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Research Article

Improving Working Mother's Child Dietary Diversity: A Case Study from RMG, Bangladesh

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ABSTRACT

Readymade garment industry has occupied a vital place in the economy of Bangladesh and the children of the female workers of this sector would be the future contributor in the economy. Thus, the health and nutritional status of these children become a matter of concern. Keeping this in mind, the study aimed to assess the dietary diversity status of the children of RMG working mothers and explore the significant factors associated with it. Data were collected from 396 RMG working mothers using a 2-stage random sampling technique. The 24 hours recall period of dietary diversity score method was applied to estimate the child dietary diversity. To explore the significant factors associated with the child dietary diversity score, a Poisson regression model was utilized. The majority of the children had low dietary diversity. Results from the regression revealed that, mothers' educational attainment, her access to resources, having improved kitchen in the households, presence of helping hand and keeping her child at the daycare center during her work time could significantly magnify the chances of higher dietary intake of their children. On the other hand, a significant gender bias was observed in dietary intake between male and female children. Findings of the study will assist the policymakers and related authorities to take necessary steps so that a better vigorous and active human resource could be developed in future. Also, a new body of knowledge will be added to the existing literature.

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Introduction

Over the past decade, Bangladesh's economy has exhibited robust growth, surpassing a GDP growth rate of 7.0%, primarily attributed to a remarkable increase in industrial production (BER 2022). Notably, the Readymade Garment (RMG) sector stands out as the largest export-oriented industry, contributing a substantial 83% to the total export earnings (BGMEA 2023). Employing approximately 4.22 million workers, of which 59% are female (Haque and Bari 2021), the RMG sector draws a significant workforce from rural areas, with many women migrating to locations housing RMG industries (Raihan et al. 2019).

Despite its pivotal role in the economy, the RMG sector faces challenges, especially concerning the well-being of its female workers. A substantial portion of these female workers, comprising around 2.50 million individuals, endures prolonged working hours for an inadequate monthly wage of approximately $113.6 (Trading Economics 2024). The adverse effects of extended work hours, coupled with insufficient compensation, are detrimental to the mental and physical health of female workers and their children (Haque et al. 2020; Hasan et al. 2020).

Conversely, the health of a child is paramount for the family and the nation's future (Ilhomovna 2023). The initial 1000 days of a child's life are crucial, with diverse and high-quality nutrition playing a pivotal role in their growth and development (Dewey 2003; WHO 2003). Child Dietary Diversity (CDD), defined as the consumption of a variety of food groups within a 24-hour period, serves as a widely recognized proxy measure of child nutrition (Hoddinott and Yohannes 2002; Steyn et al. 2006; FANTA 2007; Kennedy et al. 2007; Moursi et al. 2008; Nti 2011). In Bangladesh, only one out of three children meet the recommended

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dietary diversity (UNICEF 2013; IPC 2202), leading to potential malnutrition (Khamis et al. 2019; WHO 2021).

Maternal factors play a pivotal role in enhancing child dietary diversity. Factors such as maternal age, education, empowerment, dietary diversity, working status, height, knowledge, decision-making, fruit and vegetable cultivation, and socio-economic status significantly impact child dietary diversity (Senarath et al. 2012; Nguyen et al. 2013; Amugsi et al. 2015; Kuche et al. 2020). Household-level factors, including the education of the household head, age, household size, gender, monthly income, and exposure to media, are also associated with child dietary diversity (Nguyen et al. 2013; Beyene et al. 2015; Ochieng et al. 2017; Kumera et al. 2018; Baek and Chitekwe 2019; Kang et al. 2019; Paramashanti et al. 2022). The complex relationship between maternal factors and child dietary diversity serves as a pathway to improve child nutritional status (McPhie et al. 2014).

