*Article*

# Breakfast habit of high school going students in Bangladesh: a correspondence analysis

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**Abstract:** The importance of breakfast in maintaining a healthy lifestyle is well-documented, yet breakfast omission remains prevalent among children and teenagers, leading to negative health and academic outcomes. The purpose of this study is to identify the association between various levels of breakfast consumption and other related factors. A secondary cross-sectional dataset was used in this study to detect the habits of breakfast consumption and its association between other related factors. As chi-square test shows the association between the two attributes, corresponding analysis was applied in this study to see the level-wise association between the attributes. The dataset contains a total of 509 individuals that were enrolled in high school education in northeastern region of Bangladesh. The results of the study indicated that around fifty percent of the children are skipping breakfast and most of them are from Habiganj and Sunamganj districts. It is found that urban students are higher tendency to miss breakfast compare to rural area. It is also observed that lower levels of parental education are highly associated with not taking and/or irregular taking breakfast. In correspondence analysis, the results revealed that students whose mothers are engaged in government or private sector jobs tend to have a consistent breakfast routine, however, in a chi-square test it was found that mother's occupation and breakfast consumption is not significantly associated. It indicates correspondence analysis is more suitable to discover the level-wise association. Taken together, it is concluded that parental education and occupation may increase the taking breakfast of school children. This study highlights the need to advocate for breakfast intake among adolescents. The study concludes that correspondence analysis is essential to know the level-wise association between the attributes.

**Keywords:** adolescent nutrition; parental influence; dietary habits; school performance; health outcomes

## 1. Introduction

Many people consider breakfast to be the most important meal of the day. The advantages of eating breakfast are well-documented (O'Neil *et al*., 2014a; Coulthard *et al*., 2017; Rehm and Drewnowski, 2017) and it is widely acknowledged that breakfast is a vital part of a healthy lifestyle and a vital source of crucial nutrients in the diet for both adults and younger demographic groups (O'Neil *et al*., 2014a, 2014b; Coulthard *et al*., 2017; Rehm and Drewnowski, 2017). There is currently no agreed-upon definition of breakfast that accounts for when it is eaten, how many calories it contains, or what kinds of food and drink are included. A review once stated that breakfast is the first meal of the day that breaks the fasting status after the longest period of sleep, is eaten within two to three hours of waking, and consists of food or beverage from at least one food group and can be eaten anywhere (O'Neil *et al.*, 2014a; Gibney *et al*., 2018b). The morning meal known as "breakfast" has

