



## Research article

# Online community group food purchasing during the COVID-19 pandemic: Food security, problems, and sustainability

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## ABSTRACT

The outbreak of the COVID-10 variant Omicron epidemic in Shanghai in 2022 had a huge impact on residents' food security. This study examines the roles, challenges, and sustainability of online community group food purchasing by analyzing survey data collected from 1168 households in Shanghai between March and May 2022, in the aftermath of COVID-19. This study demonstrates that online community group food purchasing played a crucial role in ensuring residents' food access and food security during the pandemic. However, this study also reveals that residents expressed concerns about the risk of epidemic transmission, food safety, increased prices, and difficulty in safeguarding rights. Only 21.5 % of residents are willing to continue using online community group purchasing. Based on the above conclusions, this study offers some suggestions.

## 1. Introduction

The COVID-19 outbreak has had a profound impact on the global food security system, with the food supply chain experiencing unprecedented disruptions [1]. The agri-products supply chain, including fruits, vegetables, fish, and poultry, has been disrupted as well [2]. Both food supply and demand have been significantly affected by the pandemic [3], leading to increased food insecurity in numerous countries around the world [4]. Household food insecurity increased by almost one-third in Vermont, USA, with 35.5 % of households experiencing this for the first time [5]. In Arab countries, nearly a quarter of households suffered from moderate to severe food insecurity [6]. In response to growing food insecurity, countries have implemented assistance programs. A study by Wolfson and Leung [7] in the United States found that the government provided short-term assistance through the Supplemental Nutrition Assistance Program (SNAP) to mitigate food insecurity for affected families during the COVID-19 pandemic. Several African governments have implemented measures such as food distribution, personal income tax reductions, and grants to assist vulnerable households during COVID-19 lockdowns [8,9]. While these measures have helped alleviate some of the increased household food insecurity, their impact has been hardly adequate in comparison to the magnitude of the pandemic effects.

With the development of the internet, e-commerce has become increasingly effective in facilitating consumer purchasing. In the wake of the COVID-19 pandemic, offline food purchase frequency decreased significantly [10], while the frequency of new consumption behaviors such as online shopping and contactless delivery services substantially increased [11]. The proportion of online purchases increased from 12 % to 43 %, and purchasing frequency rose from 9.8 % to 25 % [12]. E-commerce has played a crucial role

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in serving customers and meeting their individual consumption needs during the pandemic [4] and has become the most prominent shopping method for consumers worldwide [13]. However, countries and regions exhibit differences in their reliance on and preference for e-commerce. Some scholars maintain that there are three e-commerce models in China: the nationwide e-commerce model, the local e-commerce model, and the unofficial e-commerce model [14]. Multiple e-commerce models have emerged in Europe and North America, such as online shopping, online group buying, and online grocery delivery models [15,16]. Thus, countries and regions should select an appropriate e-commerce model based on the local market environment and consumer preferences to fulfill the food needs of consumers, as well as commodity supply formats.

Online community group purchasing is a form of online group buying. It is a new retail mode satisfying consumer demand for high-quality and affordable shopping by leveraging social relationships among community residents and leaders within the context of the internet [17]. As a result of COVID-19, working from home and contact-free distribution have become significant aspects of daily life. Community group purchasing is highly favored due to its ability to integrate local food and agricultural resources and provide consumers with convenient distribution services in a short distance and limited range [18]. As an e-commerce model, community group purchasing effectively resolves the “last mile logistics distribution” problem during lockdowns and opens new avenues for the development of the digital economy [19]. Community group purchasing enables the aggregation of fresh agricultural product distribution demand in time and space, thereby reducing the cost of cold chain distribution per unit [20]. However, the selection of a reasonable distribution plan is essential to implement community group purchasing. A suitable plan is crucial for the success of community group purchasing operations and ensures the sustainable development of the model [20]. At present, research in many countries primarily focuses on the factors affecting online group-buying intention, including perceived usefulness, service quality, interpersonal relationship perception, habit, trust, etc. [15,21].

There are divergent practices concerning community group purchasing across different countries. The earliest group buying website in the United States was Groupon, which has experienced a steady increase in user activity, and new community group purchasing models continue to evolve and develop. In 2021, the platform boasted 98 million active users and generated an annual revenue of 967.1 million dollars [22]. According to ESNERC [23], the transaction scale of China’s community group purchasing market reached 120.51 billion RMB in 2021, with a year-on-year growth of 60.68 %, while the total user count amounted to 646 million. According to the Wang and Hao [24] survey of three cities in China, 70 % of consumers accessed their food through group purchasing during the COVID-19 pandemic.

During the COVID-19 period, online community group purchasing played a huge role to ensure residents’ food security. However, there are still some negative effects in this purchasing pattern. Some studies have found that some consumers are reluctant to make online purchases due to concerns that actual product quality and safety may not meet their high expectations [25]. Additionally, fear of infection is also a prevalent reason for consumers to refuse online purchases, with 70 % of them believing that COVID-19 could be transmitted through food [26]. However, the COVID-19 pandemic has exposed negative problems in community group purchasing, such as food safety problems [27], excessive price increases [28], and consumer difficulty in safeguarding their rights against food safety problems [29]. Compared with the guarantee effect, there is still relatively little relevant research on the problems existing in online purchasing and online community group purchasing.