However, the challenging working environment in the RMG sector, particularly for female workers, exacerbates the situation. Reports indicate poor working conditions leading to malnutrition, infectious diseases, pregnancy complications, and reproductive health issues among female RMG workers (Muhammad 2011; Ahamed 2012; Chowdhury 2017). This adversity not only reduces the productivity of female workers but also contributes to maternal depression and low intelligence, adversely affecting child nutrition (Anoop et al. 2004). Recognizing the crucial contribution of female RMG workers to the nation's human resource pool (Rahman and Siddiqui 2015), it becomes imperative to address their health and nutritional needs along with those of their children. In light of the existing malnutrition challenges among children in Bangladesh (UNICEF 2023) and the vulnerable working conditions faced by female RMG workers, this study posits that child dietary diversity could serve as a pathway to improve the nutritional status of children of female RMG workers, an area that remains underexplored in the current body of literature. Hence the study aimed to explore the factors associated with child dietary diversity of the female RMG workers in Bangladesh. The study more focus on the maternal factors along with the other factors influencing child dietary diversity due to the susceptible working context of female RMG workers. Also, mothers play the key role in their child's health development. The findings of this study will assist the RMG authority and policy makers in development of child nutrition addressing the significant factors of child dietary diversity. The ground knowledge of this study could be implemented in the mainstream policy plan as it is linked to SDG's goal 3 (Martin 2023). Also, the new body of knowledge will be added to the existing literature regarding on factors associated with child dietary diversity of female RMG workers.

Methodology

Study area, population and sample size

The study chose Gazipur district (Figure 1) randomly as the study area where a good number (16.58%) of RMG industries are located (Haque and Bari 2021) but the exact number of RMG workers in this area was not found and difficult to estimate. As the population is infinite, the study used the following formula to estimate the sample from the population (Naing et al. 2006).

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Here, n = sample size
Z = Z statistic for a level of confidence,
P = expected prevalence or proportion (in proportion of one; if 50%, P = 0.5), and
d = precision (in proportion of one; if 5%, d = 0.05)

If Z = 1.96 (95% confidence level), P = 50% of the proportion, and d = 0.05, then at least 384 sample is required for a study. Thus, the study collected 396 data randomly by direct interview of the mothers who worked in the RMG industry form the selected area. More than the required amount of sample would be minimizing the error margin and maximize the precision level (Naing et al. 2006).