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evolved through time because of changes in cultural norms, individual preferences, and access to food. Additionally, people from various cultures have various morning eating customs. For example, in Mexico, a typical kid's breakfast may consist of tortillas and beans (Afeiche *et al.*, 2017) but in the United States, it is more likely that they will have ready-to-eat cereals (RTEC) (Albertson *et al.*, 2003). In addition, eating breakfast has been shown to boost memory, attention, and even academic grades (Adolphus *et al.*, 2015; Ptomey *et al.*, 2016). However, the breakfast is the one that is most often skipped by children and adolescents (Affenito, 2007). Skipping breakfast among children and adolescents is linked to lower rates of school attendance and academic achievement, lower levels of well-being, and the adoption of unhealthy eating and exercise habits (Blondin *et al.*, 2016; Lundqvist *et al.*, 2019). Quality and consistency of breakfast eating is also related to cognitive function, academic success, physical activity, and well-being (Ahadi *et al.*, 2015; Kennedy *et al.*, 2015; Littlecott *et al.*, 2016; Adolphus *et al.*, 2019). The percentage of children who ate breakfast was rather high (ranging from 87.4% in the United States to 98.9% in Denmark), but it dropped significantly throughout adolescence (from 74.2% in the United States to 87.9% in Canada) (Gibney *et al.*, 2018a). It is well documented that healthy dietary patterns play crucial roles in total energy intake and weight management. Consuming breakfast is one of the hypothesized dietary elements that influence both body weight and the amount of energy taken in (Horikawa *et al.*, 2011). Previous research has linked having breakfast with a more healthful food pattern (Potter *et al.*, 2019). Skipping breakfast may lead to overeating at other meals and snacking more often throughout the day. Thus, eating breakfast is an effective approach for reducing the risk of obesity and maintaining a healthy energy balance throughout the day. Skipping breakfast is a bad habit that has been linked to a worse quality diet among children and adolescents (Coulthard *et al.*, 2017; Ramsay *et al.*, 2018). Adiposity in children has been linked in certain studies to them missing breakfast (Alsharairi and Somerset, 2016; Okada *et al.*, 2018; Forkert *et al.*, 2019). For instance, adolescents in Europe who are used to eating breakfast tend to have a lower body fat percentage and a healthier cardiovascular profile than their breakfast-skipping counterparts, particularly among males (Hallström *et al.*, 2013). Among American teens, the BMI was lower among those who ate breakfast regularly compared to those who ignored it (Affenito *et al.*, 2005). It has been predicted that the risk of becoming overweight virtually doubles among Canadian preschoolers who miss breakfast everyday (Dubois *et al.*, 2006). Children's academic performance may be negatively affected by the fact that only a small fraction of Saudi Arabian school children eat breakfast at home every day (Al-Hazzaa *et al.*, 2020). In early childhood, skipping breakfast was associated with an increased risk of overweight and obesity in later childhood; however, the connection may vary according to gender (Yaguchi-Tanaka and Tabuchi, 2021). Bangladeshi mothers, particularly those who worked outside the home, had a hard time preparing nutritious meals owing to time constraints and a prevalent fear of chemicals added to raw foods in markets, resulting in low rates of fruit and vegetable intake (Hasan *et al.*, 2021). There was also a correlation between childhood obesity and parents who missed breakfast on a regular basis and ate more bread and sugar-sweetened beverages than fruits and vegetables and this pattern of behavior was seen over a longer period (Watanabe *et al.*, 2014). Having a higher body mass index (BMI) and being overweight or obese throughout childhood or adolescence is associated with a greatly increased risk of death at an earlier age and adult morbidity, especially cardiometabolic disorders (Bjerregaard *et al.*, 2018). In addition, the environment and dynamics of the family have been found to influence the habits associated with breakfast. When compared to children who lived with just one parent, those who lived with both parents had a much higher rate of breakfast consumption (Levin *et al.*, 2012).

According to the findings of a research, eating breakfast relates to higher intake of macronutrients as well as healthier consumption of food and beverages overall (Giménez-Legarre *et al.*, 2020a). In addition, large-scale research conducted in ten European cities found that girls with academically advanced mothers, boys from traditional households, boys who were supported by their parents, and girls whose classmates ate healthy meals were much more likely to have breakfast than those without such variables (Hallström *et al.*, 2011). Calcium consumption was considerably greater in children who ate breakfast everyday compared to those who skipped breakfast (Giménez-Legarre *et al.*, 2020b).

A growing number of children and adolescents, particularly in urban areas, are overweight or obese in Bangladesh, contributing to the country's double burden of malnutrition (Biswas *et al.*, 2017; ICDDR,B, 2020). Researchers in Bangladesh observed that urban school students had a high intake of fast food and sugary beverages, but a low consumption of fruits, vegetables, and meals derived from animals (Bhuyan, 2019; Khan *et al.*, 2019). However, most school cafeterias in Bangladesh supplied foods focused on profit rather than health concerns, which was a problem considering how crucial schools were for the formation of children's eating choices (Yaguchi-Tanaka and Tabuchi, 2021).

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This study hypothesizes that there are significant associations between the breakfast consumption habits of high school students in Bangladesh and various socio-demographic factors, such as parental education, parental occupation, and urban versus rural residency. The primary research question was, how do different levels of breakfast consumption among high school students in Bangladesh correlate with socio-demographic factors, and what insights can correspondence analysis provide in understanding these associations? Considering the problem statement, hypothesis and research question this investigation examined the application of correspondence analysis in the dataset pertaining to breakfast consumption among high school students. The purpose was to identify the association between various levels of breakfast consumption and other socio-demographic factors.

## 2. Materials and Methods
### 2.1. Ethical approval and informed consent
A secondary dataset was used in this study; therefore, ethical approval was not needed. Written informed consent was taken from the participants at the time of primary data collection.