As the COVID-19 pandemic subsides, the sustainability of newly formed consumer purchasing patterns remains unclear. At present, no substantial scientific study has examined the long-term viability of online food shopping post initial exposure. However, some studies infer that a considerable number of consumers will continue to use online group buying, even if only occasionally [30]. McKinsey [31] suggests numerous crisis management strategies that developed during the pandemic will remain and evolve. Similarly, Wang et al. [32] assert that the epidemic has amplified awareness towards maintaining a safe distance, and reliance on e-commerce and online shopping will persist. Scholars express concern regarding the extent of continued usage of online shopping platforms after the lifting of COVID-19 restrictions and post mitigation [16]. The research above demonstrates that the potential for community group purchasing to thrive in analogous situations remains uncertain and necessitates further exploration and study.

Food security in public health crises is often overlooked, yet it remains a critical aspect of ensuring access to food for residents. In March 2022, the widespread outbreak of the COVID-19 Omicron variant in Shanghai made it challenging to effectively secure residents’ access to food. Therefore, studying changes in food purchasing habits and food security among Shanghai residents is crucial and prudent. It is yet to be determined whether alterations in the way urban residents purchase agricultural products, as a result of the current COVID-19 outbreak, are short-term or permanent.

This study utilized questionnaire data collected from 1168 households in various regions of Shanghai during the Omicron epidemic between March and May 2022. The aim is to analyze the contribution of online community group purchasing towards residents’ food security, reveal existing problems, and examine the sustainability of online community group purchasing in the aftermath of a major public health event. The study broadens the literature on COVID-19 effects and makes the following contributions: (1) Previous studies have paid limited attention to the challenges that existed during COVID-19. This study identifies and explains problems confronting online community group purchasing in public health crises and offers policy recommendations on how to address them; (2) Previous studies have rarely qualitatively analyzed the sustainability of community group purchasing. By delving into the sustainability of online community group purchasing, the current study fills a research gap. Results clarify and address extant online community group food purchasing challenges and offer solutions for other regions or analogous events that may occur in the future.

## 2. Materials and methods

### 2.1. Questionnaire design

A questionnaire comprised of multiple-choice questions was designed to collect data on community group food purchases during the Omicron period. A stratified sampling method was utilized to randomly distribute questionnaires based on the proportion of the population in 16 regions of Shanghai. All respondents were clearly informed of the survey purpose of this study and agreed to participate before answering the questionnaire.

The questionnaire's quality was assured by applying a three stage development process prior to formal release: preliminary design, pre-investigation, and modification. During the questionnaire design stage, the authors gained a deeper understanding of the online community group purchasing during the lockdown and developed questions within three key areas. The three areas correspond to three sections in the questionnaire comprising 24 questions. The first section contains three questions, focusing on the impact of COVID-19 on residents, including the impact of COVID-19 on personal food security and the lockdown level of the community. The second section comprises 13 questions, concentrating on the community group purchasing situation, such as the number of new community group food purchasing groups, the frequency of group food purchasing, the main sources of community group food purchases, the main food types of community group food purchases, etc. The third section comprises eight questions, asking about the basic characteristics of residents, including gender, age, educational level, income, marital status, etc. To prevent respondents from randomly selecting answers, the multiple-choice format included an option of "not sure". Additionally, the questions mainly employ the five-point Likert scale to clearly indicate the degree of resident responses. All questions relate to the Omicron pandemic's context in Shanghai.

### 2.2. Data collection

The survey was conducted online between April and May 2022. Due to the imposition of lockdown measures, field investigations were not possible. Prior to formal questionnaire distribution, a pre-investigation was conducted online to test its quality. For the final questionnaire, the online survey investigated the community group purchasing situation across all 16 regions of Shanghai. To ensure comprehensive coverage across the city, big data technology was utilized to randomly distribute questionnaires. To prevent any potential sampling bias, the survey used a comprehensive frame that covered key demographic aspects, such as gender, age, place of residence, per capita annual income, educational level, and marital status.

Building on the methodology of Rodrigues et al. [33], an initial pilot study was conducted in which 120 respondents were asked to identify any potential problems related to question wording, omissions, or any other difficulties preventing the completion of the questionnaire. Based on the feedback received, minor adjustments were made to the wording of certain questions and alternative responses were added. The survey company distributed online questionnaires via the internet in April 2022. A total of 1476 questionnaires were distributed. After data processing and screening, 308 unqualified questionnaires with answers that were shorter than 90 seconds or inconsistent answers were eliminated. A total of 1168 valid questionnaires were collected resulting in an effective rate of 79.1 %.

### 2.3. Statistical methods

This study utilized Stata 15 software (College Station, Texas 77,845 USA) for descriptive statistical analysis and empirical examination. In section 2.2, the collected data were examined for consistency and completeness. The frequencies and percentages of the answers in each category were calculated and presented in tabular form. In section 2.4, we conducted a descriptive analysis of the respondents' demographic characteristics, including gender, age, place of residence, lockdown level, educational level, monthly income, family status, and household size. In section 3.1, we employed descriptive analysis to investigate the role of online community group food purchasing in ensuring food security and assessing residents' satisfaction levels. Four significant issues surrounding online community group food purchasing were analyzed in section 3.2. We utilized descriptive methods to investigate residents' concerns about the risk of COVID-19, the occurrence of significant price increases, instances of weight shortage and malicious bundling sales, as well as difficulties in safeguarding consumer rights.

