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Article

Food security, dietary diversity, and age as determinants of nutritional status among adolescent girls in coastal Bangladesh

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Abstract:

Background: Adolescent girls living in disaster-prone coastal regions of Bangladesh face heightened nutritional vulnerability due to limited food access, poor dietary diversity, and environmental stressors. Despite growing concerns about adolescent malnutrition, few studies have examined the combined influence of food security, dietary diversity, and age on nutritional outcomes in these settings. **Objectives:** This study aimed to assess the association between dietary diversity, food security, and age with the nutritional status of adolescent girls in coastal Bangladesh. **Methods:** A cross-sectional survey was conducted among 345 adolescent girls aged 10–19 in Chattogram and Cox's Bazar. Data on dietary intake were collected using a 24-hour dietary recall and a food frequency questionnaire. Household food security was assessed using a validated scale. Nutritional status was determined using BMI-for-age classifications. Bivariate and multivariate analyses explored associations between dietary diversity, food security, age, and nutritional status. **Results:** Among participants, 10.14% were underweight, and 29.85% were either overweight or obese. While 17.39% demonstrated high dietary diversity (≥7 food groups), the majority had moderate diversity (5 or 6 food groups) (59.42%). Food-insecure households were significantly more likely to have overweight or obese adolescents ($p < 0.05$). Although dietary diversity was associated with BMI in bivariate analysis, it was not a significant predictor in the multivariate model. Age showed a significant relationship with both dietary diversity and nutritional status. **Conclusion:** The findings emphasize the importance of addressing household food security and age-related nutritional vulnerabilities in coastal areas. Interventions should prioritize age-sensitive, culturally appropriate strategies to improve dietary quality and prevent the double burden of malnutrition among adolescent girls.

Keywords: Adolescent Nutrition, Dietary Diversity, Food Security, Coastal Bangladesh, Malnutrition

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Highlights

What is known about the topic

- Adolescent girls in Bangladesh are vulnerable to both undernutrition and rising rates of overweight and obesity, reflecting a "double burden" of malnutrition.
- Dietary diversity and food security are known to influence nutritional status, particularly in low- and middle-income countries.

- Environmental factors in coastal regions, such as food insecurity due to natural disasters, exacerbate the nutritional challenges for adolescent populations.

What this paper adds

- Demonstrates that household food security and age are more significant predictors of nutritional status than dietary diversity in multivariate analysis.
- Identifies a paradoxical relationship between food insecurity and overweight/obesity, especially among older adolescent girls.
- Provides evidence for the need for age-sensitive, culturally tailored nutrition interventions in disaster-prone coastal regions.

Key findings

- 29.85% of adolescent girls were overweight or obese, while 10.14% were underweight.
- Food security was strongly associated with lower odds of malnutrition (AOR = 0.171, $p < .001$).
- Dietary diversity showed significance in bivariate analysis but was not an independent predictor in the logistic regression model.