### 2.2. Study area, period and data acquisition
A subset of data pertaining to breakfast has been extracted from a secondary dataset of our previous study (Sunny *et al.*, 2021). The data utilized in this study was cross-sectional in nature and was gathered from four distinct districts (Sylhet, Sunamganj, Moulvibazar and Habiganj) within the Sylhet division, which is situated in the northeastern region of Bangladesh (Figure 1). The study period was from November 2020 to October 2021. The dataset has a total of 509 individuals that were enrolled in high school education. Data were acquired through the utilization of a semi-structured questionnaire, which involved visits to various locations such as schools, residences, play areas, and internet platforms. In our dataset, we possess several demographic factors, including age, gender, location, etc., along with information regarding the educational background and occupational status of both the father and mother.
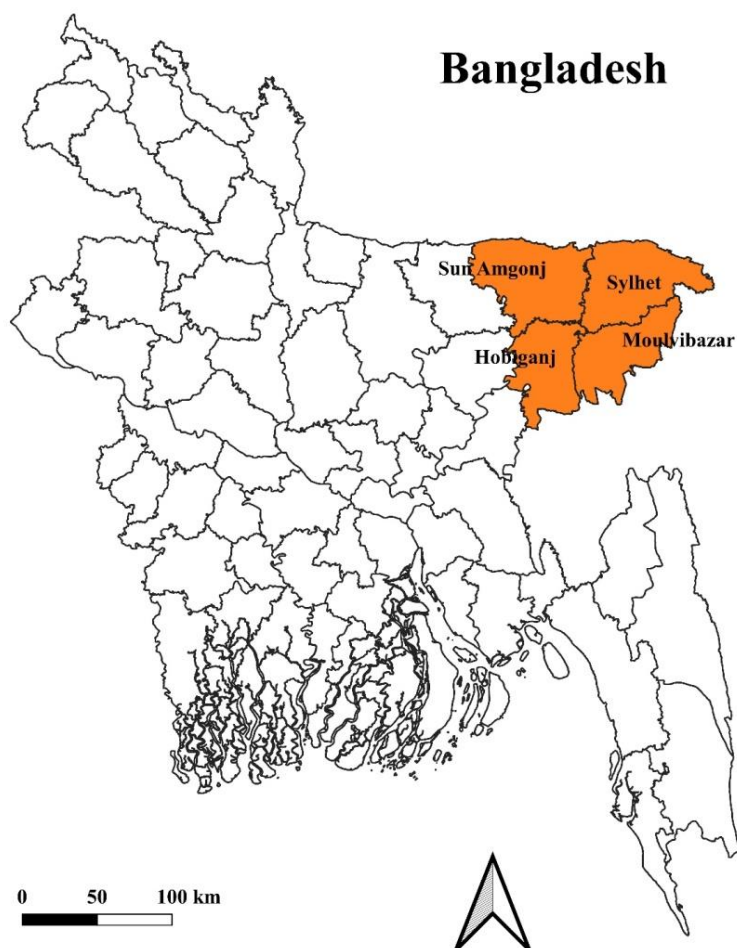


**Figure 1. Data was gathered from four districts of Sylhet division of Bangladesh.**

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## 2.3. Statistical analysis

Descriptive analysis in the form of percentages was employed to examine variable-wise associations, while the Chi-square test was utilized for further analysis. Additionally, correspondence analysis was conducted to investigate associations at different levels. Typically, researchers employ the Chi-square test to ascertain the association between two categorical variables or attributes chi-square test of independence. However, it is important to note that this test provides an assessment of the association level between the variables. Level-wise relationships cannot be directly observed. Hence, our objective was to examine the application of correspondence analysis in our dataset pertaining to breakfast consumption among high school students. The purpose was to identify the association between various levels of breakfast consumption and other factors. We utilized SPSS (version 25.0) for data analysis and QGIS (version 3.38.0) to prepare the map of the study area.

## 3. Results

The data were obtained from a total of 509 pupils, with 50.1% identified as male and the remaining students identified as female. The participants were queried regarding their frequency of breakfast consumption, specifically whether they adhered to a regular weekly breakfast routine, had an irregular breakfast routine, or abstained from breakfast entirely on a weekly basis. The data indicates that 30.9% of the participants demonstrate an "Irregular" breakfast pattern, whereas 22.6% stick to a "Regular" morning routine. Furthermore, a notable proportion of participants, specifically 46.5%, indicated that they refrained from consuming breakfast entirely.