A binary logit model was employed to test the relationships between independent variables and the likelihood of encountering food safety problems. Section 3.3 shows the initially conducted descriptive analysis to evaluate the sustainability of online community group purchasing. Subsequently, a mixed OLS regression model was applied to investigate the factors influencing the sustainability of online community group purchasing.

### 2.4. Data analysis

The survey utilized stratified sampling across all 16 districts of the city and obtained responses from a total of 1168 households. The administrative regions that had more than 5 % of the surveyed population were Pudong New Area (28.9 %), Minhang (9.6 %), Yangpu (5.8 %), Putuo (5.5 %), Songjiang (5.4 %), Huangpu (5.1 %), Xuhui (5.0 %), and Jiading (5.0 %). Additionally, 42.4 % of households were located within the city while 57.6 % were located in suburban or rural areas. The majority of respondents were female (57.8 %), with men representing 42.2 % of the sample. Among respondents, almost half (48 %) were between 31 and 50 years old, while less than half (43.9 %) were between 19 and 30 years of age. The remaining 4.2 % and 3.9 % of the respondents were younger than 18 or older

than 55 years, respectively. A higher-than-expected proportion (76.5 %) of respondents had educational levels higher than an undergraduate diploma. In terms of income, 59.6 % of respondents reported per capita monthly income exceeding 8000 RMB. Regarding family status, 60.5 % of respondents were married, with 42 % and 21.8 % of households including children and elderly members, respectively. The majority (46 %) of the household population surveyed were families of three persons. In terms of lockdown level, 50 % of respondent residences were located in lockdown regions, 20.7 % in control areas, and 24.2 % in prevention areas. [Table 1](#) displays the demographic characteristics of the survey respondents.

### 3. Result and discussion

#### 3.1. Role of online community group food purchasing

##### 3.1.1. Assuring food security

The Omicron epidemic had significantly impacted the food security of Shanghai residents. Almost nine out of ten of respondents (87.5 %) reported that their families' food security had been greatly or very greatly impacted ([Table 2](#)). Among respondents, 61.9 % identified that the Omicron epidemic impact on food security was significant. In the United States, Wolfson and Leung [34] found that 44 % of households experienced food shortages during the COVID-19 pandemic. The most commonly reported food items in shortage were vegetables (42.0 %), fruits (18.9 %), meat (14.4 %), fish (14.2 %), eggs and milk (5.7 %), and rice, noodles and cooking oil (3.0 %).

During COVID-19, there was a significant increase in the proportion of Shanghai residents joining online community group food purchasing. According to the survey results, 33.9 % of residents joined 4–6 new groups, 12.4 % joined 7–9 groups, and 10.5 % joined more than 10 groups. Additionally, 77.8 % of Shanghai residents reported buying food through online community groups more frequently compared to pre-COVID-19. The results revealed that within the month preceding the survey, 26.4 % of residents had bought food in groups one to three times, 34.0 % four to six times, 15.1 % seven to nine times, and 17.3 % more than 10 times. A study by Laguna et al. [35] found that following the pandemic lockdown, the frequency of consumers' weekly online shopping increased from 35 % to 76.5 %. During the COVID-19 pandemic, a variety of groups were created by different organizers. The main types of groups included those organized by neighborhood committees (68.6 %), community heads (56.7 %), surrounding merchants (53.9 %), government entities (18.5 %), and specialized agricultural cooperatives (14.6 %). A study by Chenarides et al. [36] also arrived at a similar conclusion, discovering that over 50 % of residents preferred grocery delivery services compared to before COVID-19. Additionally, residents frequently procure their food through community purchasing groups. According to the survey, the primary food types that residents purchased included vegetables (90.4 %), eggs and milk (65.8 %), fruits (51.6 %), meat (49.8 %), rice, noodles, and oil (19.6 %), and aquatic products (4.3 %). The findings align with residents' need for limited food supplies and support the research by Omotayo et al. [37] indicating that resident food security was successfully ensured during the COVID-19 pandemic. The results underscore the substantial impact of community group purchasing on resident food security.

##### 3.1.2. Majority resident satisfaction

Online community group purchasing played a crucial role in ensuring that Shanghai residents' basic food needs were met during the COVID-19 pandemic. Although selecting community group purchasing as the preferred means of procuring food for the majority of residents was a result of necessity rather than choice (86.5 % reported that alternative methods were difficult to access), online community group purchasing effectively ensured residents' basic food needs and they generally felt their needs were satisfied. Overall, the majority of residents (76.0 %) expressed satisfaction with online community group purchasing. Respondent satisfaction levels ranged from generally satisfied (38.9 %) to satisfied (33.0 %) to very satisfied (4.1 %). Those results align with those obtained in a study conducted by Kursan Milaković [38], who reported that 78.8 % of consumers expressed satisfaction with their online purchases ([Table 3](#)).