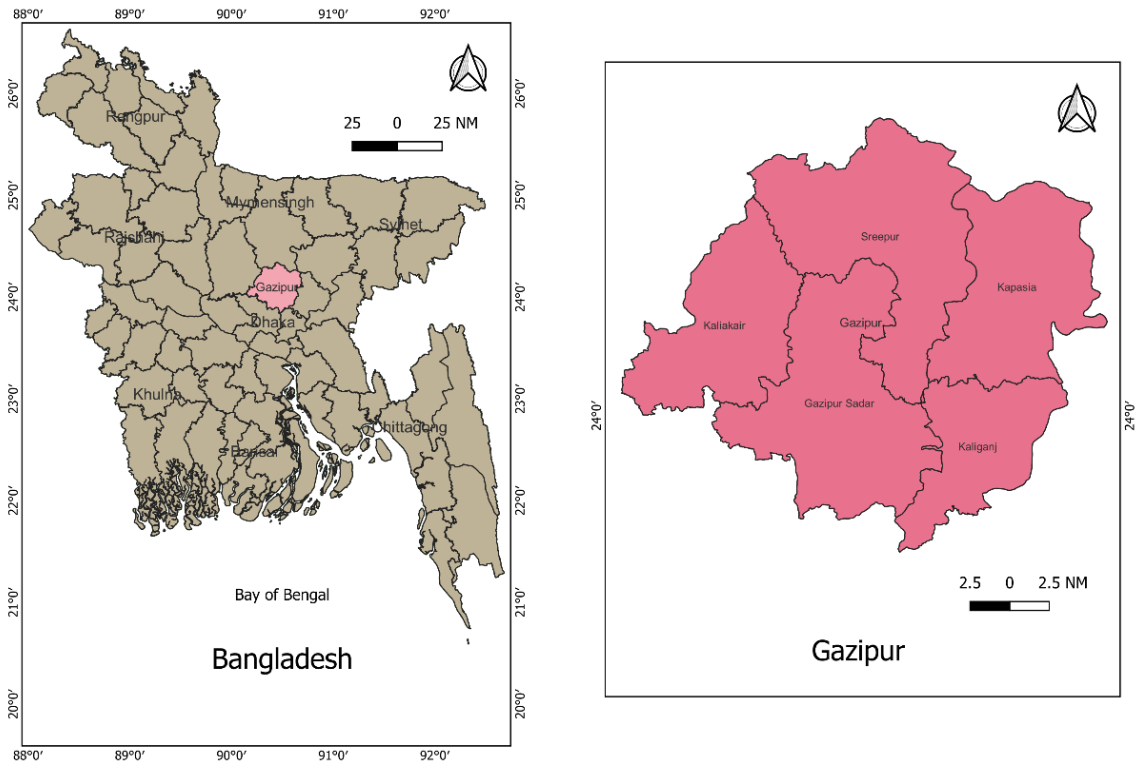


Figure 1. Map of the study area
Source: Haque et al. (2022)

Data collection

After determining the sample size, the study used a well-structured questionnaire to collect primary data from the respondents by a group of well-trained enumerators. The research team supervised all the field activities to maintain the accuracy and reliability of the data. The study applied a 2-stage random sampling technique. In the first stage, study area (Gazipur district) was randomly selected. Applying a filtering technique in the second stage, the study reached to the respondents for conducting the survey. Keeping the study objective in mind, the study surveyed only those RMG working mothers who had at least 6 months to 5 years old biological child. If more than one child was present, then index (youngest child among the under 5 children) child was considered by this study. As there was no sampling framework and it was difficult to obtain it for the study area, hence, it follows the above two filtering technique to reach the respondents. The similar method was used by the previous studies (Yount 2006; Alam et al. 2018a; Ngema et al. 2018). In this way, the study surveyed 396 RMG working mothers and collected different socio-economic and dietary diversity related data.

Inclusion and exclusion criteria

The RMG working mothers, who take regularly 3 square meals along with their index child, are included for the survey. Pregnant mothers and the mothers who had been suffering from any other kind of physical challenges were excluded. Also, data collection was not continued if a family performs religious activities or celebrate festivals where more or less food consumption practice could exist. If the index child of the RMG working mother was sick during the survey time, then the study excluded it from survey.

Variable description

Outcome variable

The outcome variable of the study is the child dietary diversity score. 24 hours period dietary intake by the child is used to estimate the dietary diversity score. Table 1 represent the food groups which is recommended by WHO to calculate the dietary diversity score of children (World Health Organization 2008).

Table 1. Seven food groups for child dietary diversity score

Sl	Food Group	Food items
1	Starchy staples	All kinds of grains like, rice, rice flour, wheat, bread, formula food, semolina, vermicelli, and white roots like potato, arum
2	Vit. A-Rich fruits and vegetables	pumpkin, carrot, or sweet potato that are orange inside + other vitamin A rich vegetables (e.g., red sweet pepper) ripe mango, ripe papaya, and 100% fruit juice made from these + other locally available vitamin A rich fruits
3	Other fruits and vegetables	other vegetables (e.g., tomato, onion, eggplant) + other locally available vegetables other fruits, including wild fruits and 100% fruit juice made from these
4	Flesh Foods	liver, stomach beef, lamb, goat, chicken, duck, other birds, fish, dry fish
5	Eggs	eggs
6	Legume, nuts and seeds	beans, peas, lentils, nuts, seeds or foods made from these
7	Milk and milk products	milk, yogurt or other milk products

Source: (World Health Organization 2008)

A child consume a particular group of foods from Table 1 and the total number of food groups consumed in the previous day (24 hours) is termed as child dietary diversity score (Rakotonirainy et al. 2018). Also, if a child consume less than 4 food groups then it is termed as low dietary diversity, consuming 4 groups is termed as medium and more than this termed as high dietary diversity of child (World Health Organization 2008).

Predictor variables

Different socio-economic variables are used by the study and their nature is different. A brief explanation of these variables is given in the Table 2.

