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Food purchase and consumption behavior during the COVID-19 pandemic lockdown in Bangladesh: association between sociodemographic composition

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Abstract

Background Bangladesh suffered a severe COVID-19 wave from June to August 2021, which forced the government to impose emergency nationwide lockdown measures for three months with discontinuities. The sudden lockdown strongly affected the dietary preferences, financial circumstances, and social interactions of citizens.

Methods In this comprehensive study, we collected sociodemographic information as well as data on food purchase and consumption behaviors from 1,350 adults in Bangladesh during the weeks of enforced confinement. The association between the sociodemographic factors (viz., gender, age, education status, income, occupation, and household size) and food purchase and consumption behaviors were determined by conducting bivariate and multivariate logistic regression models reporting as odds ratios.

Results The descriptive result reveals that 49.63% of the participants experienced wage reductions, with many people enduring reductions of up to 75%; 12.22% lost their jobs. Besides, a decline in the frequency of shopping was observed by 35.04%; and 24.52% avoided outdoor shopping during the pandemic period. Additionally, 28.74% of participants purchased less overall, while 19.48% purchased significantly fewer items per trip compared to the pre-pandemic period. The multivariate analysis shows a prominent increase in online grocery shopping (OR: 4.03, 95% CI: 2.38–6.83, $p < 0.001$) and meal delivery services (OR = 5.19, 95% CI = 3.21–7.17, $p < 0.001$) among higher educated individuals compared to the individuals having no institutional education. The personnel having formal jobs purchased 2.34 times more from online grocery sites (95% CI = 0.34–4.08, $p = 0.003$) compared to the unemployed one. In contrast, a notable increase in panic buying and stockpiling was observed, driven by scarcity and escalating prices of essential food items. The frequency of meals with families, active engagement in meal preparation, and the exploration of novel recipes also increased notably.

Conclusions The consumption of takeaway food and inter-meal snacks increased significantly with the education level of individuals. These findings highlighted that a prolonged pandemic could magnify economic vulnerability in Bangladesh.

Keywords COVID-19, Food purchase, Stockpiling, Eating behavior, Buying behavior, Pandemic

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Background

After the emergence of COVID-19, caused by the novel coronavirus or SARS-CoV-2, the World Health Organization officially classified it as a global pandemic on March 11, 2020 [1]. Several researchers focused on investigating the experiences of consumers during this unprecedented crisis, particularly regarding their food purchasing and consumption behaviors, and their adaptation to changing circumstances [2–9]. Bangladesh, like many other nations, was significantly affected by the successive waves of COVID-19. These waves strongly and adversely affected various aspects of the country, including its food supply chain, food security, dietary patterns of individuals, employment, social interactions, and income levels [10–12].

The Institute of Epidemiology, Disease Control and Research (IEDCR) officially confirmed Bangladesh's first COVID-19 case on March 08, 2020, with the first recorded fatality documented on March 18, 2020 [13]. By June 2020, confirmed cases soared to 50,000, and within three months, reached 364,900, with a death toll of 5,272 [14]. Bangladesh encountered a catastrophic second wave from March 29 to August 23, 2021, marked by a significant surge in infections and fatalities particularly between June and July 2021 [15–18]. The government implemented a nationwide lockdown on June 28, 2021, closing public transportation, educational institutions, and banning public gatherings [19, 20], anticipating a significant impact on consumer behavior due to factors like remote work setups, disrupted routines, limited food access, reduced wages, disruptions in the food supply chain, and high prices [21, 22].

During lockdowns, the imposed back-and-forth restriction measures on vehicle movement restrained rural farmers from accessing urban markets, resulting in havoc in rural-agriculture dependent urban fresh food markets [23]. Aftereffects led to a significant rise in staple food prices [24–28], including rice by 7% to 46%, pulses by 24% [25], and fish by \$0.24–0.48 USD/kg [26]. Meat prices also witnessed an increase, viz., beef rising by 4%, mutton by 3%, and chicken by a staggering 56% [25]. Households have made dietary adjustments, shifting to healthier options like fruits and eggs, while substituting fresh fish with eggs, lentils, poultry, and dry fish [28]. Moreover, panic buying has led to the stockpiling of rice, lentils, and potatoes [28, 29], resulting in decreased food intake around 15% of rural 24% of urban households compared to pre-pandemic levels [25]. Furthermore, the COVID-19 and lockdowns led to nationwide income reductions, diminishing purchasing power and demand for fresh produce, fish, poultry, and livestock products [27]. Also, some surveys indicated widespread food insecurity, decreased food consumption, and reduced dietary

diversity, particularly affecting low-income households [25, 30]. Rising prices and supply chain disruptions further exacerbated the situation, forcing low-income households to opt for cheaper, less nutritious foods [26], while middle-income groups with stable incomes made no major changes [11].

During the COVID-19 pandemic, in the United States, the availability of time, concerns regarding the potential risks of dining out, and income disparities significantly contributed to the increase in the preparation of meals at home [31]. This shift toward cooking at home allowed individuals to hone their culinary skills and also presented an opportunity to foster better food management practices, thereby reducing instances of food waste. Additionally, in the United States, citizens increased their storage capacity to accommodate larger quantities of frozen foods, which reduced the need to frequently visit grocery stores [31]. In Russia, individuals used a similar approach by stockpiling food items, which decreased their need to visit stores. Storing food items coincided with a greater emphasis on developing cooking skills and transitioning toward healthier food choices, leading to a reduction in household food waste during the COVID-19 pandemic [32]. In Italy, a two-month lockdown was implemented, which resulted in a significant increase in the use of online food shopping platforms, as consumers greatly relied on home delivery services. Thus, individuals spent more time cooking at home and reported lower food waste [33]. These changed habits in eating and buying behavior globally were largely influenced by sociodemographic settings [34, 35].

A study in Italy showed a correlation between online food shopping and educational qualification, highlighting those individuals with higher educational qualifications tend to shop online more frequently [36]. In contrast, a Dutch study found no significant changes in food purchasing and consumption behaviors during the COVID-19 lockdown, except for an increase in food delivery services. However, individuals with higher educational qualifications and overweight individuals were more likely to make unhealthier food choices [37]. The fear of COVID-19 in the USA drove a 255% increase in grocery pickups and a 158% increase in delivery services, and respondents with children consumed more fresh produce, dairy, and grains [38], contrasting with Denmark and Germany [22]. Age, education, and health concerns influenced Romanian attitudes toward sustainable food [39, 40], whereas in Morocco, shopping habits were influenced by age [41]. In Spain, gender and age impacted food consumption and spending habits [42], whilst in England, older adults altered their purchasing behaviors, with higher-educated individuals showing more pronounced effects [43]. Similarly, gender, age,

and household size impacted sustainable food choices in China [44], while income loss affected food intake differently across Slovenia, Denmark, and Germany [22]. Furthermore, in Italy, shifts towards smaller stores and dietary changes were influenced by employment status and family dynamics [45, 46].

Although some studies have reported changes in dietary patterns and shopping habits globally during the COVID-19 pandemic [31], evidence from Bangladesh remains unexplored. Some earlier studies in Bangladesh examined impact on agri-food systems, food security, fish consumption and possible risks in malnutrition [24–30], they were ineffective in linking demographic variables to consumption patterns or establishing connections between them. In this study, we first comprehensively investigated the association of sociodemographic factors with food purchase and consumption behavior among Bangladeshi adults during the COVID-19 lockdown. We aimed to find out the association between food purchasing and consumption habits with related confounders viz., gender, age, education, income, occupation, and household size. We believe that this study provides valuable insights for decision-makers as well as public health experts for further policy repercussions. Additionally, this study sheds light on how populations respond during global crises that can shape future policy inferences aimed at bolstering food security in Bangladesh and similar settings elsewhere.