The data indicates that 54.7% of the participants adhere to the Islamic faith, 44.3% of the participants associate themselves with Hinduism, and 1% of the participants profess Buddhism as their religious affiliation. The data indicates that 58% of the participants are enrolled in educational institutions situated in "Urban" regions, while 42% of the respondents attend schools located in "Rural" locations. The data reveals that 29.4% of the participants are residents of the "Sylhet" region, while 20.2% of the respondents are in "Moulvibazar". Additionally, 20% of the participants are in "Sunamganj", and 30.4% of the respondents live in "Habiganj". We also observed that 58% of the participants attend educational institutions situated in "Urban" regions, while 42% attend schools situated in "Rural" regions.

Children residing in rural areas exhibit a higher likelihood of irregular breakfast consumption, whereas children residing in urban areas are more prone to completely skipping breakfast. It also shows that children between the ages of 12 and 14 exhibit a higher likelihood of irregular breakfast consumption, whereas those aged 15 to 17 are more prone to completely skipping breakfast (Figure 2, A, B).
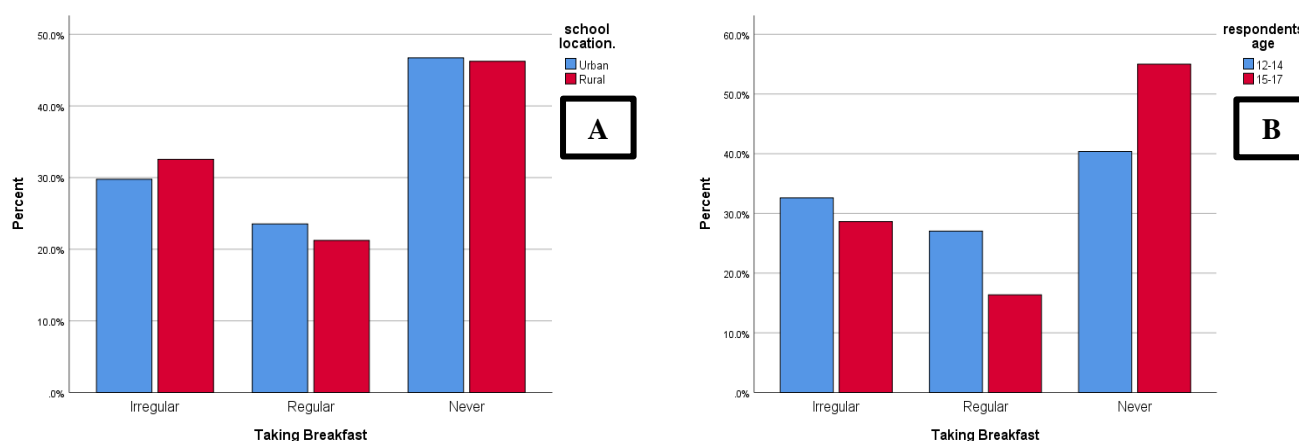


**Figure 2. (A) Taking breakfast over school location; (B) Taking breakfast over age.**

The data indicates that male respondents exhibit a higher degree of irregularity in their breakfast consumption patterns compared to female respondents. Additionally, males display a lower level of regularity in having breakfast and a lower frequency of never skipping breakfast (Figure 3A). The data indicates that children hailing from Moulvibazar have a higher propensity for irregular breakfast consumption, whereas children originating from Sylhet tend to adhere to a regular breakfast routine. Conversely, children from Habiganj are more prone to abstaining from breakfast altogether (Figure 3B).
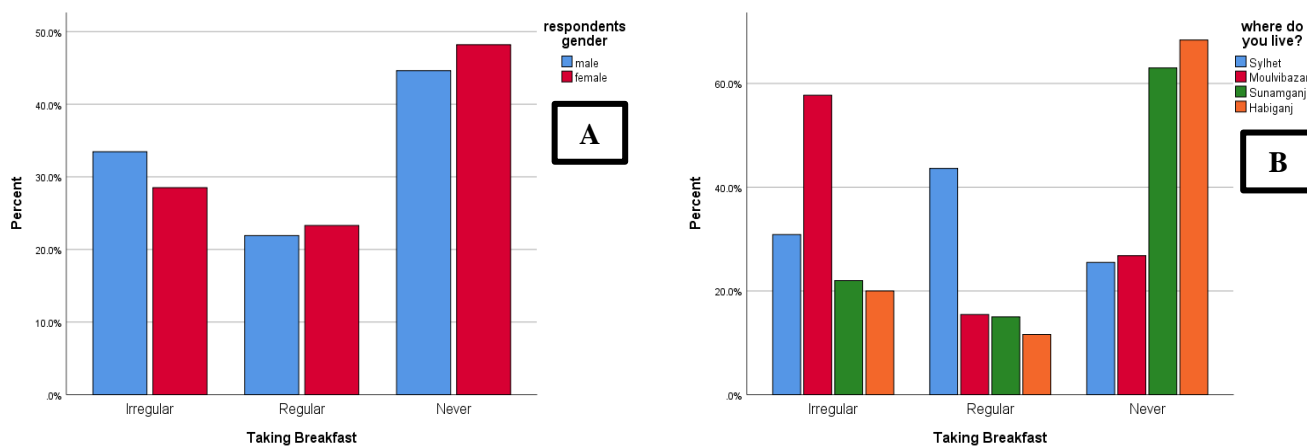
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**Figure 3. (A) Breakfast consumption with gender; (B) Breakfast consumption with division/ living location.**