1. Introduction

Adolescence is a pivotal stage of human development marked by rapid physical growth, hormonal changes, and increased nutritional requirements. According to UNICEF (2022), the global adolescent population exceeds 1.2 billion, accounting for nearly 16% of the world's population [1]. Adolescents, particularly girls, face unique nutritional challenges that are often compounded by socio-cultural, economic, and environmental factors, especially in low- and middle-income countries (LMICs) like Bangladesh [2]. Inadequate nutrition during this life stage can have lasting consequences, including stunted growth, delayed cognitive development, poor academic performance, reduced adult productivity, and increased susceptibility to chronic diseases later in life [3, 4, 5]. In Bangladesh, the burden of malnutrition among adolescent girls is particularly concerning. According to the Bangladesh Demographic and Health Survey (BDHS), approximately 26% of adolescent girls are stunted, 11% are underweight, and 7% are overweight or obese, highlighting the emergence of the "double burden" of malnutrition [6]. Alarmingly, more recent data suggest a rising trend in overweight and obesity, with the prevalence of overweight nearly doubling over the past decade among adolescent girls [7]. This reflects a shifting nutrition landscape where undernutrition and excess weight coexist within the same communities and even households, posing a major challenge for public health policy and intervention. The situation is more critical in the coastal belt regions of Bangladesh, such as Chattogram and Cox's Bazar [8], where adolescent girls are particularly vulnerable due to the intersection of environmental hazards and socioeconomic disadvantages. These areas frequently experience natural disasters, including cyclones, floods, and saline intrusion, which disrupt food production and supply chains, reduce access to clean water, and increase disease prevalence [9]. Environmental degradation and land loss also contribute to declining agricultural productivity, limiting the availability of diverse and nutritious food [10]. As a result, over one-third of households in coastal regions experience food insecurity, which significantly affects the dietary intake and nutritional outcomes of adolescents, especially girls who may face intra-household food discrimination due to prevailing gender norms [11, 12]. Household food security plays a vital role in shaping nutritional outcomes. Food-insecure households are often unable to provide sufficient, safe, and nutritious food to meet the dietary needs of their members, especially vulnerable groups such as adolescent girls [13]. Food insecurity not only leads to undernutrition due to inadequate caloric intake but also increases the risk of overweight and obesity through the consumption of cheap, energy-dense, nutrient-poor

foods [14, 15]. A study by Wrottesley et al. (2023) underscores that poor dietary diversity—a typical consequence of food insecurity—is directly associated with micronutrient deficiencies, which can impair immune function, reduce concentration, and hinder physical growth during adolescence [16]. Dietary diversity, often assessed using the Household Dietary Diversity Score (HDDS), is recognized as a proxy indicator of diet quality and micronutrient adequacy [17]. In Bangladesh, many adolescent girls lack dietary diversity, primarily consuming starchy staples such as rice and rarely accessing nutrient-rich foods like fruits, vegetables, dairy products, or lean proteins [18]. This monotonous dietary pattern exacerbates nutritional deficiencies and contributes to both underweight and overweight conditions. In addition, socio-demographic factors such as age can influence dietary needs and food intake patterns [19]. Younger and older adolescents often differ in metabolic needs, nutritional awareness, and food access, yet limited research has examined how age interacts with dietary diversity and food security to influence nutritional outcomes, particularly in disaster-prone coastal Bangladesh. National-level studies often overlook the unique cultural and environmental challenges faced by these communities. In the first phase of this study, 10.14% of adolescent girls were underweight and 29.85% were overweight or obese, underscoring a double burden of malnutrition. Nutritional status was significantly associated with age, maternal education, and family structure, and over half of the respondents had poor nutritional knowledge [20]. Building on these findings, the present study analyzes how food security, dietary diversity, and age jointly affect nutritional status among 345 adolescent girls in Chattogram and Cox's Bazar, using 24-hour dietary recall, food frequency questionnaires, and BMI classification. The aim is to provide evidence to guide context-specific, culturally appropriate nutrition interventions for vulnerable coastal adolescents.

2. Methodology

2.1. Study design

A descriptive cross-sectional study design was adopted to assess the nutritional status and its associated factors among adolescent girls. This design was appropriate to capture a snapshot of dietary diversity, food security, and nutritional outcomes within a specific population at a single point in time.

2.2. Study setting

The study was conducted in the coastal belt region of Bangladesh, specifically targeting districts highly vulnerable to environmental and socioeconomic risks—Chattogram and Cox's Bazar. These regions were selected based on their frequent exposure to natural disasters, dependency on agriculture and fishing, and predominantly rural demographics.

2.3. Study duration

The data collection period spanned from April 2024 to July 2024.

2.4. Study population

The target population included adolescent girls aged 10 to 19 years residing in the selected coastal communities. This age group was prioritized due to their heightened vulnerability to nutritional deficiencies during critical periods of physical and cognitive development.

2.5. Sample size determination

The sample size was calculated using the standard formula for prevalence studies: $n = z^2pq/d^2$, where $z = 1.96$ (95% confidence level), $p = 0.66$ (assumed prevalence of

nutritional risk based on prior research), q = 1 − p = 0.34, and d = 0.05 (margin of error). This yielded a minimum sample size of 345 participants.