#### 3.2. Problems of online community group food purchasing

##### 3.2.1. Concern about the risk of COVID-19

Residents were concerned about the risk of contracting COVID-19 during the community group purchasing process. Although the death rate from the Omicron variant has significantly decreased, Shanghai residents remain apprehensive about its potential dangers. Approximately 56.8 % of residents felt that the Omicron virus posed a very high risk to their health (40.3 % "relatively high", 16.5 % "very high"). Only 14.9 % and 3.5 % residents indicated the risk was "relatively low" and "very low", respectively. Additionally, 70.2 % of residents expressed concerns about the possibility of Omicron virus being present in food or packaging purchased through community group (48.8 % were "relatively concerned" and 21.4 % were "very concerned"). Simultaneously, 81 % of residents disinfected their food packaging after it has been delivered to them. Faour-Klingbeil et al. [10] also discovered a noticeable increase in the number of individuals who washed and disinfected their hands before handling food, upon returning home, and after touching food packaging during the COVID-19 pandemic. Survey respondents' moderate and extreme concerns regarding the risk of contracting viruses through food consumption or food packaging negatively impacted their typical food purchase behavior [26] ([Table 4](#)).

**Table 1**  
Sample characteristics (N = 1168).

Demographic characteristics	Category	Respondents (n.)	Percentage (%)
Gender	Male	493	42.2 %
	Female	675	57.8 %
Age	Below 18	49	4.2 %
	19–22	180	11.2 %
	23–30	430	36.8 %
	31–40	385	33.0 %
	41–50	127	10.9 %
	Above 51	46	3.9 %
Place of residence	City	495	42.4 %
	Suburban or Rural areas	673	57.6 %
Lockdown level	Lockdown/stay at home	584	50 %
	Control area/can move within the community	242	20.7 %
	Prevention area/no lockdown	283	24.2 %
Educational level	Not sure	59	5.1 %
	High school and below	112	9.6 %
	Junior college	162	13.9 %
	Undergraduate	737	63.1 %
	Master	124	10.6 %
Per capita monthly income (RMB)	Doctoral	33	2.8 %
	Below 4000	84	7.2 %
	4001–6000	155	13.3 %
	6001–8000	232	19.9 %
	8001–12000	332	28.4 %
	12,001–20000	230	19.7 %
Family status	Above 20,001	135	11.5 %
	Married	706	60.5 %
	Not married	462	39.5 %
	Children under 12	491	42.0 %
Household size	Elderly over 60	255	21.8 %
	1 person	70	6.0 %
	2 persons	176	15.1 %
	3 persons	538	46.0 %
	4 persons	238	20.4 %
	5 persons and above	146	12.5 %

### 3.2.2. Food safety problems

During the COVID-19 pandemic, most studies focused on consumer concerns about the risk of contracting viruses through food, but with little attention devoted to food safety<sup>1</sup> problems. However, this study's survey revealed that food safety problems were especially pronounced during the pandemic, with 44.6 % of residents reporting that vegetables and other foods were stale. In addition to fears about viral transmission from food surfaces, residents confronted significant food safety dilemmas in the COVID-19 pandemic. Food safety incidents exposed during the COVID-19 outbreak, such as syrup-contaminated honey and excessive soy protein found in sausage [39], have heightened resident fears regarding the quality and safety of community group food purchasing. Nevertheless, lockdown measures often made it challenging for people to purchase perishables, particularly fresh produce [34]. Similarly, a study by Lu et al. [40] yielded a similar result, with less than 20 % of respondents expressing confidence in the quality and freshness of fresh produce purchased online. Table 5 shows that both COVID-19 and the frequency of community group purchasing have a considerable positive effect on food safety, with both being statistically significant. The results suggest that the more severe the impact of COVID-19, the more probable that residents will encounter food safety problems. The frequency of residents' community group purchasing is also on the rise, raising the likelihood of encountering food safety problems.

### 3.2.3. Extreme price increases, weight shortfall, and spurious bundling sales

During the COVID-19 pandemic, 86.5 % of residents reported difficulty in acquiring food outside of online community group purchasing. Consequently, some community group purchasing operators engaged in undesirable behaviors, such as extreme price increases, underweight portions, and deceptive sales tactics, which disrupted market order and severely impacted resident satisfaction. Regarding prices, 63.7 % of respondents perceived community group food purchasing to be excessively expensive (Table 6). Compared to the pre-COVID-19 period, 65.2 % of respondents reported a three to four time or more increase in food prices (39.8 % for three to four times, 17.8 % for five to six times, and 7.6 % for seven times) (Table 6). Yu et al. [41] survey of Chinese consumers yielded results consistent with this study. Their findings revealed a threefold increase in the price of pork and a fivefold increase in the price of cabbage. Also, a study conducted by de Paulo Farias and de Araújo [42] in Brazil came to a similar conclusion. Their survey identified that while most food products experienced a price increase of 1–2 times, certain food prices rose threefold. Secondly, some residents

<sup>1</sup> Food safety in this study means that food is non-toxic and harmless, meets the required nutritional requirements, and does not cause any acute, subacute, or chronic harm to human health. It is different from the risk of the COVID-19 virus.

**Table 2**

Questions related to family food security and the role of online community food purchasing during the COVID-19 Omicron variant epidemic.