Methods

Study design and questionnaire

We conducted a comprehensive, in-person survey at household levels across seven divisions of Bangladesh. Bangladesh has eight divisions, but we excluded the Chittagong division due to extreme communication challenges, as most of the rural area is hilly in this division. We collected household information from the Bangladesh Bureau of Statistics. The sample size was calculated using the formula $n = z^2 \cdot p(1-p) / \epsilon$; where we considered z for a 95% confidence level as 1.96, ϵ as the margin of error of 5%, and p was assumed as the population proportion 0.5. To calculate the sample size, we considered an unlimited population since there was no baseline information available. Thus, the sample size came out to be 385. In this study, we used a combination of simple random sampling method and snowball sampling method [47]. However, we collected data from seven divisions of Bangladesh. These divisions were considered as clusters, and 193 (50% of 385) households were randomly selected from each cluster using research randomizer software. Finally, we collected data from 1350 respondents.

The survey questionnaire (see supplementary Materials 2) was designed based on the COVID-19 consumer

surveys conducted by the United Nations Systems Standing Committee on Nutrition (UNSCN) [48], International Business Machines (IBM) Corporation [49], as well as, published studies and household surveys. A draft questionnaire was formulated and analyzed via extensive panel discussions with a Technical Working Group (TWC). The draft was further reviewed and modified by the Bangladesh Demographic and Health Survey Stakeholder Advisory Committee. The questionnaire was initially created in English and then translated into Bengali, the national language of Bangladesh. To ensure the questionnaire's originality, it was translated back into English from Bengali. The final version comprised 28 questions divided into three sections, which included sociodemographic characteristics, food purchase and eating behavior, and self-awareness. Before implementing, we conducted a pre-test with 50 participants to assess the clarity and comprehensiveness of the questions. Based on their feedback, necessary adjustments were made to enhance the clarity and relevance of the survey instrument.

The survey was conducted in Bangladesh from July 01 to September 15, 2021, during the peak of the second wave of the COVID-19 pandemic [13, 15]. To conduct the survey, we included 10 volunteers who were adequately trained by one of the authors. The survey was confidential, and the anonymity of participants was maintained; we followed the guidelines of the Declaration of Helsinki, and all procedures involved in this study were approved by the Institutional Review Board of Rajshahi University, Bangladesh (72(23)/320/IAMEBBC/IBSc). All participants were informed about the objectives of the study and the maintenance of the privacy of personal information. Participation was voluntary, and respondents were free to withdraw from the study at any point. Written consent was obtained from all the participants.

Outcomes

In this study, the food purchasing and consumption behavior of respondents were used as the outcomes. For assessing purchasing behavior, participants were asked to indicate their responses on a five-point Likert scale (ranging from “never” to “always”) illustrated by Batterton and Hale [50], regarding various aspects such as: (i) purchasing food from the supermarket, (ii) purchasing food from the grocery store, (iii) purchasing food from the local market, (iv) purchasing food from online grocery shopping sites, and (v) ordering food from online food delivery platforms. The food consumption behavior was also determined by collecting the responses regarding (i) having meals separately (away from family) more frequently than before, (ii) having family meals more frequently, (iii) outdoor dining, (iv) social dining, (v) food takeaways, (vi)

trying new recipes, (vii) preparing family meals more frequently, and (viii) snacking between meals.

Participants were asked to indicate their responses regarding the quantity of food purchased, availability of food, increase in the price of products, and changes in eating-related behaviors before and during the lockdown. They were also asked whether they stockpiled food during the lockdown period, and those who responded affirmatively were asked to select specific items from a provided list, including cereals and their derivatives (e.g., bread, rice, pasta, flour, etc.), pulses, fruits and vegetables, meat and fish, milk and dairy products, sugar/salt, and oil.

Explanatory variables

The association of food purchasing and consumption behavior with several sociodemographic factors, including gender (male, female), age (>55 years, 45–54 years, 35–44 years, and 25–34 years), education (bachelor's degree/master's degree, high school/college degree, and no institutional education), income, occupation, and household size, was measured in this study (Tables 3 and 4). The income levels were categorized into five groups, ranging from low-income (below 10,000 BDT) to high-income (above 40,000 BDT) groups, based on the per capita GDP of Bangladesh (164\$/month) [51]; 1.0 USD = 84.1 Bangladeshi Taka (BDT) [Source: Bangladesh Bank, accessed on October 13, 2021]. The middle-income bracket, ranging from 10,000 to 40,000 BDT, was further divided into three subcategories: 10,000–20,000 BDT, 20,000–30,000 BDT, and 30,000–40,000 BDT. The participants were also categorized into four classes based on their occupation status as follows: (i) unemployed, (ii) formal job, (iii) informal job, and (iv) self-employed/business. The household size was grouped into three groups based on the number of family members: (i) below 4, (ii) 4–6, and (iii) above 6.

The sociodemographic factors were chosen through initial literature screening. We selected confounders that showed significant impact for such a study, considering the situation in Bangladesh. viz., for gender [22, 32, 38–42, 46, 52–54], age [22, 32, 38–42, 46, 52–54], education [22, 32, 38–41, 46, 52, 53], income [32, 38, 41, 42, 54], occupation [32, 38–41, 52], and household size [22, 32, 42, 52–54].

Statistical analysis

Descriptive statistics were used to assess the sociodemographic profile, shopping frequency, and purchasing behavior. The distribution of food categories, such as stockpiling, availability, and price increase, was presented as percentages. Bivariate and multivariate logistic regression analyses were performed to evaluate the

relationship between outcome variables (food purchasing and consumption behavior) and the explanatory variables (sociodemographic factors). The results were presented as odds ratios (ORs), 95% confidence intervals, and the reference category for each independent variable. All test results were considered to be statistically significant at $p < 0.05$, using STATA (version 15).

Results

Sociodemographic profile

The sociodemographic profile of the respondents ($n = 1,350$) is shown in Table 1. Among the participants, 24.07% were female. Most respondents (60%) were young adults (25 to 34 years). More than half of the participants (58.15%) had a higher education degree, such as a bachelor's or master's degree. Approximately half of the respondents belonged to the low-income and lower-middle-income groups, with 23.70% of individuals earning less than 10,000 BDT and 24.81% earning between 10,000 and 20,000 BDT. Additionally, 12.22% of participants reported job loss, and approximately 49.63% experienced reduced wages because of the pandemic.

Changes in food shopping behavior during COVID-19 pandemic

The effect of COVID-19 on food shopping behavior in Bangladesh is shown in Table 2. A significant proportion of participants (35.04%) reported a decrease in the number of shopping trips, whereas 24.52% refrained from outdoor shopping during the pandemic compared to before the pandemic. Additionally, 28.74% of participants indicated that they purchased less overall, and 19.48% of participants bought significantly fewer items per trip compared to the number of items purchased during the pre-pandemic period. However, 28% of respondents did not change their shopping frequency, and 24.81% reported purchasing the same quantity as before the pandemic.