2.6. Sampling technique

A stratified cluster sampling method was employed. The study area was stratified based on geographic and socioeconomic characteristics. Clusters (villages or blocks) were then randomly selected from each stratum to ensure representativeness across diverse coastal contexts.

2.7. Inclusion criteria

- Adolescent girls aged 10–19 years.
- Residing in the study area for at least one year before data collection.

2.8. Exclusion criteria

- Individuals with cognitive or severe physical impairments that hinder participation.
- Critically ill participants.
- Individuals unwilling or unable to provide informed consent.

2.9. Data collection procedures

- Data were gathered using structured face-to-face interviews with a pre-tested questionnaire.
- Socio-demographic and health information were collected.
- Dietary intake was assessed via a 24-hour dietary recall questionnaire.
- Anthropometric measurements (height and weight) were taken using standardized equipment, with BMI calculated for nutritional status classification.
- The questionnaire was translated into Bengali and back-translated to ensure linguistic accuracy.

2.10. Indicators and scoring methods

- Household Food Security was assessed using the method defined by the Household Food Security & Nutrition Assessment [21], which classifies households into food secure, moderately food secure/insecure, and food insecure.
- Household Dietary Diversity Score (HDDS) followed the FAO guidelines [17]. Food groups consumed over the previous 24 hours were recorded and summed to a maximum score of 12.

2.11. Data analysis

Data were cleaned and analyzed using SPSS (version 26) and Stata (version 13). Descriptive statistics summarized socio-demographic and dietary data. Chi-square tests were used to examine associations between categorical variables (e.g., age groups and food security). Logistic regression analysis was performed to identify predictors of nutritional status. Model fitness was evaluated using Nagelkerke's R^2.

2.12. Ethical considerations

The study was approved by the Ethics Review Committee of the Faculty of Allied Health Sciences, Daffodil International University. Written informed consent was obtained from participants and guardians. Confidentiality and the right to withdraw were upheld throughout the research process.

3. Results

Table 1 presents the demographic characteristics, individual dietary diversity, and household food security status of the respondents (N = 345). The mean age of the participants was 14.35 ± 2.41 years. The distribution of respondents across different age groups shows that 27.25% (n = 94) were aged 10–12 years, while 33.91% (n = 117) belonged to the 13–15 years age group, and the highest proportion (38.84%, n = 134) were aged 16–19 years. Regarding individual dietary diversity, the mean dietary diversity score was 14.35 ± 2.41. A small proportion (3.48%, n = 12) of respondents reported consuming three or fewer food groups, while 19.71% (n = 68) consumed four food groups. The majority (38.84%, n = 134) had a dietary diversity score of five food groups, followed by 20.58% (n = 71) who consumed six food groups, and 17.39% (n = 60) who reported consuming seven or more food groups. In terms of household food security status, 67.83% (n = 234) of the respondents were from food-secure households, while 24.35% (n = 84) reported moderate food insecurity, and 7.83% (n = 27) were from food-insecure households.

Table 1. Demographic characteristics, dietary diversity, and food security status of respondents (N = 345)

Variables	No. of respondents	Percentage
Age group (*Mean* + *SD* = 14.35 + 2.41)		
10-12 years	94	27.25%
13-15 years	117	33.91%
16-19 years	134	38.84%
Individual dietary diversity (*Mean* + *SD* = 14.35 + 2.41)		
3 or less than 3 food groups	12	3.48%
4 food groups	68	19.71%
5 food groups	134	38.84%
6 food groups	71	20.58%
7 or more than 7 food groups	60	17.39%
Household food security status		
Food secure	234	67.83%
Moderate food secure/insecure	84	24.35%
Food insecure	27	7.83%

