                                       | 3rd trimester             | 58 (60.4) |

† Job included government employee, and non-government employee.
‡ Others included shopkeeper, day laborer, business, tailor, etc.
§ Others included shopkeeper, tailor, expat, etc.
Pregnant women’s educational qualification (Chi square = 8.14, p = 0.017), occupation (Chi square = 12.23, p = 0.002), husbands’ occupation (Chi square = 9.60, p = 0.022), family monthly income (Chi square = 5.57, p = 0.018), and household food security (Chi square = 8.35, p = 0.004) were significantly associated with their DD in the study. Around 86% of pregnant women who received dietary counseling during their pregnancy had higher DD, compared to 63.2% of pregnant women who did not receive any counseling (Chi square = 4.75, p = 0.029; Table 2).

Education level (Chi-square = 10.96, p = 0.004) and occupation (Chi-square = 8.94, p = 0.011) of pregnant women were significantly associated with their PA. More than half of the pregnant women (54.2%) who were housewives were physically inactive, however, most of the pregnant women engaged in a job (80%) were physically active in the study (Table 3).

### 3.2 Risk factors associated with DD

A binary logistic regression model was performed to examine factors that influence the DD of pregnant women. A Hosmer and Lemeshow test statistic of regression analysis (Chi-square = 3.387, p = 0.908) indicated a good model fit with the observed values. The simple logistic regression shows that pregnant women having secondary or above degree were three times more likely to have high DD compared to those with primary or below education (OR = 3.00, 95% CI: 1.62 to 9.44, p < 0.05), however, while adjusting for other demographic and socio-economic variables, there was no significant association between educational qualification and DD of pregnant women. The adjusted model of regression analysis demonstrates that the pregnant women with a higher secondary or above degree were 5.99 times more likely to be physically active, compared to those with primary or below education (AOR = 5.99, 95% CI: 1.51 to 10.78, p < 0.05). Pregnant women who were employed had 4.3 times higher odds of being physically active, compared to those who were housewives (AOR = 4.30, 95% CI: 1.38 to 11.35, p < 0.05). Pregnant women in families with fewer than five members were 2.92 times more likely to be physically active, compared to those who had a family size of five or more members (AOR = 2.92, 95% CI: 1.04 to 5.17, p < 0.05; Table 5).

### 3.3 Risk factors associated with PA

Again, a binary logistic regression model was performed to examine the influencing factors that affect the PA of pregnant women. The goodness of model fit was checked by Hosmer and Lemeshow test statistic of regression analysis (Chi-square = 7.50, p = 0.379). The adjusted model of regression analysis demonstrates that the pregnant women with a higher secondary or above degree were 5.99 times more likely to be physically active, compared to those with primary or below education (AOR = 5.99, 95% CI: 1.51 to 10.78, p < 0.05). Pregnant women who were employed had 4.3 times higher odds of being physically active, compared to those who were housewives (AOR = 4.30, 95% CI: 1.38 to 11.35, p < 0.05). Pregnant women in families with fewer than five members were 2.92 times more likely to be physically active, compared to those who had a family size of five or more members (AOR = 2.92, 95% CI: 1.04 to 5.17, p < 0.05; Table 5).

### 4 DISCUSSION

Our study has investigated DD and PA, and their associated factors among pregnant women attending an antenatal care setting in Khulna City, Bangladesh.
Our study found that a major proportion of pregnant women had sufficient DD intake. In the present study, the prevalence of high DD was higher than that of previous studies conducted in Ethiopia (43.6%),\textsuperscript{35} Kenya (20%),\textsuperscript{36} and Ghana (46%).\textsuperscript{37} This difference might be due to their study methodology, mainly variation for the food group involved and its food category, in that our study contains seven food groups with two categories, and other studies contained different numbers of food groups and different numbers of categories. Additionally, different geographical locations and seasonal variability might be other reasons for the difference, as in an impoverished rural area in Ghana, where recurrent drought and flood occurred.\textsuperscript{37} Beyond this, variation in different demographic and socio-economic characteristics, as well as reporting bias (due to self-reporting), might be the possible reasons for this incompatibility.\textsuperscript{38}