We performed both the bivariate and multivariate regression analyses to evaluate the relationship between food purchasing behavior and sociodemographic factors (the bivariate result is not presented, see Supplementary Table S2). Multivariate regression analyses showed a strong association between education level, income, occupation, household size, and preference for food shopping (Table 3, Fig. 1). Individuals with bachelor's or master's degrees were five times more likely to purchase food from supermarkets than those without institutional education (OR: 5.88, 95% CI: 3.46–8.30, $i < 0.001$) (Fig. 1c). Similarly, those with middle-income (between 30,000 BDT and 40,000 BDT, OR: 2.09, 95% CI: 1.19–3.68; $p = 0.01$) and high-income (above 40,000 BDT, OR: 2.64, 95% CI: 1.64–4.23; $p < 0.001$) were twice

Table 1 Socio-demographic characteristics of the participants (n = 1,350)

Variables	Categories	Frequency	Valid Percent
Gender	Female	325	24.07
	Male	1,025	75.93
Age group	25–34 years	810	60.00
	35–44 years	305	22.59
	45–54 years	160	11.85
	> 55 years	75	5.56
Education level	Bachelor’s degree/Master’s degree	785	58.15
	High School/College degree	360	26.67
	No institutional education/Primary	205	15.19
Income category	Less than 10,000 BDT	320	23.70
	10,000–20000 BDT	335	24.81
	20,000–30000 BDT	225	16.67
	30,000–40000 BDT	125	9.26
	above 40,000 BDT	345	25.56
Occupation	Formal job	415	30.74
	Informal job	415	30.74
	Self-employed/Business	415	30.74
	Unemployed	105	7.78
Household size	Below 4	455	33.70
	4–6	695	51.48
	above 6	200	14.81
Job lost	No	1,185	87.78
	Yes	165	12.22
Salary reduction	No	680	50.37
	Yes	670	49.63
Reduction Percentage	0–25%	445	66.92
	26–50%	185	27.82
	51–75%	35	5.26

Table 2 Changes in shopping frequency and purchasing behavior during the COVID-19 pandemic

Variable	Frequency (All including rarely, sometimes, very often and always)	Percent
Shopping frequency (compared to before the pandemic)		
<i>I go shopping more frequently</i>	165	12.22
<i>I go shopping as usual</i>	378	28.00
<i>I go shopping less frequently</i>	473	35.04
<i>I did not go personally for shopping</i>	331	24.52
Total decrease in shopping frequency		59.56
Purchasing behavior (compared to before the pandemic)		
<i>I purchase a lot more than before</i>	170	12.59
<i>I purchase more than before</i>	183	13.56
<i>I purchase almost the same</i>	335	24.81
<i>I purchase less than before</i>	388	28.74
<i>I purchase a lot less than before</i>	263	19.48
Total decrease in purchase quantity		48.22

Table 3 The association between food purchasing behavior and socio-demographic characteristics (n = 1,350) during the COVID-19 pandemic was obtained by conducting a multivariate analysis

Socio-Demographic Variables	Food purchasing behavior														
	Purchasing food from supermarket		Purchasing food from grocery store		Purchasing food from local market		Purchasing food from online grocery shopping sites		Ordering food from online food delivery platform						
	OR	95% CI	p-value	OR	95% CI	P-value	OR	95% CI	OR	95% CI	P-value				
Gender															
Female	Ref.	-	-	Ref.	-	-	Ref.	-	Ref.	-	-				
Male	1.27	0.91, 1.77	0.16	2.82***	1.98, 4.03	<0.001	1.80**	1.21, 2.69	0.004	0.84	0.60, 1.18	0.32	1.03	0.72, 1.45	0.88
Age															
> 55 years	Ref.	-	-	Ref.	-	-	Ref.	-	-	-	-	-	Ref.	-	-
45-54 years	0.75	0.38, 1.48	0.41	0.93	0.43, 2.00	0.86	1.20	0.50, 2.84	0.68	1.20	0.62, 2.33	0.58	0.92	0.46, 1.81	0.80
35-44 years	0.53	0.27, 1.03	0.06	1.62	0.76, 3.44	0.20	2.47*	1.04, 5.84	0.04	0.76	0.24, 1.68	0.41	0.18***	0.09, 0.37	<0.001
25-34 years	1.47	0.77, 2.80	0.24	2.62*	1.20, 5.75	0.02	1.78	0.76, 4.16	0.18	1.66	0.13, 1.98	0.11	0.63	0.32, 1.22	0.17
Education															
No inst. education	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
High School/Collage	1.88*	1.10, 3.22	0.02	0.57*	0.35, 0.92	0.02	1.09	0.61, 1.95	0.76	1.50	0.87, 2.56	0.14	3.71***	1.96, 5.03	<0.001
Bachelor/Master's	5.88***	3.46, 8.30	<0.001	3.88***	2.16, 6.97	<0.001	2.10*	1.09, 4.01	0.02	4.03***	2.38, 6.83	<0.001	5.19***	3.21, 7.17	<0.001
Income															
Below 10000	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
10000-20000	0.94	0.62, 1.42	0.76	1.58*	1.01, 2.47	0.04	0.44**	0.26, 0.76	0.003	0.69	0.44, 1.07	0.10	0.63	0.40, 1.00	0.05
20000-30000	0.88	0.55, 1.40	0.59	0.50*	0.29, 0.86	0.01	0.19***	0.10, 0.36	<0.001	1.06	0.67, 1.67	0.81	1.25	0.78, 2.00	0.34
30000-40000	2.09*	1.19, 3.68	0.01	3.00*	1.31, 6.91	0.01	2.36	0.81, 6.93	0.12	2.09**	1.21, 3.61	0.008	1.50	0.86, 2.63	0.16
above 40000	2.64***	1.64, 4.23	<0.001	1.27	0.68, 2.39	0.45	0.56	0.28, 1.11	0.10	1.73*	1.09, 2.75	0.02	2.36***	1.46, 3.83	<0.001
Occupation															
Unemployed	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
Formal job	0.54*	0.31, 0.95	0.03	1.36	0.72, 2.59	0.33	0.38	0.14, 1.04	0.06	2.34**	0.34, 4.08	0.003	1.20	0.68, 2.13	0.53
Informal job	0.34***	0.20, 0.59	<0.001	0.99	0.54, 1.81	0.97	0.31*	0.11, 0.84	0.02	0.68	0.39, 1.19	0.18	0.76	0.43, 1.34	0.34
Self-employed/Business	0.33***	0.18, 0.57	<0.001	2.95**	1.53, 5.70	<0.001	0.62	0.22, 1.74	0.36	1.30	0.74, 2.28	0.35	1.17	0.66, 2.10	0.58
Household size															
< 4	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
4-6	1.42*	1.06, 1.91	0.02	3.01***	2.12, 4.28	<0.001	5.03***	3.32, 7.64	<0.001	0.87	0.65, 1.17	0.36	0.93	0.68, 1.25	0.62
Above 6	0.76	0.05, 1.14	0.19	3.20***	1.74, 5.91	<0.001	1.43	0.87, 2.36	0.16	1.22	0.82, 1.82	0.32	0.73	0.48, 1.09	0.13