The data regarding the distribution of respondents according to their breakfast consumption patterns, categorized as "Irregular," "Regular," and "Never" (Table 1). Chi-Square tests were applied to see the significant association between the breakfast consumption and some categorical variables (division, fathers and mother's education and occupation). The results revealed that division (living location), father's occupation, father's education and mother's education are significantly ($P<0.05$) associated with breakfast consumption. However, from these significant associations it's not clear level-wise association between the categorical variables, therefore we conducted correspondence analysis as multivariate concept where each level of each variable considered as dichotomous variable and then from the correspondence map, we can clearly see the association among the levels.

**Table 1. Cross-tabulation with Chi-square test.**

| | | Taking Breakfast | | | The value of Chi-square (p-value) |
|---|---|---|---|---|---|
| | | **Irregular** | **Regular** | **Never** | |
| | | | Count | | |
| Division | Sylhet | 46 | 65 | 38 | 117.60 (0.00) |
| | Moulvibazar | 56 | 15 | 26 | |
| | Sunamganj | 22 | 15 | 63 | |
| | Habiganj | 31 | 18 | 106 | |
| Father's occupation | Business | 53 | 44 | 89 | 33.54 (0.00) |
| | Govt. Job | 14 | 14 | 22 | |
| | Private Job | 35 | 12 | 11 | |
| | Farmer | 25 | 25 | 65 | |
| | Others | 27 | 16 | 43 | |
| Mother's occupation | Business | 5 | 1 | 2 | 10.93 (0.21) |
| | Govt. Job | 6 | 10 | 10 | |
| | Private Job | 7 | 7 | 8 | |
| | Housewife | 128 | 92 | 205 | |
| | Others | 8 | 3 | 7 | |
| Father's educational qualification | None | 18 | 9 | 44 | 30.52 (0.00) |
| | Primary | 33 | 29 | 58 | |
| | SSC | 22 | 24 | 59 | |
| | HSC | 34 | 22 | 37 | |
| | Graduate | 46 | 29 | 29 | |
| Mother's educational qualification | Primary | 54 | 36 | 86 | 15.12 (0.05) |
| | SSC | 29 | 23 | 56 | |
| | HSC | 27 | 21 | 27 | |
| | Graduate | 21 | 23 | 22 | |
| | None | 22 | 10 | 38 | |

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The correspondence map, illustrating the scores of each category on both axes simultaneously for the variables "Division" and "Taking Breakfast". In the correspondence map, closely or same direction levels are positively associated, opposites directions are negatively associated and 90 degree angles are showing there is no association between the levels of category variables. The map indicates that students residing in Sunamganj and Habiganj districts are more inclined to not consume breakfast, as they are predominantly represented in the "Never" category. Additionally, it is probable that the children who consume breakfast at irregular intervals are from the Moulvibazar area, whereas those who have breakfast at regular intervals are likely from the Sylhet region (Figure 4).
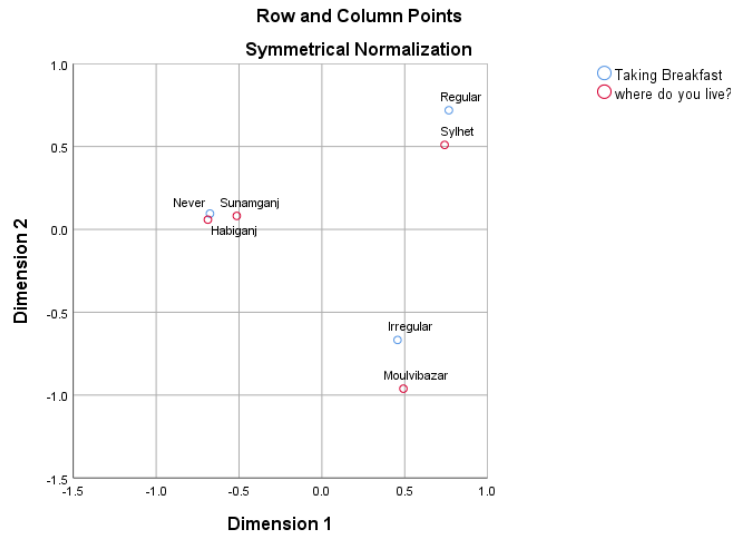