Table 2. Description of the predictor variables

Variables	Description	Nature
Mothers' age	Age of the mothers is recorded in complete years	Discrete
Mothers' year of schooling	Years of schooling is recorded in complete year of formal schooling	Discrete
ANC receive status	Antenatal care services received status by the mothers during her pregnancy of index child	Binary
Child sex	Represents the child sex: male or female	Dichotomous
Mothers' access to resources	Empowerment related variable of mother and represents whether she had access to and control over any one or more of the various tangible resources such as, liquid cash balance ($500 USD), land, house, jewelry or other related assets or not (McKenna et al. 2019; Haque et al. 2023a, b)	Binary
Improve kitchen	A household related variable represents whether a mother have access to any one or more of the modern kitchen equipment such as peeler, blender, mop, LPG gas stove, induction, frying pan or other related kitchen equipment available in the market of Bangladesh or not (Haque et al. 2023a)	Binary
Helping hand	Whether a member help mother to her household chores. The member could be from her family of house maid	Binary
Formal office hours	How many hours spend for formal office work by mothers	Continuous
Mother/ women dietary diversity score	Calculated from the ten food groups which are 1. Grains, white roots and tubers, and plantains 2. Pulses (beans, peas and lentils) 3. Nuts and seeds 4. Dairy 5. Meat, poultry and fish 6. Eggs 7. Dark green leafy vegetables 8. Other vitamin A-rich fruits and vegetables 9. Other vegetables 10. Other fruits. Consuming a particular group of foods from above and the total number of food groups consumed in the previous day (24 hours) is termed as mother dietary diversity score (FAO 2016)	Discrete
Household size	Number of members living in the family	Discrete
Child stay at daycare	Whether a mother keep her child at the daycare center provided by her office in the time of her working periods.	Binary

In the Table 2, mother/ women dietary diversity score is an explanatory variable which is used by the many studies (Haque et al. 2023a, b). Also, this variable is used as a predictor along with other predictors in some of the study (Abi Khalil et al. 2022). As, the literature support to use this variable as an exploratory variable and it is not created any endogenous or correlated to the other exploratory variables in the econometric model, hence the study retained it in the model.

Analytical technique

To get the meaningful insight from the data, the study applies both descriptive and inferential analysis. In descriptive analysis, graphical representation is used to visualizing the distribution and nature of the data. Also, frequency analysis is performed for the binary and dichotomous variables. Variables which are continuous and discrete, summary statistics like mean, standard deviation, minimum and maximum values are reported for clarification.

As the outcome variable child dietary diversity scores follows the Poisson distribution which is discrete count value (Consul and Jain 1973), Poisson regression model is used to explore the significant predictors of child dietary diversity. The empirical model is as follow:

$$\Pr(Y_i = y_i|\mu_i, t_i) = \frac{e^{-\mu_i t_i}(\mu_i, t_i)^{y_i}}{y_i!}$$

Where, $\mu_i = t_i\mu(x_i'\beta)$

$= t_i \exp(\beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki})$

The Poisson incidence rate or predicted count μ_i is determined by a set of *k* regressor (X's variables) and β's are the unknown parameters estimated from the data. Linktest was applied to test the correctly specification of the regression model. The test also ensures that, no additional independent variables that are significant except by chance. To find the link error, Let,

$$y = f(X\beta)$$

be the model and $\hat{\beta}$ be the parameter estimates. Linktest calculates,

hat = $X\hat{\beta}$

and,

hatsq = hat^2

Based on the significance of hatsq, the test is suggested by Pregibon, (1980) (Pregibon 1980) grounded on the idea of Tukey, (1949) (Tukey 1949). As the linktest is universally applicable, straightforward, and a good second-order approximation, it could be applied to any single-equation estimation technique (StataCorp 2017). All the analyses are performed in the STATA v17 software.

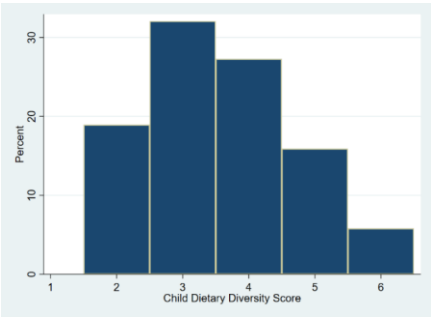
Consent to Participate (Ethics)