*** p < 0.001, ** p < 0.01, * p < 0.05

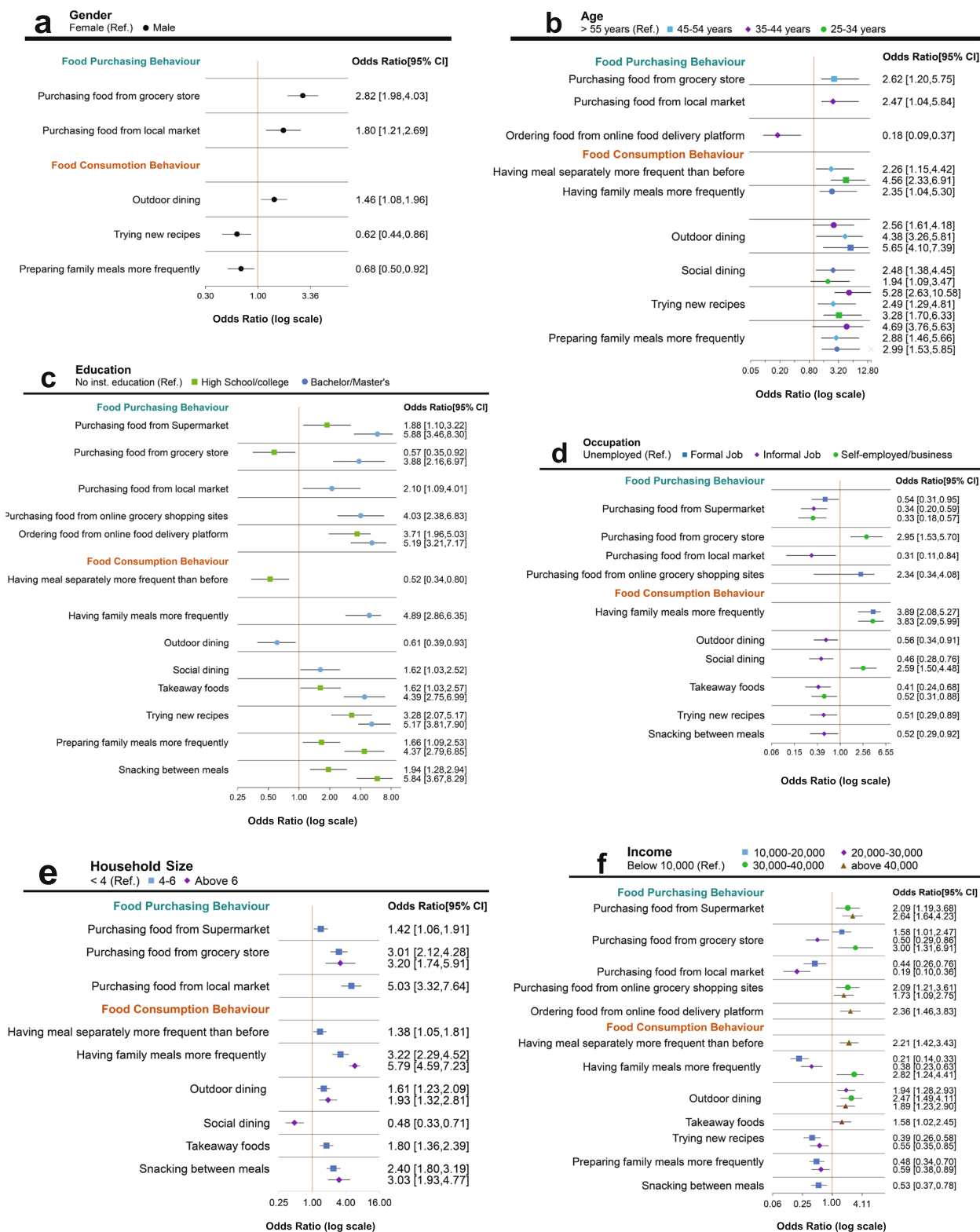


Fig. 1 Forest plot of multivariate analysis for sociodemographic variables associated with changes in food purchasing and consumption behaviors: **a** Gender, **b** Age, **c** Education, **d** Occupation, **e** Household size, **f** Income; reporting OR: odds ratio and CI: confidence interval, where * $p < 0.05$

as inclined to visit supermarkets as those earning below 10,000 BDT (Fig. 1f). However, individuals with informal jobs and self-employment/businesses were almost 70% less likely to purchase from supermarkets than unemployed individuals (OR: 0.34, 95% CI: 0.20–0.59; $i < 0.001$, and OR: 0.33, 95% CI: 0.18–0.57; $i < 0.001$); people with formal jobs were almost 50% less likely (OR=0.54, 95% CI=0.31–0.95, $p=0.03$) to purchase from supermarkets than unemployed individuals (Fig. 1d). Household size also played a role; families with 4–6 members were 1.42 times more likely to shop in supermarkets than those with fewer than four members (OR: 1.42, 95% CI: 1.06–1.91, $p=0.02$) (Fig. 1e).

Males and young adults (25–34 years) were over 2.5 times more likely to purchase from grocery stores than females (OR: 2.82, 95% CI: 1.98–4.03, $p < 0.001$) (Fig. 1a) and elderly adults aged >55 years (OR: 2.62, 95% CI: 1.20–5.75, $p=0.02$) (Fig. 1b). In contrast, individuals with high school or college education were 43% less inclined to visit grocery stores (OR: 0.57, 95% CI: 0.35–0.92, $p=0.02$), while people with higher education (bachelor's or master's degrees) had a nearly four-fold higher tendency than uneducated individuals to visit grocery stores (OR: 3.88, 95% CI: 2.16–6.97, $p < 0.001$) (Fig. 1c). Compared to reference groups, individuals earning between 10,000 and 20,000 BDT, between 30,000 and 40,000 BDT, and those who were self-employed or ran a business were 1.58 times (OR: 1.58, 95% CI: 1.01–2.47, $p=0.04$), three times (OR: 3.00, 95% CI: 1.31–6.91, $p=0.01$), and close to three times (OR: 2.95, 95% CI: 1.53–5.70, $p < 0.001$) more likely to purchase from a grocery store (Fig. 1f, d). Individuals from larger households (>4 members) shopped at grocery stores more frequently (by three times) than individuals from households with <4 members (4–6 members, OR: 3.01, 95% CI: 2.12–4.28, $p < 0.001$; >6 members, OR: 3.20, 95% CI: 1.74–5.91, $p < 0.001$) (Fig. 1e).

Regarding purchasing from the local market, males had 1.8 times higher patronage than females (OR: 1.80, 95% CI: 1.21–2.69, $p=0.004$) (Fig. 1a). Compared to the elderly (>55 years), adults aged 35–44 years were over twice as likely to visit their local market (OR: 2.47, 95% CI: 1.04–5.84, $p=0.04$) (Fig. 1b). Similarly, university-educated individuals were also twice as likely as those without education to visit their local market (OR: 2.10, 95% CI: 1.09–4.01, $p=0.02$) (Fig. 1c). However, those earning between 10,000–20,000 BDT and 20,000–30,000 BDT showed the least inclination toward visiting the local market, with 0.44 times (95% CI: 0.26–0.76, $p=0.003$) and 0.19 times (95% CI: 0.10–0.36, $p < 0.001$) lower odds than the reference group, respectively (Fig. 1f). Informal job holders were also 70% less likely to visit the local market than unemployed individuals (OR: 0.31, 95% CI: 0.11–0.84, $p=0.02$) (Fig. 1d). Individuals from households with

4–6 members were five times more likely than those from smaller households (<4 members) to visit local markets (OR: 5.03, 95% CI: 3.32–7.64, $p < 0.001$) (Fig. 1e).