Questions	N	Category	Respondents (n.)	Percentage (%)
1. How much has COVID-19 affected your family's food security?	1168	No impact	14	1.2 %
		Little impact	27	2.3 %
		Commonly	105	9.0 %
		Large impact	299	25.6 %
		Very large impact	723	61.9 %
2. What is the most scarce food in your family?	1084	Vegetable	455	42.0 %
		Fruit	205	18.9 %
		Egg and milk	62	5.7 %
		Meat	156	14.4 %
		Seafood	154	14.2 %
		Rice, noodles and oil	33	3.0 %
		Other	19	1.8 %
		0	60	5.2 %
3. How many new online community food purchasing groups have you joined?	1168	1-3	444	38.0 %
		4-6	396	33.9 %
		7-9	145	12.4 %
		More than 10	123	10.5 %
		0	60	5.2 %
4. What is the change in the frequency of your online community group purchasing?	1084	Significant increase	843	77.8 %
		Some increase	198	18.3 %
		Unchanged	34	3.1 %
		Some decrease	7	0.6 %
		Significant decrease	2	0.2 %
5. How many times have you participated in online community group food purchasing?	1168	0 times	84	7.2 %
		1-3 times	309	26.4 %
		4-6 times	396	34.0 %
		7-9 times	177	15.1 %
		More than 10 times	202	17.3 %
6. What kind of groups do you get your food from?	1084	Community leaders groups	615	56.7 %
		Neighborhood committee groups	744	68.6 %
		Surrounding businesses groups	584	53.9 %
		Agricultural cooperative groups	158	14.6 %
		Government groups	200	18.5 %
		Others	15	1.4 %
7. What kind of food do you buy from the group?	1084	Vegetable	980	90.4 %
		Fruit	559	51.6 %
		Egg and milk	713	65.8 %
		Meat	540	49.8 %
		Seafood	47	4.3 %
		Rice, noodles and oil	212	19.6 %
		Other	16	1.5 %

**Table 3**

Shanghai resident satisfaction level of online community group food purchasing.

Question	N	Category	Respondents (n.)	Percentage (%)
Are you satisfied with community group food purchasing?	1084	Very dissatisfied	69	6.4 %
		Dissatisfied	191	17.6 %
		Generally satisfied	422	38.9 %
		Satisfied	358	33.0 %
		Very satisfied	44	4.1 %

have a clear perception of the inadequate weight of food purchased through community groups. Specifically, 29.3 % of residents reported encountering the problems of weight shortfall in group purchasing, which negatively impacted their satisfaction. Chenarides et al. [36] reached a similar conclusion, as approximately 15 % of consumers reported receiving a reduced quantity of food compared to previous purchases. Thirdly, residents have a noticeable perception of malicious bundling sales of community group food purchasing. Specifically, 51.4 % of respondents reported excess, unnecessary products in the blind box group purchasing (Table 6). According to SMSAB [43], residents have lodged complaints that the food they received significantly differed from the sample pictures. Additionally, residents have expressed their inability to select their desired food portions, with group purchasing food packages often containing excessively large portion sizes that surpass the typical fresh food consumption needs of households. Consequently, this has led to a substantial amount of food waste, greatly impacting resident satisfaction. Vidal-Mones et al. [44] similarly discovered that

**Table 4**  
Shanghai resident concerns about infection following community group purchasing during the COVID-19 Omicron epidemic.

Questions	N	Category	Respondents (n.)	Percentage (%)
1. How dangerous do you think the Omicron virus is to your health?	1168	Very weak	41	3.5 %
		Weak	174	14.9 %
		Neutral	289	24.8 %
		Strong	471	40.3 %
		Very strong	193	16.5 %
2. Are you worried about Omicron virus in food or packaging obtained by community group purchasing?	1084	Very worried	232	21.4 %
		Some worry	529	48.8 %
		Neutral	218	20.1 %
		Barely worried	95	8.8 %
		Not worried at all	10	0.9 %

**Table 5**  
The logit regression results of a food safety model during COVID-19.

Food safety	Coef.	St.Err.	t-value	p-value	[95 % Conf	Interval]
Impact of COVID-19	0.227 <sup>a</sup>	0.078	2.93	0.003	0.075	0.38
Group purchasing frequency	0.191 <sup>a</sup>	0.061	3.15	0.002	0.072	0.31
Gender	0.055	0.131	0.42	0.676	-0.202	0.312
Age	-0.059	0.068	-0.87	0.383	-0.192	0.074
Educational level	0.019	0.084	0.23	0.816	-0.145	0.184
Income	-0.016	0.049	-0.34	0.736	-0.112	0.079
Population	-0.118	0.073	-1.62	0.105	-0.261	0.025
Marital status	0.355 <sup>b</sup>	0.16	2.21	0.027	0.041	0.669
Children	0.16	0.148	1.08	0.278	-0.129	0.45
Elderly	0.43 <sup>b</sup>	0.167	2.58	0.01	0.103	0.757
Mean dependent var		0.446	SD dependent var		0.497	
Pseudo r-squared		0.024	Number of obs		1041	
Chi-square		34.000	Prob > chi 2		0.000	
Akaike crit. (AIC)		1418.842	Bayesian crit. (BIC)		1473.269	

\*p < 0.1.