The simple logistic regression model of the present study demonstrates that the level of maternal education was significantly positively associated with DD, with a higher level of education associated with...
Chi-square analysis showing the distribution of physical activity level based on different socio-demographic characteristics of study participants

| Variables                        | Categories                               | Physical Activity | Statistics                  |
|----------------------------------|------------------------------------------|-------------------|-----------------------------|
|                                  |                                          | Active, n (%)     | Inactive, n (%)             | Chi-square (df) | p value |
| Age (years)                      | ≤25 years                                | 15 (57.7)         | 11 (42.3)                   | 1.79 (2)        | 0.408   |
|                                  | 26 to 35 years                           | 29 (64.4)         | 16 (35.6)                   |                |         |
|                                  | >35 years                                | 12 (48.0)         | 13 (52.0)                   |                |         |
| Religion                         | Muslim                                   | 42 (57.5)         | 31 (42.5)                   | 0.80 (1)        | 0.777   |
|                                  | Hindu                                    | 14 (60.9)         | 9 (39.1)                    |                |         |
| Educational qualification        | Primary or below                         | 14 (38.9)         | 22 (61.1)                   | 10.96 (2)       | 0.004   |
|                                  | Secondary                                | 24 (63.2)         | 14 (36.8)                   |                |         |
|                                  | Higher secondary and above               | 18 (81.8)         | 4 (18.2)                    |                |         |
| Occupation of pregnant women     | Housewife                                | 22 (45.8)         | 26 (54.2)                   | 8.94 (2)        | 0.011   |
|                                  | Job†                                     | 24 (80.0)         | 6 (20.0)                    |                |         |
|                                  | Others‡                                  | 10 (55.6)         | 8 (44.4)                    |                |         |
| Occupation of husband            | Job†                                     | 16 (61.5)         | 10 (38.5)                   | 2.28 (3)        | 0.517   |
|                                  | Business                                 | 23 (65.7)         | 12 (34.3)                   |                |         |
|                                  | Labor                                    | 4 (50.0)          | 4 (50.0)                    |                |         |
|                                  | Others§                                  | 13 (48.1)         | 14 (51.9)                   |                |         |
| Family size                      | <5 members                               | 23 (71.9)         | 9 (28.1)                    | 3.62 (1)        | 0.057   |
|                                  | ≥5 members                               | 33 (51.6)         | 31 (48.4)                   |                |         |
| Family monthly income            | <20,000 BDT                              | 28 (53.8)         | 24 (46.2)                   | 0.94 (1)        | 0.332   |
|                                  | ≥20,000 BDT                              | 28 (63.6)         | 16 (36.4)                   |                |         |
| Pregnancy duration               | 1st trimester                            | 1 (25.0)          | 3 (75.0)                    | 1.93 (2)        | 0.381   |
|                                  | 2nd trimester                            | 20 (58.8)         | 14 (41.2)                   |                |         |
|                                  | 3rd trimester                            | 35 (60.3)         | 23 (39.7)                   |                |         |
| Got diet counselling             | Yes                                      | 16 (57.1)         | 12 (42.9)                   | 0.02 (1)        | 0.879   |
|                                  | No                                       | 40 (58.8)         | 28 (41.2)                   |                |         |
| Knew about antenatal checkup     | Yes                                      | 42 (60.9)         | 27 (39.1)                   | 0.65 (1)        | 0.420   |
|                                  | No                                       | 14 (51.9)         | 13 (48.1)                   |                |         |

| p values less than 0.2 were bolded. |

Higher DD. This finding is in accordance with studies conducted in Kenya, Tanzania, and Ghana. A previous study also reported that women with higher education tend to intake a diet containing variety of food groups. A possible explanation for this is that women with higher education may be more likely to understand educational messages about nutrition delivered by the media and know the importance of a diverse diet. Additionally, educated women have better employment opportunities and higher income, which can further improve their household food security status and thus increase consumption of diversified food.

According to this study, pregnant women’s DD was associated with the wealth status of their households. The odds of high DD increase with the monthly income of the families. This finding supports the studies conducted among pregnant women in Bangladesh, Ghana, and Kenya. This reason could be that households with higher wealth status might have access to buy a variety of foods and thus, the dietary intake of pregnant women in those households will come from diversified food groups.

