The Impact of the COVID-19 Pandemic on Residents' Food Consumption Behavior

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Abstract

To assess the short-term and long-term impacts of the COVID-19 pandemic on residents' food consumption and to promote the stable and healthy development of the food industry, this study collected data on residents' food consumption behaviors at seven time points after the outbreak, including information on food stockpiling, purchase channels, quality choices, dining patterns, and consumption of imported cold-chain foods, thereby characterizing the dynamic changes in residents' food consumption behaviors following the pandemic. The research indicates that residents' food consumption behaviors exhibit risk-averse characteristics and fluctuate with the pandemic. The pandemic altered residents' food consumption behaviors in the short term and generated a persistent impact: extended food stockpiling, increased purchases through online channels, expanded consumption of green and healthy foods, stabilized diversification trends in dining patterns, and significant avoidance of imported cold-chain foods. The food industry needs to adapt to changes in residents' food consumption behaviors under regular pandemic prevention and control, promote industrial upgrading, and ensure stable and secure supply.

Full Text

The Impact of the COVID-19 Pandemic on Residents' Food Consumption Behavior

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Abstract: This study assesses the short-term and long-term impacts of COVID-19 on residents' food consumption behavior to promote stable and healthy development of the food industry. Data on food consumption behavior were collected at seven time points after the outbreak, including information on food

stockpiling, purchase channels, quality choices, dining styles, and consumption of imported cold-chain foods, to characterize the dynamic changes in residents' food consumption behavior after the pandemic. The findings reveal that residents' food consumption behavior exhibits risk-averse characteristics that fluctuate with the pandemic. The pandemic altered residents' food consumption behavior in the short term and generated lasting effects: extended food stockpiling periods, increased online channel purchases, expanded consumption of green and healthy foods, a stable trend toward diversified dining styles, and significant avoidance of imported cold-chain foods. The food industry must adapt to these changes in residents' food consumption behavior under normalized pandemic prevention and control, promote industrial upgrading, and ensure stable and secure supply.

Keywords: COVID-19 pandemic; food consumption behavior; impact

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The outbreak of COVID-19 has significantly altered residents' food consumption behavior, imposing major shocks on the food industry. Since the normalization of pandemic prevention and control, sporadic COVID-19 cases in different regions have caused residents' risk perception and food consumption behavior to fluctuate with the pandemic, affecting the food industry. Based on the analysis and comparison of residents' food consumption behavior data at six time points during the normalized prevention and control period, this paper examines the impact of COVID-19 on residents' food consumption behavior, providing critical information for the healthy development of the food industry and food management under pandemic risks.

2. Research Design and Survey

2.1 Research Design

Based on existing literature and the characteristics of Chinese residents' food consumption, this study focuses on post-pandemic behaviors including food stockpiling, purchase channels, quality choices, dining styles, and consumption of imported cold-chain foods. It examines changes in residents' risk perception and their corresponding risk-averse behaviors.

Table 1 Food Consumption Behaviors and Descriptions

Food Consumption Behavior	Description
Fresh food stockpiling	Household fresh food reserve quantities across different periods: number of days to meet family consumption (1, 3, 5, 7, 14, 21, 30 days)
Dining style behavior	Dining style choices (cooking at home, takeout, dining out): weekly dinner choices (0-7 days)
Food purchase channel	Importance of different food purchase channels (wet markets, supermarkets, fresh food takeout, fresh food e-commerce, fresh food stores, community group buying) (0=not important, 3=very important)
Food quality choice	Purchase behavior changes for different quality attributes: organic or green food, information-traceable food, vitamin-rich food, imported cold-chain food
Imported cold-chain food purchase	Purchase frequency (0 times - very frequent)

2.2 Survey and Statistical Description

This project purchased sample services from Wenjuanxing (a survey platform) to conduct random national sampling from its database of 2.6 million panelists. During sample collection, several measures were implemented to screen out invalid responses: First, participants were filtered through trap questions embedded in the questionnaire—common sense or lie-detection questions that could be answered correctly with careful attention. Second, staff randomly checked responses and marked as invalid those with abnormal completion times, inconsistent logic, identical answers across all items, or obvious random filling.

To capture the dynamic changes in residents' food consumption behavior af-

ter COVID-19, this project conducted six survey waves, distributing 300-400 questionnaires respectively in December 2020 (one year after the outbreak) and in January, March, April, May, and July 2021, obtaining 2,099 valid responses. Table 2 describes the basic statistical characteristics of respondents at each time point. To ensure questionnaire quality, eligibility criteria required respondents to be over 17 years old and the primary food purchaser in their household. The nature of online surveys means that middle-aged and young people constitute the main sample, with an average age of 30.91 years. 61.98% of households have children under 12, representing relatively representative and consumption-capable urban households.