<sup>a</sup> p < 0.01.

<sup>b</sup> p < 0.05.

**Table 6**  
Problems in online community group food purchasing during COVID-19.

Questions	N	Category	Respondents (n.)	Percentage (%)
1. What problems have you encountered in the process of community group food purchasing?	1084	Food stale	483	44.6 %
		Extreme price increase	690	63.7 %
		Weight shortage	318	29.3 %
		Contained unnecessary food	557	51.4 %
		Non-delivery	248	22.9 %
		Organizer disappeared	62	5.7 %
		None of the above	145	13.4 %
		Increased by more than 7 times	82	7.6 %
2. How do you think the price of group food purchasing has changed?	1084	Increase by 5 or 6 times	193	17.8 %
		Increase by 3 or 4 times	432	39.8 %
		Increase by 1 or 2 times	327	30.2 %
		No change	48	4.4 %
		Cheaper	2	0.2 %

70.1 % of consumers reported excessive food purchases during lockdowns. As a result, the expiration date of some purchased products passed before being consumed, leading to a significant amount of food waste.

### 3.2.4. Difficulty in safeguarding rights

During the COVID-19 pandemic, residents encountered difficulties protecting their rights with community group purchasing. After encountering food safety problems, residents exhibited two distinct behaviors. To safeguard their rights, 61.4 % of respondents who experienced problems acted by accessing various complaint channels. Of those respondents, 22.6 % lodged complaints with

government departments by dialing 12,315 and 12,345, while 39.2 % filed complaints with individual group purchasing merchants, and 44.7 % filed complaints with group purchasing organizations. However, 38.6 % of residents did not take any action to protect their rights. Those residents expressed feeling unlucky and powerless in protecting their rights, and believed that with the severe supply shortages, pursuing the claims was unnecessary. A study by Frassetto et al. [45] reported a similar finding, indicating that consumers utilized various platforms to file complaints. Specifically, their study revealed that 44 % of consumers prefer mobile applications to complain, 22 % of consumers use multiple channels, and 22 % of consumers prefer complaining on the internet. Additionally, 14 % of consumers complained directly to merchants. Likewise, Bian Yanjie et al. [29] aligned with the findings of this research, with only 57 % of respondents indicating they would take action to safeguard their rights when confronted with problems. The results mentioned above imply an enhanced awareness among residents regarding the protection of their rights, despite additional challenges posed by the COVID-19 pandemic. However, it is worth noting that some residents, who may have a limited awareness of their rights, do not undertake measures to safeguard themselves (Table 7).

During the COVID-19 pandemic, the majority of research concentrated on the positive impact of online food purchasing, while only a few studied its existing problems. The above analysis highlights that while community group purchasing guarantees an adequate food supply for residents, it also introduces a multitude of problems during the pandemic. Beyond the aforementioned concerns, 22.9 % of residents encountered difficulty with non-delivery, and 5.7 % reported the disappearance of the group purchasing organizer after placing an order. Those findings indicate a wealth of pressing problems within community groups purchasing food, reducing resident satisfaction and negatively impacting willingness to continue using community group purchasing.

### 3.3. Sustainability of online community group food purchasing

#### 3.3.1. Continued willingness to purchase food through online community groups after COVID-19

Online community group purchasing effectively met residents' food security during the COVID-19 pandemic. However, poor consumer experience significantly reduces the willingness to continue using it. As many as 40.2 % of residents stated they would no longer utilize community group purchasing if society returns to normal after the pandemic. Only 21.5 % claimed they would continue to purchase food through community groups, while 38.3 % remained uncertain (see Table 8). However, Young et al. [46] showed that 63.3 % of respondents still commonly purchased through online group buying even after the COVID-19 pandemic. According to our study, the usage rate of community group purchasing among residents is just 20 %, while nearly 40 % of residents choose not to use it again. The findings highlight significant issues within the community group purchasing system that contribute to a negative consumer experience. To address these problems, it is crucial for various departments to collaborate in order to improve residents' food security and enhance their overall consumer experience. The difference in the shares of respondents using community group purchasing may be attributed to the fact that it becomes a necessary option for obtaining food during lockdowns and presents a challenge.

#### 3.3.2. Factors influencing sustainability of online community group purchasing

There is a rich literature on factors influencing purchase intentions. For instance, factors such as perceived trust, perceived risk, product price, product quality, service, and quality of content generated by community leaders are all factors that stimulate consumers' continuous purchase [47–50]. The studies on the continuation of purchase behavior following the pandemic display two perspectives. One perspective suggests that although it remains uncertain whether consumer behavior changes are permanent or temporary, such changes are likely to continue [51]. The other perspective posits that consumers are likely to revert to their pre-pandemic habits [52], that is, any changes in consumer behavior are short-lived and pre-pandemic habits will resume after the pandemic concludes.

