Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.
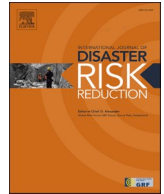
Food availability and shopping channels during the disasters: Has the COVID-19 pandemic changed peoples' online food purchasing behavior?

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A R T I C L E   I N F O

A B S T R A C T

COVID-19 caused online buying channels to flourish across the globe. However, the extent to which online channels in Pakistan assisted peoples in coping with the pandemic remains unknown. This study aims to examine peoples behavior and perceptions regarding online food purchasing and its impact on different aspects of food security. The data were collected through online surveys of 1067 respondents in Punjab and Sindh provinces during the COVID-19 pandemic. We find that peoples access to food was adversely affected by the pandemic. However, people are increasingly purchasing food online, which has improved their accessibility to food. According to the findings, 62.51% of respondents reported to have changed their perception and behavior regarding online food purchasing. In addition, almost 46.40% of peoples reported that online shopping increased their access to food during the pandemic. Using logit regression, economic analysis shows that education, monthly income, and access to basic necessities such as clean drinking water, better sanitation, and better employment are positively related to online buying behavior. For future disaster situations in Pakistan to mitigate the adverse effects on food security, strengthening and promoting the use of online purchasing channels could be an important policy instrument.

1. Introduction

COVID-19 pandemic has affected the entire food system, thereby presenting an unexpected challenge with profound social and economic costs, including compromising food and nutrition security [1]. The containment measures of COVID-19 disaster across countries have health, economic and environmental consequences. In this ongoing pandemic, a variety of vulnerabilities, such as the health system's capacity to respond, overcrowding, informality, and social work practices, as well as the transport system, have been exposed. In South Asia, disasters of this kind are not uncommon. In Pakistan, for example, Dengue has caused the most epidemics in the

last two decades. A disease outbreak, however, is unlike other disasters, such as earthquakes, hurricanes, and floods, which last for minutes, days, weeks. The COVID-19 pandemic revealed that countries and cities throughout the world have not been putting much effort into overcoming the limitations of a hazard-by-hazard, siloed, fragmented approach to risk management. In a world that is increasingly connected, globalized, and populous, the very nature and scale of risks have changed to the point that they overwhelm traditional disaster risk management institutions and approaches [2]. Short, medium, and long-term disaster risk management must be based on a systemic approach. Diversifying the food distribution channels in disaster situations such as the COVID-19 pandemic can be an effective policy to safeguard food security for people [3] .

Reduction in income and decline in market activities due to the pandemic have adverse impact on food consumption which is a primary causes of increasing food insecurity [4,5]. The COVID-19 has also exposed the vulnerabilities linking livelihoods and food distribution. Vendors worldwide have reported being unable to sell food because markets closed or hours were shortened, which resulted in food losses. Furthermore, perishable food usually transported from farms to markets for exports or domestic consumption was left on farms to rot. The loss of jobs due to measures to control the spread of COVID-19 has a wide range of consequences on the livelihood of people. The informal economy is particularly vulnerable [6]. Therefore, technology interventions are necessary to transform the food sector in the new era [7,8]. COVID-19 is a wake-up call for food systems, which have already been on a knife-edge for decades.

Various fears have arisen during this crisis, with food shortages looming large above them all [9]. In the aftermath of the COVID-19 outbreak, food systems have been adversely affected. Globally, online buying channels have grown at an unprecedented pace in response. As a result of the pandemic, households have changed their lifestyles and spending habits from bricks to clicks [10]. The food delivery systems operate mainly through mobile apps. These apps have become increasingly popular since the outbreak of the pandemic. Thus, the crisis has accelerated peoples adoption of online services by dissociating the food sector to some extent. The COVID-19 pandemic is a major situational influence that shapes people behavior to use online food ordering services. However, Nguyen et al. [11] argued that studies examining the impact of situational factors on e-commerce are limited. E-retail or online shoppers require greater trust in the company from which they are buying. In addition, the extent and duration of this new trend of increased online shopping during the pandemic remain uncertain [12].