**Figure 4. Correspondence map between breakfast and district (living location).**

The correspondence map, illustrating the simultaneous scores of each category on both dimensions for "Taking Breakfast" and "Mother's educational qualification". The data indicates that students whose mothers have achieved primary education or SSC, or have no educational qualifications, are more inclined to skip breakfast. This is evident from the fact that mothers who have attained primary education or SSC, or have no educational qualifications, are more likely to fall into the group of "Never" consuming breakfast. Furthermore, it can be observed that students whose mothers have obtained a higher level of education are more inclined to consume breakfast on a regular basis, whereas students whose mothers have completed their Higher Secondary Certificate (HSC) are more prone to irregular breakfast consumption (Figure 5).
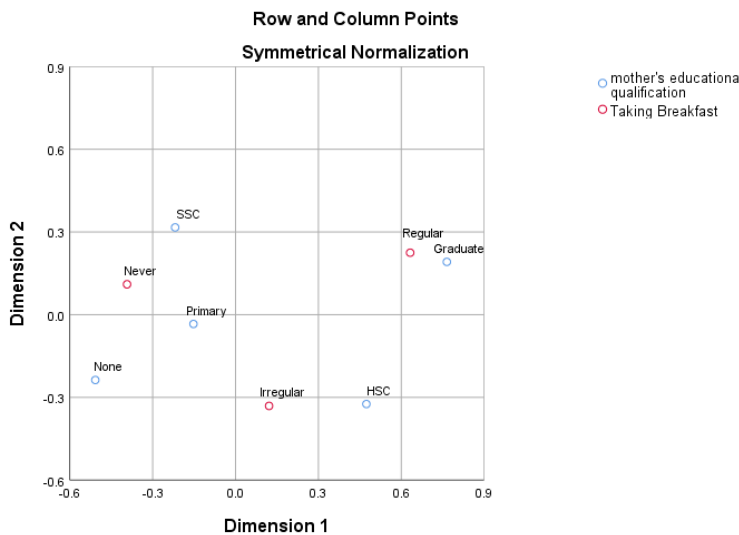


**Figure 5. Correspondence map between breakfast and mother education.**

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The scores of each category on both dimensions simultaneously for both "Taking Breakfast" and "Father's educational qualification". The data indicates the association between students whose fathers have attained SSC and primary education levels, and they are not consuming breakfast. This is evident from the fact that fathers with SSC and primary education levels are more inclined towards the "Never" category in terms of breakfast consumption. Furthermore, it is observed that students whose fathers have obtained a higher level of education tend to have irregular breakfast consumption patterns (Figure 6).
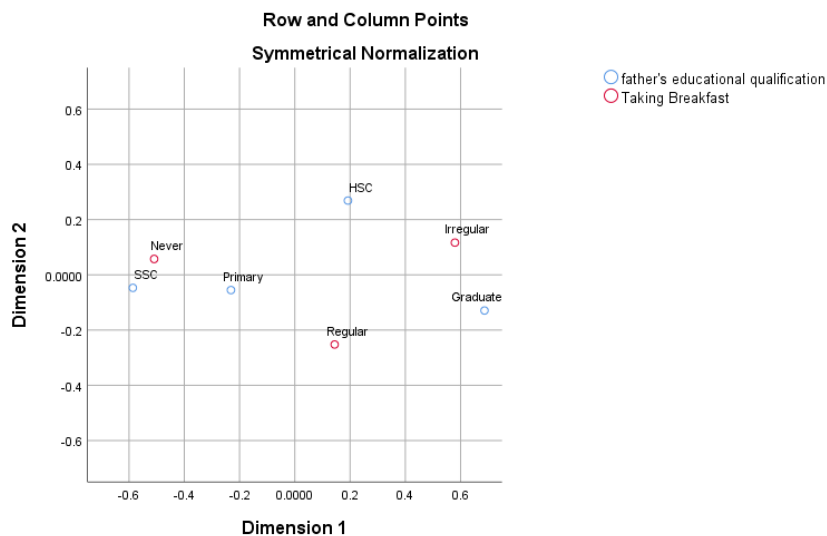