We also found that pregnant women from food-secure households were more likely to have higher DD scores, compared to those from food-insecure households. A previous study from Malaysia revealed similar findings. Another Bangladeshi study also reported a positive association between food security and DD of pregnant women. Food security increases the accessibility of adequate and diversified food due to the economic status of respondents. Previous studies also reported that individuals who had food insecurity and low socioeconomic status are more prone to low diversity diets. This study identified that diet counseling during pregnancy had a positive...
TABLE 4  Binary logistics regression on risk factors affecting high dietary diversity of pregnant women

| Variables                      | Unadjusted     | Adjusted       |
|-------------------------------|----------------|----------------|
|                               | Odds Ratio     | 95% CI         | p-Value | Odds Ratio     | 95% CI         | p-Value |
| Age (years)                   |                |                |         |                |                |         |
| ≤25 years                     | 3.67           | 0.97 – 13.90   | 0.056   | 3.56           | 0.50 – 25.42   | 0.206   |
| 26 to 35 years                | 1.33           | 0.49 – 3.67    | 0.577   | 0.97           | 0.20 – 4.75    | 0.966   |
| >35 years                     | Ref            | Ref            |         | Ref            | Ref            |         |
| Educational qualification     |                |                |         |                |                |         |
| Primary or below              | Ref            | Ref            |         | Ref            | Ref            |         |
| Secondary                     | 1.96           | 0.75 – 5.13    | 0.163   | 0.79           | 0.17 – 3.74    | 0.769   |
| Higher secondary and above    | 3.00*          | 1.62 – 9.44    | 0.011   | 2.32           | 0.21 – 7.83    | 0.495   |
| Occupation of pregnant women  |                |                |         |                |                |         |
| Housewife                     | Ref            | Ref            |         | Ref            | Ref            |         |
| Job†                          | 2.68           | 0.79 – 9.09    | 0.115   | 2.12*          | 1.28 – 4.19    | 0.042   |
| Others‡                       | 0.26           | 0.084 – 1.81   | 0.221   | 0.18           | 0.033 – 1.94   | 0.087   |
| Occupation of husband         |                |                |         |                |                |         |
| Job†                          | Ref            | Ref            |         | Ref            | Ref            |         |
| Business                      | 1.47           | 0.44 – 4.89    | 0.526   | 1.62           | 0.31 – 8.52    | 0.571   |
| Labor                         | 0.12*          | 0.02 – 0.76    | 0.024   | 0.52           | 0.034 – 7.84   | 0.636   |
| Others§                       | 0.74           | 0.23 – 2.40    | 0.612   | 1.28           | 0.23 – 7.27    | 0.780   |
| Family monthly income         |                |                |         |                |                |         |
| <20,000 BDT                   | Ref            | Ref            |         | Ref            | Ref            |         |
| ≥20,000 BDT                   | 3.05*          | 1.18 – 7.85    | 0.021   | 5.90**         | 2.06 – 9.59    | 0.005   |
| Got diet counseling           |                |                |         |                |                |         |
| Yes                           | 3.49*          | 1.09 – 11.21   | 0.036   | 7.42**         | 2.40 – 11.56   | 0.008   |
| No                            | Ref            | Ref            |         | Ref            | Ref            |         |
| Food security                 |                |                |         |                |                |         |
| Food secure                   | 3.88**         | 1.50 – 8.99    | 0.005   | 4.31**         | 1.95 – 9.87    | 0.004   |
| Food insecure                 | Ref            | Ref            |         | Ref            | Ref            |         |

*p < 0.05.
**p < 0.01.
†Hosmer and Lemeshow test for adjusted model: chi-square = 3.378, df = 8, p = 0.908.
- CI = Confidence Interval.
§Others included shopkeeper, day laborer, business, tailor, etc.
- Others included shopkeeper, tailor, expat, etc.