The individual dietary intake pattern of the respondents based on a 24-hour dietary recall indicates that starchy staples were the most commonly consumed food group, with 99.71% (n = 344) of respondents reporting intake. Legumes and nuts were also widely consumed, with 93.04% (n = 321) of participants including them in their diet. Among vegetable and fruit consumption, 67.83% (n = 234) of respondents consumed dark green leafy vegetables, while 96.81% (n = 334) reported an intake of red-orange-yellow (ROY) vegetables. ROY fruits and vitamin C-rich vegetables were consumed by 39.71% (n = 137) of participants, whereas vitamin C-rich fruits were consumed by only 29.57% (n = 102). Additionally, 66.96% (n = 231) reported consuming other vegetables or fruits. Regarding protein sources, 37.68% (n = 130) consumed eggs, while 41.45% (n = 143) reported eating organ meat. Small fish was a significant part of the diet for 66.96% (n = 231) of respondents, while small dried fish was consumed by 35.36% (n = 122). Large fish or sea fish were consumed by 51.01% (n = 176), whereas large dried fish had a much lower intake at 13.04% (n = 45). Additionally, 28.41% (n = 98) reported consuming flesh foods and small animal protein. 58.26% (n = 201) of respondents reported intake for dairy consumption. Edible oil and spices/condiments were universally consumed (100.00%, n = 345). Furthermore, 74.20% (n = 256) of respondents included sugar, honey, or molasses in their diet (Table 2).

Table 2. Individual dietary intake pattern of the respondents based on 24-hour recall (*N* = 345)

Food items/groups	No. of respondents	Percentage
Starchy staples	344	99.71%
Legumes and nuts	321	93.04%
Dark green leafy vegetables	234	67.83%
ROY fruits	137	39.71%
ROY vegetables	334	96.81%
Vitamin C-rich fruits	102	29.57%
Vitamin C-rich vegetables	137	39.71%
Other vegetables or fruits	231	66.96%
Eggs	130	37.68%
Organ meat	143	41.45%
Small fish	231	66.96%
Small dried fish	122	35.36%
Large fish/Sea fish	176	51.01%
Large dried fish	45	13.04%
Flesh foods and small animal protein	98	28.41%
Dairy	201	58.26%
Edible oil	345	100.00%
Sugar, honey, molasses	256	74.20%
Spices/condiments	345	100.00%

The nutritional status of the respondents (*N* = 345) was categorized as underweight, normal, overweight, and obese according to their BMI. The majority of the respondents (60.00%, *n* = 207) had a normal nutritional status, while 10.14% (*n* = 35) were classified as underweight. A significant proportion of respondents exhibited excess weight, with 15.07% (*n* = 52) categorized as overweight and 14.78% (*n* = 51) classified as obese. These findings indicate the coexistence of undernutrition and overweight/obesity within the study population, suggesting a double burden of malnutrition (Figure 1).

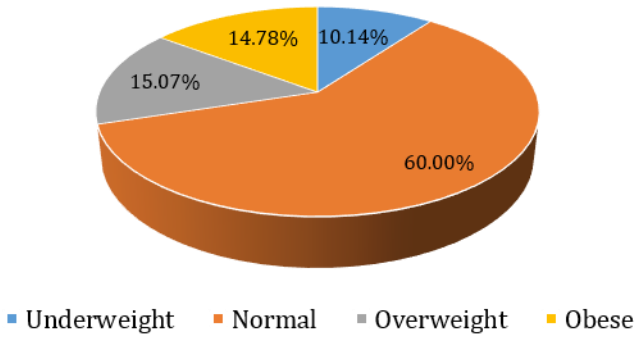

Figure 1. Nutritional status of the respondents (*N* = 345)

The association between dietary diversity, food security, and age groups of the respondents shows a statistically significant association between dietary diversity and age group (χ^2 = 27.468, $p < 0.001$). Among the respondents, those consuming three or fewer food groups were more prevalent in the 16–19 years age group (41.67%, *n* = 5), followed by the 13–15 years group (33.33%, *n* = 4), and the 10–12 years group (25.00%, *n* = 3). The proportion of respondents consuming four, five, and six food groups was relatively higher

among older age groups. However, consumption of seven or more food groups was more frequent among younger respondents, with the highest proportion (38.33%) in the 10–12 years group, followed by 35.00% in the 13–15 years group and 26.67% in the 16–19 years group. Similarly, food security status was found to be significantly associated with age group (χ^2 = 10.376, p = 0.034). A greater proportion of respondents from food-secure households belonged to the younger age groups, with 29.49% in the 10–12 years group, 34.19% in the 13–15 years group, and 36.32% in the 16–19 years group. In contrast, food insecurity increased with age, as 42.86% of respondents from moderate food-insecure households were in the 16–19 years group, compared to 33.33% in the 13–15 years group and 23.81% in the 10–12 years group (Table 3).