**Figure 6. Correspondence map between breakfast and father's education.**

The scores of each category on both dimensions simultaneously for both "Taking Breakfast" and "Father's occupation". The data indicates that students whose fathers are engaged in occupations such as farming, business, and other professions tend to have a less consuming breakfast. This observation is attributed to the fact that fathers in these occupations are more frequently categorized in the "Never" breakfast consumption category. Furthermore, it is observed that children with fathers employed in the private sector tend to have irregular breakfast consumption patterns, whereas children with fathers employed in the government sector are more likely to have regular breakfast habits (Figure 7).
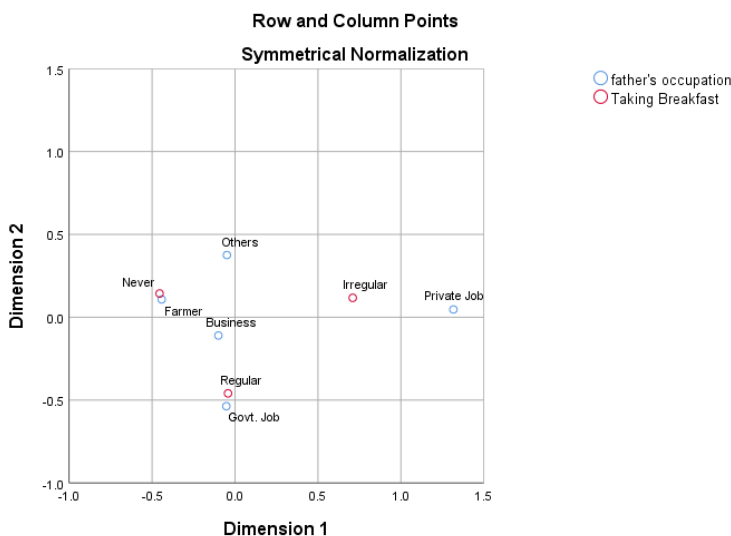


**Figure 7. Correspondence map between breakfast and father's occupation.**

The correspondence map illustrating the simultaneous representation of each category's contribution of both dimensions for "Taking Breakfast" and "Mother's occupation." The data indicates the level-wise association

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between breakfast and mother's occupation. It is observed that students whose mothers are employed in government or private sector jobs tend to have a consistent breakfast routine, while students whose mothers have occupations other than government or private sector jobs tend to have an inconsistent breakfast routine. However, in a chi-square test it was found that mother's occupation and breakfast consumption is not significant. Therefore, this kind of categorical data correspondence analysis is more suitable to discover the level-wise association (Figure 8).
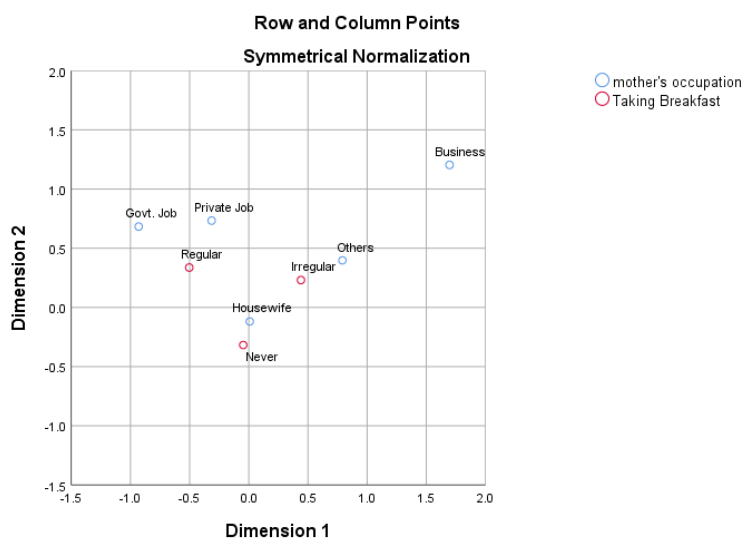