The results indicated a strong correlation between various demographic characteristics (age, education, income, and occupation) and online ordering behavior on grocery shopping sites and food delivery platforms (Table 3). The university-educated individuals showed over four times higher odds of online grocery ordering than those without formal education (OR: 4.03, 95% CI: 2.38–6.83, $p < 0.001$) (Fig. 1c). Similarly, individuals who were earning 30,000–40,000 BDT and had formal jobs also exhibited greater online grocery ordering, with 2.09 times (95% CI: 1.21–3.61, $p=0.008$) and 2.34 times (95% CI: 0.34–4.08, $p=0.003$) higher odds than those earning under 10,000 BDT and unemployed individuals, respectively (Fig. 1f, d). However, regarding online food delivery, people aged 35–44 years were less likely to order than elderly people aged >55 years (OR: 0.18, 95% CI: 0.09–0.37, $p < 0.001$) (Fig. 1b). In contrast, individuals with high school/college education (OR=3.71, 95% CI=1.96–5.03, $p < 0.001$), university degree (OR=5.19, 95% CI=3.21–7.17, $p < 0.001$), and earning above 40,000 BDT (OR=2.36, 95% CI=1.46–3.83, $p < 0.001$) had substantially higher odds of ordering food online than those without formal education and the lowest income (below 10,000 BDT) (Fig. 1c, f).

Changes in food consumption behavior during COVID-19 pandemic

We examined the association between sociodemographic characteristics and food consumption patterns among respondents using both the bivariate and multivariate regression analyses (see supplementary Table S3 for the bivariate analysis result).

First, we found that age, education, income level, and household size significantly influenced meal habits (Table 4, Fig. 1). Specifically, young adults (25–34 years) were over 4.5 times more likely than elders (>55 years) to have separate meals more frequently (OR=4.56, 95% CI=2.33–6.91, $p < 0.001$) (Fig. 1b), as were individuals from the high-income group (>40,000 BDT, OR=2.21, 95%CI=1.42–3.43, $p < 0.001$) compared to those from the lowest income group (<10,000 BDT) (Fig. 1f). However, high school/college-educated respondents were 48% less likely than those without formal education to frequently have separate meals (OR=0.52, 95% CI=0.34–0.80, $p=0.003$) (Fig. 1c).

Second, significant associations were also found between family meal frequencies and all sociodemographic characteristics except gender (Table 4). Adults aged 45–54 years (OR=2.35, 95% CI=1.04–5.30, $p=0.04$) and university-educated individuals (OR=4.89,

Table 4 The association between food consumption behavior and socio-demographic characteristics (n = 1,350) during the COVID-19 pandemic was obtained by conducting a multivariate analysis

Socio Demographic Variables	Food consumption behavior										
	Having meal separately more frequent than before		Having family meals more frequently		Outdoor dining		Social dining				
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value		
Gender											
Female	Ref	-	-	Ref	-	-	Ref	-	-	-	
Male	0.85	0.62, 1.15	0.29	1.02	0.69, 1.49	0.93	1.46*	1.08, 1.96	1.10	0.81, 1.49	0.53
Age											
> 55 years	Ref	-	-	Ref	-	-	Ref	-	Ref	-	-
45–54 years	1.53	0.76, 3.07	0.23	2.35*	1.04, 5.30	0.04	2.56***	1.61, 4.18	0.70	0.39, 1.26	0.24
35–44 years	2.26*	1.15, 4.42	0.02	1.41	0.66, 2.99	0.37	4.38***	3.26, 5.81	2.48**	1.38, 4.45	0.002
25–34 years	4.56***	2.33, 6.91	<0.001	1.84	0.86, 3.96	0.11	5.65***	4.10, 7.39	1.94*	1.09, 3.47	0.02
Education											
No inst. education	Ref	-	-	Ref	-	-	Ref	-	Ref	-	-
High School/ Collage	0.52**	0.34, 0.80	0.003	1.23	0.77, 1.96	0.39	0.84	0.56, 1.26	0.85	0.56, 1.28	0.44
Bachelor/ Master's	1.34	0.87, 2.06	0.18	4.89***	2.86, 6.35	<0.001	0.61*	0.39, 0.93	1.62*	1.03, 2.52	0.03
Income											
Below 10,000	Ref	-	-	Ref	-	-	Ref	-	Ref	-	-
10,000–20,000	0.89	0.61, 1.29	0.55	0.21***	0.14, 0.33	<0.001	1.07	0.75, 1.53	0.70	0.48, 1.02	0.06
20,000–30,000	1.54	1.00, 2.36	0.05	0.38***	0.23, 0.63	<0.001	1.94**	1.28, 2.93	0.97	0.62, 1.50	0.89
30,000–40,000	1.29	0.76, 2.20	0.34	2.82*	1.24, 4.41	0.01	2.47***	1.49, 4.11	0.81	0.48, 1.35	0.42
above 40,000	2.21***	1.42, 3.43	<0.001	4.09	2.04, 6.22	0.51	1.89**	1.23, 2.90	0.94	0.60, 1.46	0.78
Occupation											
Unemployed	Ref	-	-	Ref	-	-	Ref	-	Ref	-	-
Formal job	0.92	0.55, 1.55	0.77	3.89***	2.08, 5.27	<0.001	1.05	0.64, 1.75	0.92	0.55, 1.56	0.77
Informal job	1.12	0.68, 1.85	0.66	1.08	0.61, 1.91	0.80	0.56*	0.34, 0.91	0.46**	0.28, 0.76	0.002
Self-employed/Business	0.71	0.43, 1.19	0.20	3.83***	2.09, 5.99	<0.001	0.95	0.58, 1.56	2.59**	1.50, 4.48	0.001
Household size											
<4	Ref	-	-	Ref	-	-	Ref	-	Ref	-	-
4–6	1.38*	1.05, 1.81	0.02	3.22***	2.29, 4.52	<0.001	1.61***	1.23, 2.09	1.06	0.80, 1.39	0.69
Above 6	1.37	0.92, 2.02	0.12	5.79***	4.59, 7.23	<0.001	1.93**	1.32, 2.81	0.48***	0.33, 0.71	<0.001

Table 4 (continued)