Pakistan's food sector has also leveraged online food distribution channels in response to the pandemic. In terms of internet users, Pakistan is the 10th most populous country in the world. It is home to 76.38 million internet users, of which 44.10 million are online shoppers [13]. Growing numbers of young people and their appetite for food have spurred the growth of online food delivery services. Despite the massive market potential, only 15% of Pakistanis order food online. This evidence on online food service indicates, on the one hand, that the consumption pattern of Pakistani users of the service remains low. On the other hand, there are only few studies devoted to people online food purchasing behavior, its influencing factors, and its impacts on food security. Therefore, this research aims to analyze the peoples' behavior toward online food purchasing channels to sustain their food accessibility during COVID-19 pandemic, and identifies the determinants of buying behavior. Specifically, the objectives of this study are to 1) understand the buying behavior of Pakistani people during the pandemic; 2) to assess the role of online food buying behavior in food accessibility during the pandemic and 3) to explore the factors that affects the online buying behavior.

This study contributes to the literature in the following ways. First, to the best of our knowledge, this is the first study to explore these linkages. Second, the existing research based on the primary data, which was collected using online sources during the COVID-19 pandemic. Third, this study explores the food buying behavior for food accessibility in times of pandemic. Fourth, this research explores the determiannts of online buying behavior under natural disaster which are not considered in very few studies before, and no study in Pakistan has addressed this issue. Finally, this study provides grassroot level assesment which may help policymakers and managers to develop and reinforce recovery plans effectively to combat with COVID-19 disaster.

2. Literature review

The few studies that have been conducted on the effect of COVID-19 disaster on online shopping channels revealed that disease significantly affected the behavioral systems and given rise to the e-commerce platforms. Furthermore, COVID-19 caused the business closures and hindrance of marketing operations across many economies which shifted the peoples decision-making behaviors. For instance Ref. [14], found that the COVID-19 had escalated online shopping. Moreover [15], indicates that COVID-19 disaster changed buying behaviors, product needs, purchasing behaviors and the post purchase satisfaction level, i.e., at the start of the COVID-19 disaster, it was observed people avoid using publicly used goods with an increase in virtual and online shopping behaviors.

Recent studies have suggested that the COVID-19 pandemic moderates the relationship between buying behavior intention and people adoption. For instance, Nguyen et al. [11] found that COVID-19 significantly influenced people behavior under particular situations. A study by Ref. [16] found that people behavior was influenced by the situational influences they are experiencing at the time. The disaster led to reexamining production and consumption practices. Furthermore, the higher level of people satisfaction in online shopping reduced food waste and resulted in increased online food purchases [17].

The sudden disruption in supply chain due to disaster brought changes in the buying patterns and the retailers faced severe problems whereas peoples also faced data privacy problems while buying through online channels [18]. The long-term shifts in people behavior emerging from the COVID-19 crisis have significant implications for marketers to revise their supply chain channels [19]. The study by Galati et al. [20] highlighted the sustainability challenge of the online food deliveries systems and logistics and distribution channels impact on the environment. However, In the context of a developing country like Pakistan, research is limited on the people's behavior towards using an online platform to buy food, and the effect on food accessibility.

3. Materials and methods

3.1. Study area

Punjab and Sindh, two provinces in Pakistan, were used as a case study for this study (see Fig. 1). These provinces were chosen because of the following reasons. Firstly, Punjab and Sindh are the two largest provinces in Pakistan. Punjab, for instance, is home to nearly 60% of the country's population and contributes 58% to Pakistan's GDP. Similarly, Sindh's population in 2010 census was 42.44 million, which is growing at 2.8% annual rate since 1998. Second, Punjab and Sindh have relatively more developed infrastructures and logistics to support e-commerce platforms [21]. Punjab province, for example, holds the highest share of e-commerce orders at 55%, followed by Sindh at 36%. Those provinces account for the bulk of the country's economic output [21–23]. Third, smart phone and internet penetration rates are the highest in these two provinces, which are prerequisites for e-commerce. Furthermore, both of these provinces are exposed and most vulnerable to adverse effects of the COVID-19 pandemic [24].