Consumer habits are key in determining the sustainability of community group purchasing, with public policies influencing the generation of new habits [52]. Research has shown that policy support can promote sustained intention, where the strength of sustained intention correlates with the degree of public policy support [19]. To ensure the food security of Shanghai residents during the Omicron epidemic, community group purchasing has become popular. While supporting the development of community group purchasing, the government has actively addressed concerns expressed by consumers. A proposal to impose an "online sales tax" to balance the development of virtual and real economies was discussed during the UK government's 2021 meeting [53]. Although there is no definitive conclusion on the sustainability of online food purchases, most scholars believe they will persist [32,51]. Future research on the sustainability of community group purchasing seems warranted.

Table 9 shows that the COVID-19 impact and consumer satisfaction significantly affect the sustainability of community group

**Table 7**  
Shanghai resident rights protection during the COVID-19 pandemic.

Question	N	Category	Respondents (n.)	Percentage (%)
What actions have you taken to protect your rights after your community group food purchasing encounters problems?	1084	Complaint to the government	245	22.6 %
		Complain to the merchant	425	39.2 %
		Complain to the group purchasing Organizer	484	44.7 %
		Other	30	2.8 %
		No action or no problems encountered	418	38.6 %



**Table 8**  
Descriptive analysis of sustainability of online community group purchasing.

Question	N	Category	Respondents (n.)	Percentage (%)
Are you willing to continue using community group purchase after COVID-19?	1084	YES	233	21.5 %
		NO	436	40.2 %
		Not sure	415	38.3 %

**Table 9**  
Factors affecting sustainability of online community group purchasing.

Variables	Coef.	St.Err.	t-value	p-value	[95 % Conf	Interval]
Impact of COVID-19	-0.058 <sup>a</sup>	0.014	-4.13	0	-0.086	-0.031
Group purchasing frequency	0.003	0.011	0.25	0.8	-0.019	0.025
Satisfaction	0.146***	0.014	10.76	0	0.119	0.172
Food safety problem	-0.025	0.024	-1.01	0.313	-0.073	0.023
Price	0	0.013	-0.03	0.98	-0.026	0.025
Gender	-0.03	0.024	-1.26	0.208	-0.077	0.017
Age	-0.01	0.012	-0.82	0.415	-0.034	0.014
Educational level	0.012	0.015	0.78	0.436	-0.018	0.041
Income	-0.004	0.009	-0.48	0.632	-0.021	0.013
Population	0.018	0.013	1.36	0.175	-0.008	0.043
Marital status	0.103 <sup>a</sup>	0.029	3.55	0	0.046	0.159
Children	0.104 <sup>b</sup>	0.027	3.87	0	0.051	0.156
Elderly	-0.016	0.03	-0.54	0.592	-0.076	0.043
Constant	-0.195 <sup>c</sup>	0.107	-1.82	0.069	-0.405	0.015
Mean dependent var		0.211		SD dependent var		0.408
R-squared		0.194		Number of obs		1041
F-test		18.970		Prob > F		0.000
Akaike crit. (AIC)		893.010		Bayesian crit. (BIC)		962.281

<sup>a</sup>  $p < 0.01$ .

<sup>b</sup>  $p < 0.05$ .

<sup>c</sup>  $p < 0.1$ .

purchasing in contrast to the frequency of group purchasing, food safety problems, and prices. Those findings suggest that the frequency of group purchasing does not determine consumer continued intention to utilize community group purchasing. However, higher levels of overall satisfaction are associated with the continued intention to purchase through group buying. Nevertheless, COVID-19 has a statistically significant negative impact on the sustainability of community group purchasing. In the future, as the severity of COVID-19 diminishes, residents may become less anxious about the transmission of the virus through food. This, in turn, could increase their willingness to continue using community group purchasing. The lack of statistically confirmed food safety and price influence on community group purchasing could be attributed to the limited access residents had to food during the pandemic, resulting in the reliance on community group purchasing as a means to ensure an adequate food supply. Families with children and the elderly, in particular, may exhibit a stronger inclination to continue using community group purchasing to safeguard their food security throughout the pandemic.

#### 4. Limitation

Although the current study expands research on food safety and community group purchasing sustainability during COVID-19, there are still limitations. The conducted survey only includes a sample of Shanghai residents, and the data collection was limited in scope. Thus, the conclusions drawn may not be extrapolated to all regions of the world, and results should be cautiously applied to other large urban areas. However, the findings provide basic information for comparisons across different regions and serve as a reference for future studies. Future research should expand the sample data to allow for research with more general conclusions.

#### 5. Conclusion and suggestions

##### 5.1. Conclusion

The COVID-19 pandemic has posed significant challenges for residents across all aspects of society. However, online community group purchasing has provided much-needed convenience for residents. With regard to food security, community group purchasing has been effective in ensuring sufficient food supply for residents during lockdown, with 78.0 % expressing overall satisfaction. However, several problems in community group purchasing cannot be ignored. Our study showed 70.2 % of residents are concerned about the transmission of viruses through food, while 44.6 % have experienced food safety problems. The impact of the epidemic and the frequency of group purchasing have been linked to food safety problems. In addition, 63.7 % of the respondents express concerns over extreme price increases, while 29.3 % report weight shortfall. Furthermore, 51.4 % were forced to accept unwanted bundled sales,

and 61.4 % faced challenges while safeguarding their rights. In terms of sustainability, only 21.5 % of residents expressed intentions to use community group purchasing in the future. Consumer satisfaction has been associated with the sustained community group purchasing. Higher satisfaction levels are associated with a greater willingness to continue participating in group purchasing. Community group purchasing increases consumer satisfaction and protects vulnerable groups, supports the export of local agricultural products, promotes local development, and reduces resident concerns about the risk of the virus. It appears that COVID-19 has promoted the sustainability of community group purchasing.