Association with higher DD, and inadequate DD was higher among pregnant women who did not receive dietary counseling during their pregnancy. It has been demonstrated that dietary counseling significantly increases the number of food groups consumed by pregnant women.48

4.2 | Factors associated with PA of pregnant women

More than half (58.3%) of the pregnant women in this study physically active. This is lower than the study findings in the United States49 and Ireland,50 which were 77.5% and 78.5%, respectively. It is higher than study findings in Nigeria51 and Brazil,52 which were 49.0% and 30.8%, respectively. The discrepancies in the level of PA between other studies and ours may be due to differences in sample characteristics, and tools used for measurements.52

Women with no formal education or below primary education were more likely to be inactive in the present study. Similar findings were also observed in the earlier studies from Australia,53 Brazil (Nascimento et al., 201554), and Canada.55,56 Another study also argued that pregnant women with higher education tended to be more active during pregnancy than women with lower education.49 This may be related to the possibility that women with higher educational levels are better informed or have more access to knowledge about PA during pregnancy.
**TABLE 5** Binary logistics regression on risk factors affecting physically active ness of pregnant women

| Variables                          | Unadjusted |           | Adjusted   |           |
|-----------------------------------|------------|-----------|------------|-----------|
|                                   | Odds Ratio | 95% CI    | p-Value    | Odds Ratio | 95% CI    | p-Value    |
| Educational qualification         |            |           |            |            |           |            |
| Primary or below                  | Ref        |           |            | Ref        |           |            |
| Secondary                         | 2.69*      | 1.05 – 6.90 | 0.039      | 2.67       | 0.92 – 7.74 | 0.070      |
| Higher secondary and above        | 7.07**     | 1.98 – 13.28 | 0.003      | 5.99*      | 1.51 – 10.78 | 0.011      |
| Occupation of pregnant women      |            |           |            |            |           |            |
| Housewife                         | Ref        |           |            | Ref        |           |            |
| Job†                             | 4.73**     | 1.64 – 11.64 | 0.004      | 4.30*      | 1.38 – 11.35 | 0.012      |
| Others‡                          | 1.48       | 0.50 – 4.39 | 0.483      | 2.10       | 0.62 – 7.08 | 0.233      |
| Family size                       |            |           |            |            |           |            |
| <5 members                        | 2.40       | 0.96 – 5.98 | 0.060      | 2.92*      | 1.04 – 5.17 | 0.042      |
| ≥5 members                        | Ref        |           |            | Ref        |           |            |

* p < 0.05.
** p < 0.01.
† Hosmer and Lemeshow test for adjusted model: chi-square = 7.50, df = 7, p = 0.379.
‡ CI = Confidence Interval.
§ Job included government employee, and non-government employee.
‖ Others included shopkeeper, day laborer, business, tailor, etc.

Employed women were more likely to be physically active during pregnancy than housewife women. This finding is in line with that of earlier studies in Iran and the United States. The observation that half of the pregnant women of this study were housewives, accounted for lower participation in the occupational activity. In addition, most of the pregnant women in Bangladesh usually take maternity leave that may also make them spend lower time at the occupational activity. In addition, most pregnant women feel more comfortable and safer doing household activities than engaging in occupational or sports activities during pregnancy.

**4.3 Limitations**

Since this is a cross-sectional study, a causal relationship cannot be established. In addition, the figure of the DD practice, as well as the PAs and their intensity, might be influenced due to biases associated with self-report measures, such as recall bias and social desirability bias. Furthermore, this study did not address the availability of food in markets and the extent of partners’ support, which may also influence their dietary practices and PAs.

**5 Conclusion**

Mother’s educational attainment/level and occupation, household monthly income, dietary counseling, and household food security were positively associated with the high DD of pregnant women. In light of these findings, there is a need to support existing policies and develop new policies targeting these variables. So, improving the awareness of DD during the pregnancy, incorporating counseling services, ensuring household food security, and providing diet counseling are recommended strategies to enhance the women’s DD. Diet counseling during pregnancy has been proven as an influential factor to improve nutritional practice for pregnant women. Thus, pregnant women need to be counseled and shown how to prepare foods from diversified groups available in their houses. This study revealed that almost half of the pregnant women were inactive and most of the PAs were done during their occupational activity, with little participation in exercise aside from activities that were part of their occupation. Further large-scale longitudinal studies should be designed to explore the predictors and risk factors of why pregnant women in Bangladesh do not meet the recommended levels of PA; collect detailed information about the duration and intensity of activities; and assess physicians in Bangladesh regarding how well they educate women about and promote PA during an uncomplicated pregnancy.

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**Conflict of interest**

The authors declare no conflict of interest.
DATA AVAILABILITY STATEMENT
Data are available on request from the authors.

ORCID
Satyajit Kundu https://orcid.org/0000-0001-9610-1479

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