3.2. Sampling and data collection

The best representative sample size of this study was estimated using Cochran's formula [25] for large populations. The subsequent equation symbolizes the Cochran formula:

$$N = Z^2 pq/e^2$$

where N shows sample size; Z is the abscissa of normal curve that cuts off an area α at the tail; e is the desired level of precision; p is the determined proportion of an attribute; q = 1 − p with the assumption of p = 0.5 (maximum variability) as the desired confidence interval, a ±3% precision level, and value of 1.96 for Z.

$$N = (1.96)^2 0.5(0.5)/(0.03)^2$$

$$N = 0.9604/0.0009$$

$$N \approx 1067$$

This strategy resulted in a representative sample size of 1067 for this study. The non-probability sampling method used in the present study was also used in prior studies [25–27] to collect data in Pakistan from Punjab and Sindh through online surveys. The peak of the outbreak was marked by social distancing policies and other mitigation measures that made data collection challenging.
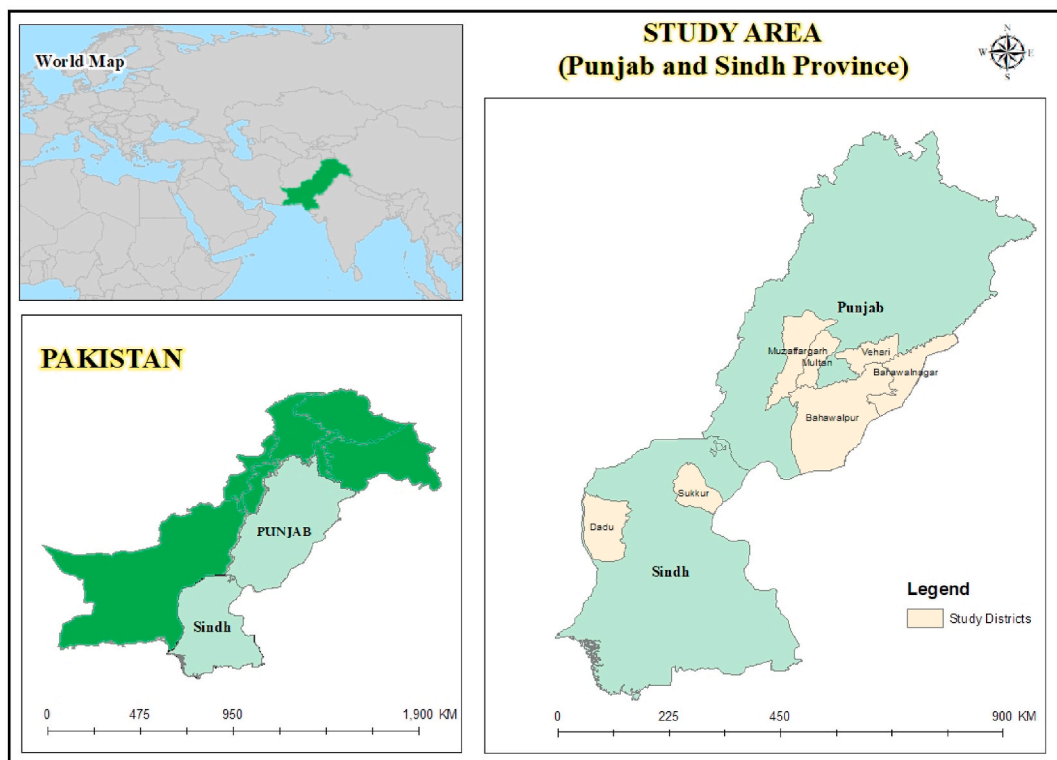

Fig. 1. Study area for second survey round.
*Note: The author takes the neutral stance in relation to territorial disputes or jurisdictional claims in its research.