The reported problems associated with the community group purchasing process indicate great concerns about food quantity, quality, and safety attributes, while simultaneously ensuring sufficient food supply. Prioritizing the needs of residents in the community group purchasing process can improve consumer satisfaction and promote system sustainability. During the COVID-19 pandemic, community group purchasing led businesses to enhance the shopping experience and to immediately adapt to the crisis fostering future system sustainability. Community group purchasing plays a crucial role in maintaining social stability and helps to reduce carbon emissions promoting environmental sustainability.

## 5.2. Recommendations

To ensure the food safety in community group purchasing, it is crucial to strengthen the disinfection at various distribution stages and constantly promote awareness of personal protection and hygiene. Efforts to prioritize epidemic prevention and control in food production and distribution need to be strengthened. Delivery staff fulfilling community group purchase orders can apply preventive measures such as ventilation and cleaning food and packaging surfaces to prevent the spread of viruses during transportation. Secondly, enhanced training and supervision of personal protection measures for distributors accepting orders from community groups and delivery couriers can be initiated. The implementation of strict training and supervision of practitioners can prevent the spread of viruses during distribution. Thirdly, it is essential to enhance public awareness of epidemic prevention measures. Through science-based and effective publicity, we can guide residents to take protective measures, improve their awareness of self-protection, and avoid infection.

Ultimately, the goal should be to develop compliance operation standards and effective monitoring and management measures for community group purchasing at the municipal level in Shanghai. In the past, the management methods applied to community group purchasing were scattered and inoperable, which could have contributed to frequent problems during the COVID-19 pandemic. To reduce problems observed in the recent past, we must prioritize the monitoring of food prices in group purchasing. Based on existing laws and regulations such as the “E-commerce Law,” “Price Law,” “Consumer Protection Law,” “Food Safety Law,” and “Online Food Management Supervision and Management Measures,” government agencies have an opportunity to carefully formulate targeted and effective compliance norms, monitoring, and management measures guiding and protecting community group purchasing that are suitable for the local conditions. Secondly, we must enhance prevention measures to eliminate the incidents of problems such as price gauging, weight shortfall, and malicious bundled sales. Recommendations can stipulate that businesses serving group purchasing must provide non-package blind box options, which offer group members the flexibility to choose the variety and quantity of products they desire. If products are sold in preset packages, the name, quantity, and unit price of the products included must be clearly indicated along with the total sales price.

From the perspective of the entire supply chain, the monitoring of community group purchasing processes must be further refined to ensure food safety through strengthening traceability. Government agencies should strictly supervise the entire chain of community group purchasing, from food production to purchase, transportation, storage, and distribution. Businesses must maintain records of the entire process to guarantee all food products traceability. Currently, the variety of community groups purchasing food and the absence of management subject information, incomplete circulation, elimination information, and other related problems increase the risk of virus infection and pose hidden dangers to food quality and safety. Establishing a traceability system is crucial to ensuring every link is detectible. Such a system can effectively address arising problems and enhance the overall safety of community group purchasing.

Improving consumer awareness of their rights, forms of protection, and expanding channels for exercising those rights is a priority. Firstly, an appropriate government agency should promote knowledge of consumer rights. Consumers informed about their rights have the ability to deter businesses from causing harm, ultimately increasing social benefits for all stakeholders. Secondly, the expansion of channels for consumer rights protection is needed. Consumers may have abandoned efforts to protect their rights since the existing laws are ineffective. Government agencies must prioritize the formulation of new and improvement of existing laws and regulations for their effective implementation.

It is crucial to understand consumer habits, provide quality customer service, and implement differentiated marketing strategies. Firstly, since consumer groups and their consumption habits constantly change, it is necessary to grasp the scope of consumer demand. Monitoring and analyzing consumer behavior can identify shifts in consumer demand and quickly align marketing strategies to meet their needs. Secondly, ensure quality and provide excellent customer service through establishing product quality protection mechanisms and optimizing transaction processes. Consumers must have access to high quality and affordable products that enhance their overall shopping experience. Thirdly, maintain community group relations and implement differentiated marketing strategies. Strengthening group relations is crucial for the sustainable community group purchasing. Understanding the unique needs of different consumers within community groups allows tailoring of marketing strategies to specific consumer categories and achieving a differentiated effect.

## Data availability statement

Data used in this study are available upon reasonable request from the authors.

## Ethics statement

The study complies with all regulations and informed consent was obtained from the participants in collecting the samples. This study will not cause privacy or personal harm to the respondents, and there is no ethical risk. This study has been approved by Academic Ethics and Morals Committee of Shanghai Ocean University, China (ethical number: SHOU-DW-2022-06).

## CRedit authorship contribution statement

**Weijun Liu:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Haiyun Du:** Writing – review & editing, Writing – original draft, Software, Investigation, Data curation. **Chen Sun:** Writing – review & editing, Funding acquisition, Formal analysis.

## 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.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e29581>.

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