Socio Demographic Variables	Food consumption behavior															
	Having meal separately more frequent than before				Having family meals more frequently				Outdoor dining				Social dining			
	OR	95% CI	p-value		OR	95% CI	p-value		OR	95% CI	p-value		OR	95% CI	p-value	
Socio Demographic Variables																
Gender																
Female	Ref			Ref				Ref				Ref				
Male	0.944	0.69, 1.30	0.73	0.62**	0.44, 0.86	0.005	0.68*	0.68*	0.50, 0.92	0.01	0.01	1.21	0.87, 1.68	0.26		
Age																
> 55 years	Ref			Ref				Ref				Ref				
45–54 years	0.72	0.38, 1.36	0.32	5.28***	2.63, 10.58	< 0.001	4.69***	4.69***	3.76, 5.63	< 0.001	< 0.001	1.47	0.78, 2.76	0.23		
35–44 years	0.86	0.47, 1.57	0.63	2.49**	1.29, 4.81	0.007	2.88**	2.88**	1.46, 5.66	0.002	0.002	0.90	0.49, 1.62	0.72		
25–34 years	0.95	0.52, 1.73	0.88	3.28***	1.70, 6.33	< 0.001	2.99**	2.99**	1.53, 5.85	0.001	0.001	1.44	0.78, 2.64	0.24		
Education																
No inst. education	Ref			Ref				Ref				Ref				
High School/ Collage	1.62*	1.03, 2.57	0.04	3.28***	2.07, 5.17	< 0.001	1.66*	1.66*	1.09, 2.53	0.01	0.01	1.94**	1.28, 2.94	0.002		
Bachelor/ Master's	4.39***	2.75, 6.99	< 0.001	5.17***	3.81, 7.90	< 0.001	4.37***	4.37***	2.79, 6.85	< 0.001	< 0.001	5.84***	3.67, 8.29	< 0.001		
Income																
Below 10,000	Ref			Ref				Ref				Ref				
10,000–20,000	0.79	0.54, 1.17	0.24	0.39***	0.26, 0.58	< 0.001	0.48***	0.48***	0.34, 0.70	< 0.001	< 0.001	0.53**	0.37, 0.78	0.001		
20,000–30,000	0.89	0.58, 1.37	0.61	0.55**	0.35, 0.85	0.008	0.59*	0.59*	0.38, 0.89	0.01	0.01	0.75	0.46, 1.21	0.23		
30,000–40,000	0.94	0.56, 1.59	0.82	0.86	0.51, 1.48	0.60	0.64	0.64	0.38, 1.07	0.09	0.09	0.92	0.51, 1.65	0.78		
above 40,000	1.58*	1.02, 2.45	0.04	1.17	0.72, 1.87	0.52	1.21	1.21	0.77, 1.89	0.40	0.40	0.76	0.47, 1.24	0.27		
Occupation																
Unemployed	Ref			Ref				Ref				Ref				
Formal job	0.92	0.54, 1.57	0.77	0.81	0.46, 1.43	0.47	0.67	0.67	0.40, 1.14	0.14	0.14	0.94	0.52, 1.72	0.85		
Informal job	0.41**	0.24, 0.68	0.001	0.51*	0.29, 0.89	0.02	1.01	1.01	0.61, 1.68	0.97	0.97	0.52*	0.29, 0.92	0.02		
Self-employed/Business	0.52*	0.31, 0.88	0.01	1.26	0.71, 2.21	0.43	0.93	0.93	0.55, 1.56	0.78	0.78	1.02	0.56, 1.84	0.95		

Table 4 (continued)

Socio Demographic Variables	Food consumption behavior								
	Having meal separately more frequent than before		Having family meals more frequently		Outdoor dining		Social dining		
	OR	95% CI	p-value	OR	95% CI	P-value	OR	95% CI	P-value
Household size									
< 4	Ref			Ref			Ref		
4–6	1.80***	1.36, 2.39	< 0.001	0.88	0.66, 1.18	0.41	0.34	0.58, 0.99	1.80, 3.19
Above 6	1.28	0.87, 1.88	0.22	0.72	0.48, 1.07	0.10	0.21	0.43, 0.92	1.93, 4.77

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

95% CI=2.86–6.35, $p < 0.001$) reported the highest family meal regularity relative to the reference groups (Fig. 1b, c). Individuals earning 10,000–20,000 BDT showed a lower frequency of having meals with their families (OR=0.21, 95% CI=0.14–0.33, $p < 0.001$) than those from the lowest income group (<10,000 BDT) (Fig. 1f). Relative to unemployed individuals, formal job holders (OR=3.89, 95% CI=2.08–5.27, $p < 0.001$) and self-employed/business owners (OR=3.83, 95% CI=2.09–5.99, $p < 0.001$) had nearly four times higher family meal frequency (Fig. 1d). Individuals from large households with 4–6 members (OR=3.22, 95% CI=2.29–4.52, $p < 0.001$) and above six members (OR=5.79, 95% CI=4.59–7.23, $p < 0.001$) reported a higher family meal frequency than those from smaller households (<4 members) (Fig. 1e).

Third, males, millennials, mid and high-income groups, and larger households showed a greater tendency to dine out. Males dined out 1.46 times more frequently than females (OR=1.46, 95% CI=1.08–1.96, $p = 0.01$) (Fig. 1a). Adults aged 25–34 years and 35–44 years exhibited the highest frequency; they dined out five times (OR=5.65, 95% CI=4.10–7.39, $p < 0.001$) and four times (OR=4.38, 95% CI=3.26–5.81, $p < 0.001$) more frequently than elders (>55 years), respectively (Fig. 1b). The middle-income group (30,000–40,000 BDT) also showed 2.47 times higher odds (OR=2.47, 95% CI=1.49–4.11, $p < 0.001$) of dining out than the lowest-income group (<10,000 BDT) (Fig. 1f). Additionally, individuals from larger households with 4–6 members (OR=1.61, 95% CI=1.23–2.09, $p < 0.001$) and above six members (OR=1.93, 95% CI=1.32–2.81, $p < 0.001$) had a higher frequency of dining out than those from smaller households (<4 members) (Fig. 1e). Conversely, individuals with a university education (OR=0.61, 95% CI=0.39–0.93, $p = 0.02$) and informal jobs (OR=0.56, 95% CI=0.34–0.91, $p = 0.02$) showed lower inclination than uneducated and unemployed individuals to dine out (Fig. 1c, d).

Fourth, respondents aged 35–44 years were over twice as likely to participate in social dining compared to older adults >55 years (OR=2.48, 95% CI=1.38–4.45, $p = 0.002$) (Fig. 1b). Similarly, university-educated (OR=1.62, 95% CI=1.03–2.52, $p = 0.03$) and self-employed/business owners (OR=2.59, 95% CI=1.50–4.48, $p = 0.001$) showed higher social dining frequency than their reference groups (Fig. 1c, d). However, individuals from larger households (>6 members) were the least prone to social dining, demonstrating 48% lower odds (OR=0.48, 95% CI=0.33–0.71, $p < 0.001$) than individuals from smaller households (<4 members) (Fig. 1e).

Fifth, respondents with university education (OR=4.39, 95% CI=2.75–6.99, $p < 0.001$) and high

income >40,000 BDT (OR=1.58, 95% CI=1.02–2.45, $p = 0.04$) had a higher tendency to purchase ready-to-eat takeaway meals compared to their respective reference groups (Fig. 1c, f). Individuals from mid-sized households with 4–6 members (OR=1.80, 95% CI=1.36–2.39, $p < 0.001$) also showed a higher frequency of ordering takeaways (Fig. 1e). In contrast, informal job holders (OR=0.41, 95% CI=0.24–0.68, $p = 0.001$) and self-employed/business owners (OR=0.52, 95% CI=0.31–0.88, $p = 0.01$) showed lower tendency to order takeaways than unemployed individuals (Fig. 1d).

Sixth, we found significant associations between demographic characteristics (gender, age, education level, income, and occupation) and culinary practices during the lockdown period. Specifically, males were 38% less likely than females to try new recipes (OR=0.62, 95% CI=0.44–0.86, $p = 0.005$) (Fig. 1a). Middle-aged adults (45–54 years) were found to explore the most; they tried new recipes five times more frequently than seniors above 55 years (OR=5.28, 95% CI=2.63–10.58, $p < 0.001$) (Fig. 1b). Educated individuals tried more new recipes than those with no education. Specifically, individuals with a high school/college education (OR=3.28, 95% CI=2.07–5.17, $p < 0.001$) and university education (OR=5.17, 95% CI=3.81–7.90, $p < 0.001$) had a higher likelihood (Fig. 1c). However, those earning 10,000–20,000 BDT (OR=0.39, 95% CI=0.26–0.58, $p < 0.001$) and informal workers (OR=0.51, 95% CI=0.29–0.89, $p = 0.02$) had a lower interest in trying new recipes compared to their respective reference groups (Fig. 1f, d).