For this reason, we collected data through online surveys using snowball sampling. Non-probability sampling techniques such as snowball sampling have specific advantages. This method allows researchers to rapidly reach the desired population within a specific study area and can save time for the researchers. Nevertheless, it may result in some sample bias due to less control over oversampling by researchers. When virus has human to human transmission then is very difficult to physically meet with the people for surveys. In this study, the choice of the sampling technique was based on the inaccessibility of respondents as a result of pandemics and budgetary constraints [25,26,28]. The internet connects people throughout the world and other sampling techniques make it difficult to target the required population. Although random sampling has the advantage of having randomness, it is not always practical. Moreover, sequential sampling has a complex design and is taken at a given time interval when the required sample size has not been determined. When diseases or pandemics are still present in the population, then the snowball sampling method is the best method for conducting surveys [29].

The data were collected through questionnaires. The English version of the questionnaire is attached in the supplementary materials. For the better understanding of the respondents the questionnaire was translated into local Urdu language. We used Google Sheets to prepare the questionnaire and shared it on Facebook, WhatsApp, and other social media platforms to collect responses. The people with age of 17 years or above were inclusion criterion to participate in the study. The respondents were well informed about the purpose of the study before filling out the questionnaire. Concerning the respondents' data security and safety, they were assured that their data will only be used for education and research purposes and informed consent was requested in the questionnaire. The experimental design of this study was presented to the institutional committee, which was confirmed and approved by the members. Table 1 shows the survey area and respondents, as well as their distribution.

3.3. Analytical approaches

The dependent variables used in the study was the food buying behavior. If the people changed buying behavior because of COVID-19 then it is given a value 1, and 0 otherwise. The independent variables used in this study are the socioeconomic conditions of the peoples and variables related to the COVID-19 such as lockdown status. Moreover, food accessibility and factors related to income status such as access to basic necessities are the independent variables. Because of binary dependent variable and the several binary and continuous independent variables, the most suitable model for this estimation is the logit regression model as explained below.

3.4. Logit regression model for the estimation of the determinants of food buying behavior

There are a number of factors that influence online food buying behavior. In this study, online buying behavior (dependent variable) is characterized; if a people 's online buying behavior is affected by a pandemic, then a value of 1 is assigned; otherwise, a value of 0. To determine which factors influence online shopping behavior among peoples, the logit regression model was fitted to the data. In an earlier study, discrete choice models were used to examine the relationship between online buying behavior changed in pandemic and no change in online buying behavior. Thus, a logit regression model is appropriate. Logit models are commonly used in binary classification [30–32]. This study used a logit model for analyzing food purchasing behavior as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots \ldots \ldots + \beta_n X_n + \varepsilon$$

where Y represents the online food buying behavior (1 if the people has changing behavior in pandemic and 0 otherwise). The description of the independent variables is given below:

X_1 = age of the respondent (number of years).
X_2 = respondent's gender (1 = male; 0 = female).
X_3 = education of the respondent (school years).
X_4 = household head's parents' education (school years).
X_5 = location (0 for rural; 1 for urban).
X_6 = family members infected (numbers).
X_7 = lockdown status (1 if the household has quarantine status, 0 otherwise).
X_8 = food accessibility (1 if the household has access, 0 otherwise).
X_9 = basic necessities sanitation (0 if not having basic necessities sanitation; 1 if have basic necessities).
X_{10} = basic necessities clean water (0 if not having basic necessities clean water; 1 if have basic necessities).
X_{11} = type of employment (1 if formal employment, 0 otherwise).

Table 1
Sample distribution.

CITY	FREQUENCY	PERCENTAGE
PUNJAB PROVINCE		
Bahawalpur	200	18.74
Vehari	200	18.74
Multan	200	18.74
Muzaffargarh	60	5.63
SINDH PROVINCE		
Daddu	203	19.03
Sakhar	204	19.12
Total	**1067**	100

X_{12} = monthly income.