Table 3. Association of dietary diversity and food security with the age of the respondents

Variables	Frequency (%)	Age group						χ^2 values	*p*-value
		10-12 years (94)		13-15 years (117)		16-19 years (134)			
		n	%	*n*	%	*n*	%		
Dietary diversity									
3 or less than 3 food groups	12 (3.48%)	3	25.00%	4	33.33%	5	41.67%	27.468	.000
4 food groups	68 (19.71%)	19	27.94%	24	35.29%	25	36.76%		
5 food groups	134 (38.84%)	32	23.88%	43	32.09%	59	44.03%		
6 food groups	71 (20.58%)	17	23.94%	25	35.21%	29	40.85%		
7 or more than 7 food groups	60 (17.39%)	23	38.33%	21	35.00%	16	26.67%		
Food security									
Food secure	234 (67.83%)	69	29.49%	80	34.19%	85	36.32%	10.376	.034
Moderate food secure/insecure	84 (24.35%)	20	23.81%	28	33.33%	36	42.86%		
Food insecure	27 (7.83%)	5	18.52%	9	33.33%	13	48.15%		

The association between age, dietary diversity, food security, and nutritional status among the respondents shows a statistically significant association between age group and nutritional status (χ^2 = 13.634, p = 0.034). The highest proportion of underweight respondents (12.77%) was in the 10–12 years age group, while 7.46% of those aged 16–19 years were underweight. The prevalence of normal weight was relatively consistent across age groups, with the highest percentage observed among the 13–15 years age group (60.68%). The prevalence of overweight and obesity increased slightly with age, with the 16–19 years group having the highest proportion of overweight (15.67%) and obese (16.42%) individuals. A significant association was also found between dietary diversity and nutritional status (χ^2 = 24.074, p = 0.019). Among respondents consuming three or fewer food groups, the majority (58.33%) had a normal weight, while 16.67% were either overweight or obese. In contrast, those consuming seven or more food groups had the highest prevalence of normal weight (75.00%), with a relatively lower prevalence of overweight (11.67%) and obesity (1.67%). This trend suggests that higher dietary diversity is associated with a greater likelihood of maintaining normal weight status, while lower dietary diversity may contribute to both undernutrition and excess weight. Additionally, food security status was significantly associated with nutritional status (χ^2 = 12.703, p = 0.048). Among food-secure respondents, 64.53% had a normal weight, while 11.54% were underweight, and 12.39% were obese. In contrast, food-insecure respondents had a higher prevalence of overweight (22.22%) and obesity (22.22%), with a lower proportion maintaining a normal weight (48.15%).

Table 4. Association of respondents' age, dietary diversity, and food security with nutritional status

Variables	Frequency (%)	Nutritional status								χ^2 values	*p*-value
		Underweigh t (35)		Normal (207)		Overweight (52)		Obese (51)			
		n	%	*n*	%	*n*	%	*n*	%		
Age group											
10-12 years	94 (27.25%)	12	12.77%	55	58.51%	15	15.96%	12	12.77%	13.634	.034
13-15 years	117 (33.91%)	13	11.11%	71	60.68%	16	13.68%	17	14.53%		
16-19 years	134 (38.84%)	10	7.46%	81	60.45%	21	15.67%	22	16.42%		
Dietary diversity											
3 or less than 3 food groups	12 (3.48%)	1	8.33%	7	58.33%	2	16.67%	2	16.67%	24.074	.019
4 food groups	68 (19.71%)	6	8.82%	44	64.71%	10	14.71%	8	11.76%		
5 food groups	134 (38.84%)	14	10.45%	65	48.51%	22	16.42%	33	24.63%		
6 food groups	71 (20.58%)	7	9.86%	46	64.79%	11	15.49%	7	9.86%		
7 or more than 7 food groups	60 (17.39%)	7	11.67%	45	75.00%	7	11.67%	1	1.67%		
Food security											
Food secure	234 (67.83%)	27	11.54%	151	64.53%	27	11.54%	29	12.39%	12.703	.048
Moderate food secure/insecure	84 (24.35%)	6	7.14%	43	51.19%	17	20.24%	18	21.43%		
Food insecure	27 (7.83%)	2	7.41%	13	48.15%	6	22.22%	6	22.22%		