We found similar correlations between gender, age, education level, income level, and the regularity of family meal preparation. Males were 32% less likely than females to prepare family meals regularly (OR=0.68, 95% CI=0.50–0.92, $p = 0.01$) (Fig. 1a). Younger adults were more likely than older adults (>55 years) to regularly prepare family meals, with odds ratios of 2.99 for ages 25–34 years (95% CI=1.53–5.85, $p = 0.001$), 2.88 for ages 35–44 years (95% CI=1.46–5.66, $p = 0.002$), and 4.69 for ages 45–54 years (95% CI=3.76–5.63, $p < 0.001$) (Fig. 1b). Similarly, higher education levels were associated with a greater likelihood of regular family meal preparation, with higher odds of 1.66 (95% CI=1.09–2.53, $p = 0.01$) for high school/college education and 4.37 (95% CI=2.79–6.85, $p < 0.001$) for university education compared to no education (Fig. 1c). In contrast, individuals in the low-to-middle income groups (10,000–20,000 BDT and 20,000–30,000 BDT) were less likely to prepare regular family meals compared to those in the lowest income group (<10,000 BDT), with odds ratios of 0.48 (95% CI=0.34–0.70, $p < 0.001$) and 0.59 (95% CI=0.38–0.89, $p = 0.01$), respectively (Fig. 1f).

Finally, respondents with high school/college degrees (OR=1.94, 95% CI=1.28–2.94, $p=0.002$) and university degrees (OR=5.84, 95% CI=3.67–8.29, $p<0.001$) were more likely to snack between meals during the lockdown compared to those without formal education (Fig. 1c). Additionally, individuals from large households with 4–6 members (OR=2.40, 95% CI=1.80–3.19, $p<0.001$) and above six members (OR=3.03, 95%CI=1.93–4.77, $p<0.001$) were more prone to snacking between meals (Fig. 1e). However, individuals earning 10,000–20,000 BDT (OR=0.53, 95% CI=0.37–0.78, $p=0.001$) and those with informal jobs (OR=0.52, 95%CI=0.29–0.92, $p=0.02$) reported snacking the least (Fig. 1f, d).

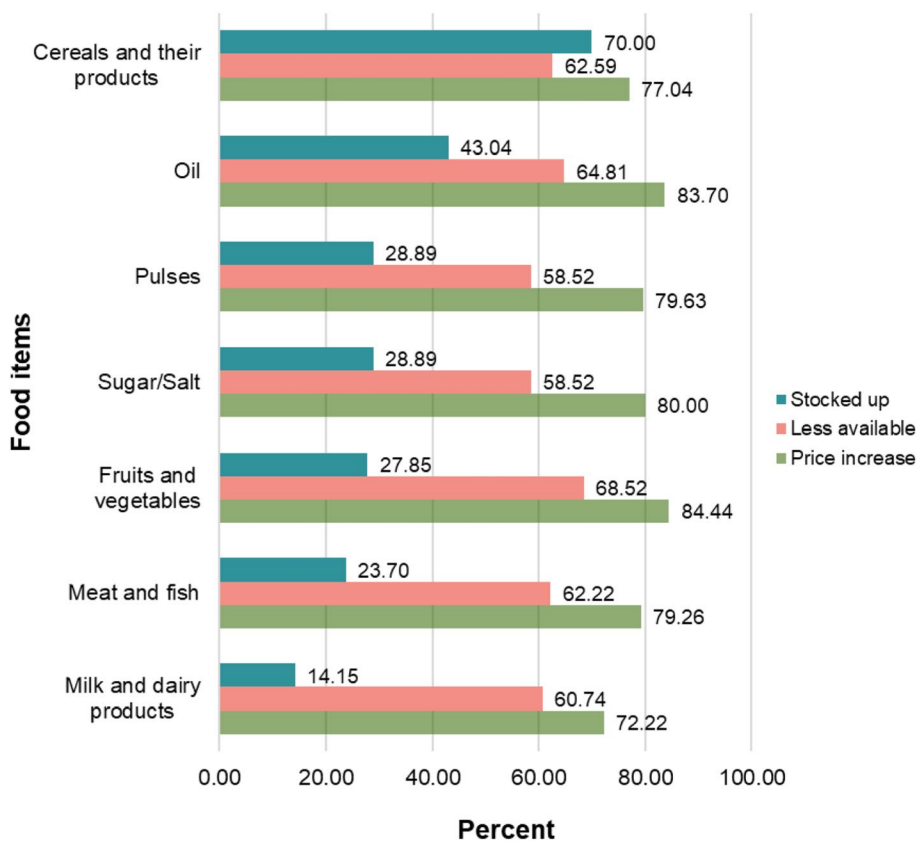
Increase in food prices, lesser availability, and stockpiling

Many respondents (22.30%) stockpiled food items due to perceived scarcity and rising prices during the lockdown (Fig. 2). Among stockpiled food items, cereals and their derivatives (70%), oil (43.04%), and pulses (28.89%) were most frequently amassed. Participants reported price surges in fruits and vegetables (84.44%), oil (83.70%),

sugar and salt (80%), pulses (79.63) and meat and fish (79.26%) along with a decrease in the availability of similar food products.

Discussion

This was the first study on the overall food purchase and consumption behavior of Bangladeshi consumers during the COVID-19 lockdown. Our findings provided novel insights into how sociodemographic factors affect individual and household food-related behaviors associated with food shopping, utilization, and eating. Our findings were similar to those reported in studies on changes in dietary habits and shopping patterns during the lockdown period; thus, our study contributed to existing knowledge while also providing new information from the perspective of a developing country. Initially, similar to the pattern found in the United States, Russia, North Macedonia, Denmark, Germany, Slovenia, and the Netherlands, Bangladeshi consumers reduced their shopping frequency during the COVID-19 lockdown [22, 32, 37, 38, 55, 56]. In total, 59.56% of respondents (including



	Frequency	Percent
• Stocked up on food and beverages	No 1045	77.70
	Yes 300	22.30

Fig. 2 Different categories of food items that were stocked up, less available, and subject to an increase in price during the COVID-19 pandemic

those who reduced shopping quantity to some extent and those who significantly reduced it) reported a decrease in their purchase quantity by 48.22%, which was probably because of nationwide restrictions on supermarket operations, government-mandated stay-at-home orders, an increase in the risk of contracting the disease, and an increase in cases of infection and transmission, all of which disrupted the typical shopping patterns of consumers. The findings of this study suggested that these changes in shopping patterns were probably influenced by sociodemographic factors.

Second, individuals holding bachelor's or master's degrees had a greater inclination to purchase from supermarkets, grocery stores, and local markets compared to those with other educational qualifications. Similarly, age, income, occupation, and household size affected shopping behavior; specifically, male participants, self-employed/business owners, and individuals from large households bought more from grocery stores. In contrast, individuals earning above 30,000 BDT purchased most frequently from the supermarket, whereas participants in the middle-income bracket (earning between 10,000 and 30,000 BDT) purchased least frequently from local markets compared to participants from the low-income group (below 10,000 BDT). These findings highlighted the potential adverse effects of job loss and wage reduction on vulnerable groups, considering that 12.22% of respondents reported job loss and 49.63% reported a salary reduction of up to 75% during the pandemic. Economic vulnerability probably affected shopping frequency and quantity due to a reduction in purchasing power, considering that 28.74% of participants reported that they bought less, and 19.48% bought significantly less on each trip compared to the volume they purchased before the pandemic. A study reported a 94% reduction in spending on protein-rich food items among low-income groups [57]. Additionally, 75% of individuals reported insufficient food availability, and 91% expressed their inability to afford food [30]. Urban and rural households experienced approximately 30% and 20% decrease, respectively, in food expenditure [58]. The transition from wage reduction to zero income might cause vulnerable groups to suffer extreme economic hardship, subsequently leading to food insecurity.