X_{13} = perception about buying channels either helped during COVID-19 (1 if people said, yes; otherwise, 0).

ε = an error term.

The software package STATA 17 was used to analyze data. The results are termed with a simple numeric score to follow the previous research [33,34].

4. Results

The results indicate the participants were on average 32 years old and attained average 9 years of education. A typical family had on average about 7 members in their family and the average number of earners was 1.4, which indicates that most families only have one earning member. It also indicates that respondents have a higher degree of dependence on earning members. Almost 58.77% of the population lived in urban areas, whereas about 41.23% came from rural areas. Furthermore, in the survey, the women are adequately represented, i.e., 40.30% female, 59.70% male. Married, and single respondents account about 84.35%, and 15.65% of sample population, respectively. The people living in joint family system account for around 79.66%, whereas 20.34% of people live as single families. The families having refrigerator facility for food storage in their house accounts for 79.38%, whereas 2.62% of the population do not have refrigerator facilities. Moreover, almost 15.65% people reported their parents have the basic education whereas about 84.35% people said their parents are not educated. The access to the basic necessities such as sanitation and clean water was available to almost 59.05%, and 66.26% respondents, respectively. On the other hand, almost 40.95%, and 33.74% people did not have access to basic necessities i.e., sanitation, and clean water, respectively. The households with formal employment account for 27.84%, and informal employment 72.16%, in the data. Hence, informal has the highest share in the employment sector among the sample respondents.

The respondents who do not have any income source account for almost 2.25% of sample population. While people with monthly income less than 10,000 Pakistan rupees (PKR, whereas 1 PKR = 0.0054 US dollar) represents about 47.32%, indicating incidence of poverty in the study area (Table 2). The results indicate that people have a high poverty level among the sample population and cannot afford the basic necessities of life.

4.1. Dynamics of buying behavior and food accessibility in COVID-19 perspective

The results in Table 3 shows that almost 98.78% sample of population reported that they were quarantined in their homes, and only 0.46% in hotels. Moreover, results show that 0.38% respondents quarantined at their friends' homes and other places. Because homes were the main quarantine place adopted by the households, therefore, providing facilities of food and health services at homes can have better impact on lives of peoples during disaster.

Table 2
Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max
Age (Years)	32.8	9.049	17	91
Education (Years)	9.2	4.131	0	18
Family Size (No.s)	7.7	2.684	1	15
Earning members (No.s)	1.4	.667	1	6
	Description		Frequency	Percentage (%)
Area	Rural		440	41.23
	Urban		627	58.77
Gender	Female		430	40.30
	Male		637	59.70
Marital status	Married		900	84.35
	Single		167	15.65
Family type	Joint		850	79.66
	Nuclear		217	20.34
Having refrigerator	No		220	20.62
	Yes		847	79.38
Parents education	Educated		167	15.65
	Not educated		900	84.35
Access to basic facilities i.e., Sanitation	No		437	40.95
	Yes		630	59.05
Access to Clean Water	No		360	33.74
	Yes		707	66.26
Type of employment	Formal employment		297	27.84
	Informal employment		770	72.16
Household Monthly Income	0		24	2.25
	<10,000		505	47.32
	10,000–15,000		256	24.00
	15,000–30,000		220	20.61
	30,000–50,000		49	4.60
	50,000–100,000		12	1.12
	100,000–150,000		1	.10

Table 3

Dynamics of buying behavior and food accessibility in COVID-19 perspective.