Table 5 presents the results of the adjusted logistic regression analysis examining the association between age, dietary diversity, and food security with nutritional status among respondents. Age was significantly associated with nutritional status (*AOR* = 0.528, *95% CI*: 0.420–0.660, $p < 0.001$), indicating that older respondents had lower odds of being underweight, overweight, or obese compared to younger individuals. Food security was also a strong predictor (*AOR* = 0.171, *95% CI*: 0.100–0.290, $p < 0.001$), suggesting that food-secure respondents were significantly less likely to experience malnutrition, including undernutrition and overweight/obesity. However, dietary diversity was not significantly associated with nutritional status (*AOR* = 0.970, *95% CI*: 0.800–1.180, $p = 0.822$), implying that its direct effect may be limited when controlling for other factors. The model demonstrated a moderate explanatory power (Nagelkerke's $R^2 = 0.42$), suggesting that these predictors explained 42% of the variance in nutritional status.

Table 5. Adjusted Logistic Regression Analysis of Factors Associated with Nutritional Status

Variable	Adjusted odds ratio (*AOR*)	95% Confidence interval (*CI*)	*p*-value
Age	0.528	(0.420 – 0.660)	<.001
Dietary diversity	0.970	(0.800 – 1.180)	.822
Food security	0.171	(0.100 – 0.290)	<.001

Model fit: Nagelkerke's $R^2 = 0.42$, N = 345.

4. Discussion

This study examined how food security, dietary diversity, and age interact to shape the nutritional status of adolescent girls living in disaster-prone coastal areas of

Bangladesh. The results demonstrate a clear double burden of malnutrition: 10.14% of girls were underweight, while 29.85% were either overweight or obese. This mirrors national-level data, where adolescent malnutrition remains a growing concern, particularly in coastal and marginalized populations [7]. Similar trends have been observed by Akseer et al. (2020), who reported the co-existence of stunting and overweight in many low- and middle-income countries, including Bangladesh [3]. Among the 345 participants, 59.42% had medium dietary diversity (consumed 5–6 food groups), 17.39% had high diversity (≥7 food groups), and only 23.19% fell into the low dietary diversity group (≤3 to 4 food groups). While dietary diversity was significantly associated with nutritional status in bivariate analysis ($p < 0.05$), it was not retained as an independent predictor in the multivariate logistic regression model. This suggests that while dietary variety plays an important role, its influence may be mediated by other factors such as household food security and age. This is consistent with findings from Farzana et al. (2017), who reported that food diversity alone may not sufficiently capture diet quality unless contextualized with socioeconomic status and food availability [11]. Food security emerged as a strong predictor of nutritional status. Among the food-secure households, 64.53% of girls had a normal BMI compared to only 48.15% in food-insecure households. Alarmingly, 44.44% of girls from food-insecure households were overweight or obese, indicating a paradoxical link between food insecurity and excess weight, likely driven by reliance on calorie-dense, nutrient-poor foods. This finding aligns with studies by Hossain et al. (2025) and Ruiz et al. (2019), which have shown that food-insecure populations may compensate for limited access by consuming cheaper, energy-rich but low-nutrient foods [14, 15]. Age was also significantly associated with nutritional outcomes ($p = .034$). Older adolescents (16–19 years) were more likely to be overweight or obese (32.09%). Additionally, younger adolescents had better dietary diversity scores: 38.33% of girls aged 10–12 consumed ≥7 food groups, compared to just 26.67% in the 16–19 age group. This may reflect declining parental oversight and increased autonomy with age, contributing to more irregular eating patterns and increased exposure to processed or fast foods, as suggested by Arlinghaus et al. (2018) and Ahsan et al. (2023) [4, 19]. Phase I of this study also found that maternal education and family structure were significantly associated with both dietary diversity and BMI ($p < 0.05$). Adolescent girls from nuclear families and households where mothers had attained at least secondary education were more likely to have a normal BMI and higher dietary diversity. These findings support earlier evidence indicating that maternal literacy positively influences adolescent nutritional outcomes [18, 20].