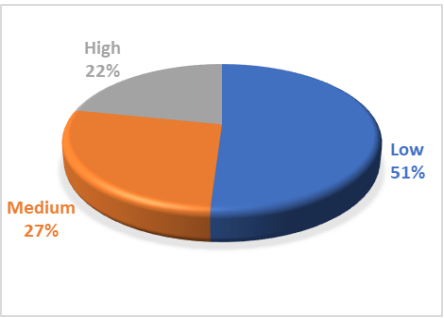
The study took verbal consent of the respondents before the survey. The detail purpose of the study has been explained by the research team and enumerators and after allowing and accepting the terms and conditions by the respondents, the survey procedure proceeds. If any respondent refused to continue in the middle of the survey, then the study dropped that observation and moved to the next. Their personal information and privacy were strongly maintained by the study and each of them was identified as a unique serial number instead of their name and address, after processing the data. No financial incentives were given to the respondents and no human and natural resources got harmed during the study process. Apart from this, the research team has completed the basic course of Ethics in Evidence Generation by UNICEF. Review or approval by any authority or institutions was not needed for this study because it was undertaken by the research team through self-funding and their interest on scientific study. But the team has ensured all the dimensions that need to be maintained in a study which is reviewed and approved by the authorized institutions.

Results

Descriptive analysis

Figure 2 represents the percent distribution of different food groups consumed by the children over 24 hours recall period. It shows that approximately 32% of the children consumed only 3 food groups followed by 4 and 2 food groups (Figure 2a). After categorization, the study found, more than half of the child had low dietary diversity followed by medium to high dietary diversity (Figure 2b)





(a) (b)

Figure 2. Status of child dietary diversity

Also, the mean CDD score was found 3.5 with a minimum consumption of 2 food groups to maximum 6 food group consumption (Table 3). The average age of the mothers was 27.3 years and the youngest mother surveyed was 13 years old where the oldest mother was 45 years old. The educational qualifications of mothers were found on an average 8 years of formal schooling, where maximum attainment was found 17 years. Approximately 86 percent of the mothers received ANC services during their pregnancy time. Among all the children, 62 percent were female and rest of them was male. Around 42 percent of the mothers had access to resources and 44 percent had improved kitchen at their households (Table 3.)

Table 3. Descriptive statistics of the study variables

Variables	Mean ± SD	Min, Max	Frequency (Percentage)
CDD	3.576 ± 1.137	2, 6	
Mothers' age	27.333 ± 5.361	13, 45	
Mothers' year of schooling	8.321 ± 5.076	0, 17	
ANC receive status			
No			55 (13.89)
Yes			341 (86.11)
Child sex			
Male			151 (38.13)
Female			245 (61.87)
Mothers' access to resources			
No			229 (57.83)
Yes			167 (42.17)
Improve kitchen			
No			222 (56.06)
Yes			174 (43.94)
Helping hand			
No			78 (19.7)
Yes			318 (80.3)
Formal office hours	8.684 ± 2.975	1, 16.5	
MDDS	3.922 ± 0.934	1, 6	
Household size	4.316 ± 1.22	3, 10	
Child stay at DC			
No			119 (30.05)
Yes			277 (69.95)

Source: Authors estimation 2023

The proportion of mother who had helping hand was 80 percent. Mothers spent more than 8 hours in their formal workplace in a daily basis and maximum 16.5 hours work time had recorded. Also, the minimum 1 hour office time has found by the study. The justification of the findings is that, mother of RMG workers took leave for an emergency case and attended ffice for 1 hour before leave. The average dietary diversity score of mothers was found nearly 4 good groups. The average household size was found 4.3 with a minimum 3 members to maximum 10 members. Almost 70 percent of the mothers kept their children at the daycare center during their work time, provided by the RMG industries.

Regression analysis

Table 4 represents the results of the Poisson regression on Child Dietary Diversity (CDD) score. CDD score is usually define as the number of food groups consume by child in a 24 hours period. It was found that, if mothers' year of schooling increases by 1 year, the incidence on high DD score of children will be increased by 1.016 times holding effect of all other variables as constant. The female children have a lower incident rate of high DD score by 0.892 times compared to the male children holding others predictors as persistent. An incident rate of 1.147 times greater CDD score has been found when comparing those mothers who have access to resources to those mothers who do not have, holding all the other regressors constant in the model. If household has improved kitchen, then the incident rate would be 1.166 times higher CDD score compared to those who do not have improved kitchen, holding other variables as fixed. The incident rate is 1.179 times higher CDD score to children of those mothers who have helping hand compared to those who do not have helping hand holding other factors as unchanged. When mothers keep their child at day care center during their worktime, then it has a rate of 1.263 times higher incident of CDD score comparing with those children who do not stay at day care center by keeping all the other explanatory variables static.