Variable	Description	Frequency	Percentage (%)
Place of Quarantine	Friend Home	4	0.38
	Home	1054	98.78
	Hotel	5	0.46
	Other places	4	0.38
How much COVID-19 reduced buying frequency for food purchase?	>5 times/week	176	16.50
	3–4 times/week	421	39.45
	0–2 times/week	470	44.05
Have COVID-19 changed buying behavior towards online purchases?	No	400	37.49
	Yes	667	62.51
Have online buying channels increased food accessibility during pandemic disaster?	No	572	53.60
	Yes	495	46.40
Difficulty in food accessibility during pandemic disaster	Higher	288	27.00
	Medium	455	42.64
	Lower	324	30.36
Food purchasing channels	Food ordering and delivering - E-commerce	18	1.69
	Government or community-based food distribution	12	1.13
	In person grocery shopping	707	66.26
	In-house storage	330	30.92
Excluded (missing) observations	10	Valid observations	1067

Further results revealed that the COVID-19 appears to have reduced the peoples' movement. About 44.05% of respondents reported to go out for food buying between 0 and 2 times per week, and 39.45% sample population went out for food purchases 3–4 times per week. Only 16.50% sample respondents reported to leave homes more than 5 times per week. These results are in line with those of Rodgers et al. [35] which indicates disaster reduces the frequency of going out in supermarkets and people engage in home cooking and health concerns in choices for food products. Furthermore, the Huang et al. [36] also found that the US consumers' spending behaviors were also significantly affected by their safe handing levels and the Covid-19 severity and food accessibility in their residences. The COVID-19 have changed the peoples behavior towards online buying. The results in Table 3 show that almost 62.51% peoples reported that they had changed their perceptions and behavior toward online buying channels. They perceived that online buying platform are beneficial and easy access to food and other groceries during the pandemic. On the other hand, still 37.49% peoples reported that they did not change their behavior towards online buying channels. Hence, results indicated that there's a large potential in online buying in Pakistan which need to be explored. These results are consistent with Ellison et al. [37] who found that COVID-19 caused US consumers to reduce food-away-from-home expenditures and increase online grocery shopping.

COVID-19 affected the peoples perceived effect of online food buying behavior on their food accessibility. It is indicated that almost 46.40% peoples reported that during the COVID-19 pandemic online buying channels had increased their food accessibility. Whereas about 53.60% peoples reported the online buying channels did not increase food accessibility which indicates the huge potential of online buying platforms in the country. Furthermore, it may be possible that the food did not deliver on time, or the required quantalities and variety of food was not available online.

Furthermore the COVID-19 caused higher level to medium level disruption in food accessibility (Table 3). Almost 27% and 42.64% peoples reported they faced high and medium level difficulty in food accessibility during COVID-19 pandemic respectively. We also

Table 4

Food affordability during the COVID-19 pandemic.

Questions	Response	N	%
Was the food expensive?	No	90	8.44
	Yes	977	91.56
The perceived increase in food prices	1 Scale slider (1-10)	0	0
	2	4	.37
	3	22	2.06
	4	91	8.52
	5	107	10.03
	6	42	3.94
	7	24	2.26
	8	29	2.71
	9	53	4.97
	10	695	65.14
Do you get the same type of food as before COVID-19?	No	620	58.10
	Yes	447	41.90
Do you get the same amount of food as before COVID-19?	No	778	72.91
	Yes	289	27.09

found that during the COVID-19 pandemic people prefer in person grocery shopping as about 66.26% peoples reported in person buying (Table 3). People were also cautious when buying food and they stored food ahead of time to prepare before worse conditions occurred. The results revealed that almost 30.92% peoples prefer in house storage during the COVID-19 pandemic disaster. In addition, only 1.13% of peoples obtain food from government or community-based food distribution services. However, it is indicated that a large population did not use the online buying channels for food buying during the COVID-19 pandemic in Pakistan and around 1.69% of peoples used online platforms for food ordering and delivering. This indicates that the online channels have the huge potential for businesses in the country.

4.2. Food affordability during the COVID-19 pandemic

Table 4 presents the results of the food affordability indicators during the COVID-19 pandemic. About 91.56% peoples reported that the food they obtained during pandemic was expensive. Peoples' perceived increases in food prices on the highest Likert scale 10 were 65.14%, while on Likert scale 9 were 4.97%, indicating the larger perceived increase under the pandemic. In addition, almost 58.10% of peoples' reported not getting the same kind of food they did before COVID-19. About 72.91% of peoples' said they did not get the same amount of food as they did before the COVID-19 pandemic. These results show that food affordability was adversely affected by the COVID-19 pandemic.