4.1. Implications for practice

- Dual-action nutrition strategies are needed to address both undernutrition and rising overweight/obesity among adolescent girls in coastal Bangladesh.
- Food security interventions must focus on improving not just food availability but also the quality and diversity of diets, especially in environmentally vulnerable communities.
- Age-specific and culturally relevant nutrition education should be integrated into schools and community programs to influence lifelong healthy eating behaviors.

4.2. Recommendations and limitations

Based on the findings of this study, several recommendations can be made to improve the nutritional status of adolescent girls in the coastal regions of Bangladesh:

- Age-specific and school-based nutrition interventions should be developed to address the distinct needs of younger and older adolescents,

incorporating culturally appropriate education on dietary diversity and the long-term risks of poor diet quality.
- Food security initiatives in disaster-prone areas should be strengthened through targeted subsidies, promotion of local food production, and integration of community-based food systems such as homestead gardening and traditional food preservation.
- Family-centered nutrition programs, particularly those engaging mothers, should be promoted to influence adolescents' eating behaviors and support healthier dietary practices at the household level.

Several limitations of the study should be acknowledged:
- As a cross-sectional study relying on self-reported dietary recall, the findings are subject to memory bias and cannot establish causal relationships between variables.
- Nutritional status was assessed using BMI alone, and the geographic focus on Chattogram and Cox's Bazar limits the generalizability of the results to all coastal regions of Bangladesh.

5. Conclusion

This study highlights the complex interplay between food security, dietary diversity, and age in shaping the nutritional status of adolescent girls living in disaster-prone coastal areas of Bangladesh. The findings reveal a troubling double burden of malnutrition, with both underweight and overweight conditions prevalent among participants. While dietary diversity was associated with nutritional outcomes in bivariate analysis, household food security and age emerged as stronger predictors in multivariate models. These results underscore the need for comprehensive, context-specific interventions that address not only food availability but also access to diverse, nutritious foods, particularly in socioeconomically and environmentally vulnerable regions. Recognizing the unique nutritional needs of adolescents at different stages of development, future programs should incorporate age-sensitive approaches, promote culturally relevant dietary education, and strengthen food security systems. By doing so, policymakers and public health practitioners can more effectively combat adolescent malnutrition and foster long-term health and well-being in coastal Bangladesh.

Author contributions

Tanzina Akter and Abu Ansar Md Rizwan conceptualized and designed the study. Data analysis and interpretation were carried out by Taslima Akter, Sharmin Shilpy Nokshi, Sujit Kumar Banik, and Abu Ansar Md Rizwan. The initial draft of the manuscript was prepared by Tanzina Akter, Taslima Akter, and Abu Ansar Md Rizwan, with substantial revisions and inputs from Sharmin Shilpy Nokshi and Sujit Kumar Banik to finalize the document. All authors reviewed and approved the final version of the manuscript.

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Conflict of Interest Disclosure

The authors affirm that there are no competing interests or conflicts of interest associated with this study.

Consent for Publication

All listed authors have reviewed the manuscript and consented to its submission and potential publication.

Ethical Approval Statement

The study was conducted by ethical standards and received formal approval from the Ethics Review Committee of the Faculty of Allied Health Sciences of Daffodil International University, Bangladesh.

Informed Consent Statement

Before participation, written informed consent was obtained from all study participants, ensuring their voluntary involvement.

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