Third, we found that online grocery shopping and food ordering increased among educated individuals (holding bachelor's or master's degrees) in Bangladesh, which was similar to the pattern found in Italy [36], the Netherlands [59], Russia [32], China [60], the United States [38, 56, 61], the United Kingdom [62], Germany [63], and Taiwan [64]. This increase in online food shopping and ordering occurred due to stay-at-home orders, social distancing mandates and apprehensions about the risk of infection

during in-person shopping trips [65, 66]. A study conducted in Bangladesh by Akter & Disha reported that 35% of respondents ordered food online during the lockdown; 23% of respondents ordered food online at least once a week [67]. However, we found that individuals aged between 35 and 44 years were least likely to utilize online grocery sites and food delivery platforms. Those with informal jobs were also less likely to order groceries and food online compared to individuals with formal employment.

Fourth, our findings suggested an increase in family meals, outdoor dining, and social dining. Changes in these behaviors were closely associated with age and education. Younger and middle-aged adults (between 25 and 44 years) had more meals away from their families during the lockdown, dined out more frequently, and attended social dining events, whereas people aged between 45 and 54 years had meals with their families more frequently. Respondents with a university degree reported significantly higher frequency of family meals and dined out less frequently than those without formal education. Also, gender, age, education, and income influenced cooking practices, as an increase in exploring new recipes and preparing family meals was recorded among respondents with higher education (bachelor/master's) and those aged between 45 and 54 years. This finding indicated that middle-aged and educated individuals were more inclined to adopt a healthier diet and invest more time in cooking, having family meals, and engaging in communal eating. This positive shift occurred probably because of the availability of spare time, nutritional concerns, and the emergence of new sources of entertainment [37, 68, 69]. This transition might foster sustainable dietary patterns [70]. We also found that income level, occupation, and household size were strongly associated with family meals. This relationship occurred because people with a higher income (above 30,000 BDT) had more frequent family meals and dined out more often, while individuals in low-to-middle income groups (10,000–30,000 BDT) had family meals least frequently, least often tried new recipes, and prepared family meals least frequently. This finding further highlights the effect of a decrease in income or job loss on these vulnerable groups and the ensuing repercussions on food affordability.

Fifth, an increase in snacking frequency was recorded among educated individuals (high school/college and university degree holders) and those from larger households (over four members). Increased unhealthy sweet and salty snacking during the COVID-19 lockdown was also reported in Italian [71], Spanish [72], New Zealander [73], French [74], Polish [75], Lithuanian [76], Greek [77], British [78], and Danish populations [79].

An increase in unhealthy snacking occurred probably because of boredom (which increased the consumption of sugar-dense and salt-dense foods), stress (leading to overeating), and anxiety [80]. This, in turn, resulted in weight gain and obesity [81].

Sixth, we found an increase in stockpiling of daily commodities driven by panic buying, as respondents reported price hikes and a decrease in the availability of goods during the lockdown period. A study carried out during the initial COVID-19 wave in Bangladesh noted a decline in vegetable prices [82], while fish and poultry prices saw an upturn due to supply shortages [57]. Shortages of fresh fish, fruits, and vegetables were observed in Dhaka, the capital city of Bangladesh [83]. This food instability probably occurred because of stay-at-home measures, as well as the unplanned and sudden enforcement of lockdown measures by the government and the failure to implement strategic action plans [84].

Seventh, we asked participants to rate the factors that influenced their shift toward healthier eating patterns on a five-point Likert scale ranging from “not at all influenced” to “extremely influenced” (see supplementary Table S3). The results indicated that self-awareness, health-conscious articles, and word-of-mouth recommendations were extremely influential. Also, social media and social media-based awareness campaigns were extremely influential.

Finally, our study had a large sample size and included different types of sociodemographic characteristics; thus, the findings are reliable and accurate. The survey was designed to comprehensively capture information on food purchasing and consumption patterns during the lockdown, which was conducted at a critical time during the second wave of the pandemic. Our findings shed light on critical sociodemographic characteristics that might be considered while making national policies, as the study’s findings have profound implications for public health professionals, food policymakers, and government-affiliated organizations. They enable tailored interventions to tackle challenges like reduced shopping frequency and increased reliance on online grocery shopping by understanding the influence of sociodemographic factors on these behaviors. Public health professionals can design targeted health education programs promoting healthier eating habits among vulnerable populations. Food policymakers can craft policies ensuring equitable access to nutritious foods, particularly for those experiencing job loss or income reduction. Government organizations can integrate these insights into crisis response strategies, implementing measures to alleviate food insecurity while encouraging sustainable consumption practices.

However, our study had certain limitations. The use of a self-reporting structured questionnaire might introduce response bias, which could result in a discrepancy between reported behaviors and actual practices. To combat this bias, we conducted a pre-test among 50 participants to refine the questionnaire and provided extensive training to ensure neutrality among surveyors. We prioritized participant anonymity, confidentiality, and obtained informed consent while implementing quality control measures. Although snowball sampling has inherent limitations and may not ensure generalizability, we acknowledge potential biases like validity limitations. However, by utilizing strategies such as a 5-point Likert scale, we aimed to address these vulnerabilities. This approach facilitated robust statistical analysis, revealing intriguing correlations in food-related behaviors during the pandemic [52].

Conclusions

We comprehensively evaluated changes in food shopping and consumption behavior among Bangladeshi individuals during the COVID-19 lockdown period to assess the influence of sociodemographic factors on these behaviors. We conducted a study involving in-person and telephone interviews with 1,350 Bangladeshi adults between July and September 2021. Our findings provided novel insights into the effect of the pandemic on food-related behaviors, indicating association of food purchasing and eating behaviors. Our results showed significant associations between these behaviors and sociodemographic characteristics, highlighting the role of education as a key determinant. Among the factors that influenced these behavioral changes, the spreading of information via word of mouth and health-conscious articles was extremely effective. This finding indicated the importance of social networks and information dissemination in shaping the food intake patterns of individuals. However, we also found that many participants were financially vulnerable; specifically, half of the participants reported a decrease in their income, and 12.22% of participants experienced job loss, which influenced the food consumption behavior of low-income and middle-income groups. These findings raise concerns about food insecurity among low-income and middle-income groups. However, Investigating the long-term impact of COVID-19 on global food supply chains, including disruptions in production, distribution, and access to food, is crucial for ensuring food security in the future.

Abbreviations

COVID-19	Coronavirus disease 2019
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
OR	Odds ratio
CI	Confidence interval
USD	United States dollar
BDT	Bangladeshi taka

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-19982-w>.

Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

Authors' contributions IA conceptualized, designed the online survey, coordinated data collection and analyzed the data, wrote the draft manuscript, and edited the manuscript. JHS analyzed the data, interpreted data, and edited the manuscript. TS coordinated survey design, data collection, and analysis. MMR edited and revised the manuscript. GMRI supervised the research and edited and reviewed the final manuscript. All authors read, provided input, and agreed to the manuscript before submission.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study adhered to the guidelines of the Declaration of Helsinki, and all procedures undertaken in this research received approval from the Institutional Review Board of Rajshahi University, Bangladesh (Approval Number: 72(23)/320/IAMEBBC/IBS). All participants were informed about the objectives of the study and the maintenance of the privacy of personal information. The written informed consent was obtained from all the participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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