4.3. Results of the logit regression model for measuring the determinants of the food buying behavior

The determinants of the peoples online food buying behavior were estimated using the logit regression (Table 5). The results indicated that age and location (rural-urban) have negative impact on online buying behvaior. However, education of respondents has a positive and statistically significant impact on online food buying behvaior. The variable of the person infected with COVID-19 is positively and significantly associated. In addition, the monthly household income, parents' education, access to basic necessities such as sanitation and clean water, type of employment (formal or informal), the variable of lockdown and perception that online food buying helped during the COVID-19 pandemic are all positively and statistically correlated with online food buying behvaior. Although, food accessibility has a positive effect on online buying behavior, but this not statistically significant (Table 5).

5. Discussion

This research explore the dynamics of people behavior in food accessibility to eliminate the problems faced during the COVID-19 disaster. This study is unique as it links peoples buying behavior in food accessibility with COVID-19 pandemic in a developing country. The results revealed that the peoples monthly income and access to basic necessities such as availability of clean drinking water, better sanitation and better formal employment are positively significant association with online buying behavior. Online shopping may also be disproportionately observed among wealthier and poorer, urban and rural peoples, who otherwise may lack of online payment sources (such as credit or debit cards) or reliable internet. The studies by Refs. [38,39] found similar results. Results further showed that the reduced food availability changed the buying behavior. This is because lockdown has impeded the growers access to markets, thus limiting their productive and sales capacities [40]. These results are consistent with the studies of [15,18] which states that COVID-19 causes the business closure, hinder marketing operations across many economies which shifts the peoples' decision-making behaviors. Moreover, the disaster changed buying behaviors, product needs, purchasing behaviors and the post purchase satisfaction level. Sudden disruption in supply chain due to disaster brought changes in the buying patterns. The [17] indicated that disease significantly affected the behavioral systems and given rise to the m-commerce platforms. The disaster led to

Table 5

Results of logit regression model used to identify determinants of online buying behavior during Covid-19 pandemic.

Food buying behavior	Coef.	Std. Err.	Z	P > z
Demographic variables				
Age	−.0014,394	.0116,964	−0.12	0.902
Gender	.0045,507	.207,365	0.02	0.982
Education	.0564,989**	.0271,018	2.08	0.037
Parents education	1.132483*	.2,709,637	4.18	0.000
Location (Rural-Urban)	−.613,398*	.2,227,192	−2.75	0.006
Covid-19 variables				
Family members infected	.9,553,325*	.2,279,238	4.19	0.000
Lockdown	.2,413,751	.3,065,198	0.79	0.431
Food accessibility	.3,779,717	.2,838,888	−1.33	0.183
Economic factors				
Access to basic necessities-Sanitation	1.993966*	.2,334,524	8.54	0.000
Access to basic necessities - clean water	.8,672,096*	.2,407,242	3.60	0.000
Type of employment	.4,251,018*	.1,490,316	2.85	0.004
HH monthly income	.288,578**	.1,337,076	2.16	0.031
perception about ecommerce help during COVID-19	2.297062*	.2,583,563	8.89	0.000
_cons	−3.803939	.8,641,511	−4.40	0.000
LR chi2 (13) = 694.55	Log likelihood = −355.54511			
Prob > chi2 = 0.0000	Pseudo R2 = 0.4941			
Missing observations = 10	Number of valid observations = 1067			

**and * represent levels of significance (α) at 5% and 1%, respectively.

reconsidering the way of production and consumption. Whereas, intermediary purchase methods such as group purchasing, shopping with the help of neighboring communities, and volunteers became the most essential or the only channel for the peoples to access the food during the peak of the pandemic disaster [24,41–43]. In China [44], found that online sites enabled both producers and peoples through various resources in procurement, logistics, and marketing operations to maximize links between producers and peoples.