Table 4. Factors associate with CDD score by Poisson regression model

CDD Score	IRR	St. Err.	z-value	p-value	95% Conf Interval		Sig
Mothers' age	1.005	0.006	0.82	0.412	0.993	1.016	
Mothers' year of schooling	1.016	0.008	2.00	0.045	1.000	1.032	**
ANC receive status (yes)	1.077	0.111	0.72	0.473	0.880	1.317	
Child sex (female)	0.892	0.049	-2.07	0.039	0.800	.994	**
Mothers' access to resources (yes)	1.147	0.086	1.82	0.068	0.990	1.329	*
Improve kitchen (yes)	1.166	0.104	1.73	0.084	0.979	1.387	*
Helping hand (yes)	1.179	0.094	2.08	0.038	1.009	1.378	**
Formal office hours	0.991	0.010	-0.86	0.390	0.972	1.011	
MDDS	1.028	0.033	0.88	0.380	0.966	1.094	
Household size	0.999	0.024	-0.06	0.955	0.954	1.046	
Child stay at DC (yes)	1.263	0.096	3.07	0.002	1.088	1.465	***

Constant	1.719	0.448	2.08	0.038	1.031	2.866	**
Pseudo r-squared		0.050		Number of obs		396	
Chi-square		69.018		Prob > chi2		0.000	

*** p<.01, ** p<.05, * p<.1: Source: Authors estimation 2023

In the post estimation, the study found that, the hatsq is statistically insignificant coefficient (Table 5). It proves that, there is no error link between the residuals and the variables used in the model. Also, it is confirmed that the model is correctly specified as well.

Table 5. Linktest on the Poisson regression model

CDD Score	Coefficient	Std. err.	z	P>z	95% conf. interval	
hat	0.925	1.200	0.770	0.441	-1.426	3.277
hatsq	0.031	0.488	0.060	0.950	-0.926	0.987
constant	0.044	0.723	0.060	0.951	-1.373	1.461

*** p<.01, ** p<.05, * p<.1: Source: Authors estimation 2023

Discussion

The study found that mothers' year of schooling could significantly increase the chances of child dietary diversity score. Formal education enhances the knowledge of diet, health and other health related facts of any person. With the wide range of knowledge, mothers could become more aware of her health and diet, feel the necessity of balanced food intake, take care of her health as well as her child and family members. A well-educated mother usually knows better than any less educated or illiterate person, could properly utilize the resources available to her and make independent decision regarding her health (Ababa 2020). Higher education could also essential for acquiring information for appropriate feeding practice (Kiboi et al. 2017). Some previous studies have found that maternal education was significantly associated with higher child dietary diversity (Frost et al. 2005; Marinda et al. 2018).

The result showed that there is a significant gender difference in the child diet in Bangladesh. Typically, male children get more love and affection compared to the female children in this country. This biasness in love and affection also reflected in food intake as well. Though literate mothers do not make any difference in dietary intake between male and female children but it might be caused of dietary intake difference in case of illiteracy and superstitions among the mothers or other influential family members (Borooah 2004). Also, in some cases female children have got less or insufficient complementary feeding practice (Ng et al. 2012). Similar results were evidenced in India, that is the male children got more attention in feeding practice than the female children (Fledderjohann et al. 2014). The findings of the prior knowledge verify the finding of gender difference in dietary diversity of child found by this study.

Access to resources has been found positively associated with the CDD score. If the land used in agricultural practice or any other purpose which may provide food or produce an income, it could be a reason for having improved dietary diversity through this food or buying diverse food utilizing the income. Having cash money in hand enables a mother to buy food whenever necessary and she has also some flexibilities to buy different variety of food for maintaining healthy diet for her child. Access to money enables a mother to lead a better livelihood and ensure more healthy diets for her and her children (Malapit and Quisumbing 2015). Similar result found in Bangladesh that having land ownership positively stimulated dietary diversity (Harris-Fry et al. 2015). On the other hand, access to resources could reduce the chances of food insecurity of both mothers and children (Schmeer et al. 2015).