**Figure 8. Correspondence map between breakfast and mother's occupation.**

## 4. Discussion

The Chi-square test results show a significant association between the division (living location) and breakfast consumption. Students from Sylhet are more likely to have a regular breakfast routine, while those from Sunamganj and Habiganj are more likely to skip breakfast. There is a significant association between father's occupation and breakfast consumption. Students whose fathers are in business or farming show higher rates of irregular or no breakfast consumption. Although the Chi-square test indicates no significant association between mother's occupation and breakfast consumption, correspondence analysis reveals that students whose mothers work in the government or private sectors tend to have more regular breakfast habits.

Father's educational qualification significantly affects breakfast consumption patterns. Students whose fathers have only primary or no education are more likely to skip breakfast, while higher educational levels correlate with more regular breakfast consumption.

The association between mother's education and breakfast consumption is significant. Children whose mothers have no education or only primary education are more likely to skip breakfast. The objective of this study was to investigate the breakfast intake patterns of students living in the Sylhet division of Bangladesh. The study effectively accomplished its objectives by analyzing the breakfast patterns of the students in three unique categories (Irregular, Regular, and Never) and exploring their association with various categorical factors.

The findings of this study suggest that a significant proportion of the assessed students, approximately 50%, reported abstaining from having breakfast. This percentage represents the highest proportion when compared to the students who were evaluated and found to have breakfast consistently or inconsistently. This observation aligns with the findings presented in previous studies (Affenito, 2007) which suggest that breakfast is often skipped by children and adolescents. Furthermore, the findings of this study suggest that children whose parents, both the father and mother, possess only the basic level of education (Primary or SSC) or lack educational credentials, have a greater inclination towards skipping breakfast. This observation aligns with the results of a prior investigation (Moore *et al.*, 2007) which indicates a greater propensity for children from lower socioeconomic backgrounds to miss breakfast, as opposed to their counterparts from better socioeconomic backgrounds. Several studies (Dubois *et al.*, 2006) show that there is an association between the omission of breakfast and the prevalence of overweight status among children and adolescents. This study presents more data supporting a favorable association between the maternal employment of housewife and the likelihood of children engaging in breakfast skipping. Furthermore, empirical observations have revealed that children whose

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mothers are employed in either the public or private sectors have a consistent breakfast routine, but children whose mothers are involved in jobs beyond these sectors likely to have an inconsistent breakfast routine. The results presented in this study diverge from the results reported in a prior investigation (Hasan *et al.*, 2021) which suggested that Bangladeshi mothers, particularly those involved in employment beyond the home, encountered difficulties in preparing nourishing meals due to time constraints and apprehensions regarding the presence of chemical additives in raw food items obtainable in markets. The findings of the study suggest that students residing in urban areas are more prone to completely skipping breakfast as a regular part of their daily routine. According to the results of earlier studies (Alsharairi and Somerset, 2016; Okada *et al.*, 2018; Forkert *et al*., 2019) there is an association between adiposity in children and their habit of skipping breakfast. Our study is consistent with a prior investigation (Biswas *et al*., 2017; ICDDR,B, 2020) that also found a higher prevalence of overweight or obesity among children in urban regions of Bangladesh.

## 5. Conclusions

The outcome of this study underscore the significance of advocating for the eating of breakfast among adolescents enrolled in high school, with a particular focus on urban regions and individuals from socio-economically challenged circumstances. It is also concluded that besides chi-square test, correspondence analysis is essential to know the level-wise association between the attributes. Promoting the cultivation of nutritious breakfast practices can have favorable effects on one's general health. Additional study and interventions are necessary to effectively address the widespread issue and enhance the breakfast behaviors of adolescents in Bangladesh to improve adolescents health.

## Data availability

Not applicable.

## Conflict of interest

None to declare.

## Authors' contribution

Md. Abrar Ashfaq Khan and Jakia Benta Sonia- organized the secondary data with draft analysis and prepared the draft manuscript, and Mohammad Ohid Ullah developed the idea, finalized the data analysis and manuscript. All authors have read and approved the final manuscript.

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