The community scale technology can benefit small scale farmers and through distributed food system, it can increase food accessibility [45]. The infection rate and anxiety reduced due to online buying channels [46] and COVID-19 pandemic accelerated the trend of online ordering prepared food and changed the peoples behavior towards online buying channels [47]. The peoples compatibility has greatest impact on the shopping behavior during disaster period [48]. So, the COVID-19 positively and significantly affected the people behavior towards online buying [49]. Moreover, the prices of commodities and the security of buying found positively affected the peoples online behavior [50,51]. In addition [52,53], found security, appearance, quick loading, sitemap, and legality are the most significant factors of online shopping that affect peoples bevaior to make online purchase because peoples cannot tough the product through online buying. And through the knowledge exploration browser and internet availability, along with the services, pricing and affordability determines the peoples behavior [54]. The changing peoples behvaior towards buying channels have increased the food accessibility and contributed positive in reducing the food insecurity. The study by Refs. [19,20] highlighted the sustainability challenge and long-term shifts in peoples behavior emerges from the COVID-19 crisis have significant implications for marketers to revise their supply chain channels.

The study recommends the problem of food inaccessibility during the pandemic should be overcome by designing the strategies reflective of the changed people behaviors and innovative market services. These strategies should also consider the advancement of technology such the promotion of e-commerce. Retailers should consider flexible marketing channels and consistency of information provided in online channels to avoid people from confusing in process of online shopping. The study suggests the consistent regulation so that people should not perceive any potential risk in its personal data. Furthermore, the results emphasize the increasing role of online buying platforms in order to better mitigate with the disasters of the current COVID-19 pandemic and upcoming calamities.

6. Conclusions

This study was conducted to examine the people's behavior towards online buying channels for the sustainability of food system and peoples' perceptions about online food buying. The study concluded that the pandemic has changed peoples shopping behaviours as part of maintaining their food availability during the pandemic. While some peoples purchased their food and groceries online, a large number of sampled respondents still do not utilize these channels even in the presence of increased difficulties in accessing foods during COVID-19 pandemic. This situation indicates that there is a lot of potential to improve the usage of these online food channels among peoples. The majority of those who purchased food online reported that it increased their food accessibility. However, some peoples did not see this benefit. This may be due to a lack of diversity and quantity of required food items on online shopping channels. Moreover, we find that respondents' location, the prevalence of COVID-19 infection, monthly income, and access to basic facilities affect their use of online shopping channels. Therefore, these factors should be taken into account in determining policies for promoting access to food through online purchasing channels.

Policies needs to encourage people to buy food and agricultural products through online marketplaces since doing so can make it easier for them to get these products and assist farmers sell their produce on timely manner and can overcome difficulties in food accessibility that arises because of the pandemic. A further obstacle is a lack of education. In order to boost the use of e-commerce, education has to receive greater attention. To boost people's digital connectedness, the infrastructure of telecommunications networks needs to be improved to reach out the rural populations. To create more employment opportunities and to improve accessibility, particularly during disasters, rural e-commerce businesses can be established (on the Chinese model). A gender-friendly approach to development must be adopted when drafting policies. Additionally, a proper check and balance on sellers would ensure quality products to enhance customer trust for online shopping.

Even though this study covered various aspects of food insecurity, it has some limitations. First, we did not include all four provinces in the online survey due to lack of time and resources. Second, no panel data on respondents is collected to observe their long-term behavior during different pandemic waves. Third, the survey was conducted online so additional investigation of the reasons for some of the answers provided by respondents was not possible. Future research should address these issues by including a nationally representative dataset and comparing the outcomes over a longer period. Research may also consider the ongoing effects of the pandemic on food access and food insecurity, particularly among underserved groups. Furthermore, future studies might also consider additional factors such as trust in online shopping channels, prices and quality of foods, and technical barriers to online shopping in studying the determinants of people online shopping behavior during the disaster.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data will be available from corresponding author on reasonable request

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