Having improved kitchen could enhance the child dietary diversity score was another finding of the study. Preparing food for the family members and cooking a variety of food is usually time intense and learning of new food items cooking in every days meal is challenging (Palay and Newman 2009). Improved kitchen could reduce drudgery of cooking and using improved tools assist to cook more variety of items within the limited time. Hence mothers could prepare of more diverse food resulting a higher chance of getting more dietary diversity score of their children.

Having a helping hand means having a maid or a family member who helped mothers in different household work including cooking. It was mentioned that a mother has several work pressures in home and outside. If there is any person present with whom mother could share her work, she might feel less pressure and save some time for taking care of her child and other activities or if the person help mother in cooking more items, it might be resulted an improvement in mothers' cooking skill and her confidence also. As a working mother, they face a lot of time constraints and presence of helping hand redistribute of the workload for her. Evidence shows that mother's time management skills improve when they receive support with domestic tasks such as childcare, cleaning, and cooking. This support provides mother with extra time to plan, prepare, and eat a wide range of foods. Furthermore, when mothers are assisted with their daily household duties, it not only reduces their burden but also allows them more time to focus on enhancing the diversity and nutritional value of their meals. Consequently, this can greatly enhance their overall dietary variety and well-being of her child.

Lastly, if the mothers keep their children at the daycare center, then the chances of the high dietary diversity

score have been increased. It is an institution where mother keep their children during their work times and a group of specialized team monitor and supervise their children's feeding, and take care of them (Tikkanen. 2023). In this facility children could consume proper and diverse diet and also could play and interact other children which helps to develop some valuable behaviors (Ahn and Nelson 2015). On the other hand, mothers become satisfied by keeping their children in such facilities which met the basic requirements of their children and mother could visit her children time to time during work (Islam et al. 2016).

Conclusion

The 24 hours recall period of dietary diversity score for child showed that, majority of the RMG working mothers' children has low DD score which is very unfortunate. The formal educational attainment was also found low for the RMG working mothers. Significant maternal and household factors which are explored by this study reveal the state of relationships that influence CDD score. Gender bias among the children in case of dietary intake evidenced by the study is a matter of concern. Distribution of resources, having improved kitchen and helping hand facilities could enhance the capacity of mothers which leads to a better health outcome of the children. Daycare center could be a better option for both RMG working mothers and their children for childhood development.

Recommendations

Based on the findings, the study has some recommendations which could be resulted better outcomes if properly implemented. Both formal and informal education need to be promoted as well as adult education facilities for the female. Formal and informal awareness should be spread out in such a way that alleviates the gender biasness among child sex. Daycare center need to be established by all the RMG industries and its facilities need to be enhanced. Proper monitoring of children and care-taker should be done on the daycare centers so that it could operate at its best level. The policymakers and the related authority should be considering the facts in the mainstream policy programs so that, a healthy and energetic upcoming human resource could be developed through the improvement of child dietary diversity score of RMG working mothers. The findings will be helpful to implement the SDG goals and targets by proving a ground level knowledge for Bangladesh and its RMG sector.

Study limitations and future scope

Though the study has some valuable insights, it has some limitations too. The study used a cross section data and used almost a homogeneous group. A time series analysis and multiple group comparison could show different outcomes. Also 24 hours recall period of dietary diversity score showed a narrow view of dietary intake. A seven or fourteen-day's dietary intake could result more rigorous outcomes. Dietary diversity score could have more complex relationship with other observed or latent factors which could provide more deep insights. Future research needs to be conducted by overcoming the limitations of this study to generate more valuable knowledge.

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Consent to Publish (Ethics)

The respondents were informed and their verbal consent was taken. The consent about publishing was that, the findings of the study will be published in the renowned journal and all the personal information they are providing, will be hidden and will not be disclosed at any circumstances. After their agreement, the study moved to the further steps.

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