Table 2 Sample Characteristics Description

Characteristic	Dec 2020 (N=322)	Jan 2021 (N=418)	Mar 2021 (N=355)	Apr 2021 (N=364)	May 2021 (N=317)	Jul 2021 (N=323)	Total (N=2,099)
Gender (%)							
Age (years)							
Education (%)							
$ $12 years							
13-16 years							
>16 years							
Household monthly income (%)							
<4,000 yuan							
4,001-8,000 yuan							
8,001-12,000 yuan							
12,001-16,000 yuan							
16,001-20,000 yuan							

Characteristic	Dec 2020 (N=322)	Jan 2021 (N=418)	Mar 2021 (N=355)	Apr 2021 (N=364)	May 2021 (N=317)	Jul 2021 (N=323)	Total (N=2,099)
20,001-24,000 yuan							
$ $24,001 yuan							
Children under 12 (%)							

2.3 Residents' Food Safety Risk Perception and Pandemic Expectations at Different Time Points

Previous studies have shown that risk perception is an important factor affecting residents' food purchasing and risk-averse behaviors (Wang, 2012). Statistical analysis reveals (see Figure 1) that residents' risk perception continuously adjusts with domestic COVID-19 case numbers. Except for a wave of outbreaks in January 2021 that increased risk perception, at other time points residents generally perceived the domestic pandemic as between "moderate" and "not severe." In contrast, most residents considered their personal risk of infection to be "low." Correspondingly, this study also collected national Baidu search index data for the terms "novel coronavirus," "COVID-19," and "pandemic" from January 21, 2020 to July 20, 2021, then aggregated the data across the three search terms to obtain residents' attention levels to COVID-19 at different periods. The comparison shows that surveyed residents' risk perception is somewhat consistent with Baidu search index data.

Risk perception is complex. Cognitive psychology research indicates that consumers often exhibit biases in risk estimation (Xie et al., 1996; Quan et al., 2011). This project designed two questions: respondents' perception of current domestic pandemic severity and their perceived risk of personal infection. Statistical analysis finds that residents' risk estimate for pandemic severity is higher than their estimate for personal infection risk. This risk cognition data suggests that residents may simultaneously exhibit panic behaviors from overestimating social risks and inadequate protection from underestimating personal risks.

Figure 1 [Figure 1: see original paper] Residents' Risk Perception Under the Pandemic

Note: Pandemic severity: respondents' view on current domestic COVID-19 severity (1=not severe at all, 3=moderate, 5=very severe); Risk of being infected: respondents' perceived risk of being infected with COVID-19 (1=very low, 5=very high).

Given that residents' income and expectations about pandemic duration may

also affect food consumption behavior (Yin et al., 2018), this project surveyed residents' expectations regarding how long the pandemic would last. Figure 3 [Figure 3: see original paper] shows that Chinese residents' expectations for pandemic duration continuously adjust with domestic and international pandemic changes. Overall, residents expect COVID-19 to last longer. Compared with the optimistic expectation during the early pandemic that it would only last 2.15 months (Wang et al., 2020), residents' expectations for pandemic persistence have changed dramatically, jumping from 14 months to 20 months. The pandemic has also severely impacted household income: 67.65% of respondents reported reduced household income; 52% reduced household consumption expenditures; 68.3% postponed purchases of major items. Affected by income uncertainty risks, 59.67% of respondents reduced credit card usage and other advance consumption behaviors.

Figure 2 [Figure 2: see original paper] Baidu Search Index
Data source: Aggregated national Baidu search index data for "novel coronavirus," "COVID-19," and "pandemic."

Figure 3 [Figure 3: see original paper] Residents' Expectations for Pandemic Duration

3. Dynamic Changes in Residents' Food Consumption Behavior

3.1 Impact on Fresh Food Stockpiling Behavior

Panic food purchasing is a main characteristic of residents' food consumption behavior during various disasters. Panic consumption generally refers to the phenomenon of panic buying materials due to uncertainty and disasters. In the early stage of COVID-19, as various regions successively implemented strict transportation controls, partial enterprise shutdowns, and strict restrictions on vehicle and personnel movement, consumers anticipated food shortages and price increases, triggering intense panic buying behavior. Stockpiling extra food serves as a self-protection mechanism under future consumption uncertainty. Survey data show that 9.54% of respondents reported food shortages in their households during the early pandemic. Figure 4 [Figure 4: see original paper] shows that before the pandemic, residents stockpiled an average of 3.03 days of household fresh food consumption, which rapidly jumped to 10.01 days during the early pandemic, demonstrating obvious panic buying characteristics. Meanwhile, subsequent surveys show that when the pandemic became normalized and food supply was relatively abundant, this change in stockpiling behavior proved persistent. Compared with pre-pandemic levels, the average household stockpiling of fresh foods increased by 1 day during the normalized prevention and control period.

Specifically (see Table 3), before the pandemic, over 80% of residents stockpiled 1 or 3 days of fresh food consumption. During the early pandemic, over

80% of residents stockpiled more than 7 days of fresh food consumption. After pandemic normalization, although most households returned to 3 days of stockpiling, the number of households stockpiling 5 or 7 days increased substantially. Increased household fresh food stockpiling leads to more food waste and increases total social demand for fresh foods.

Table 3 Residents' Fresh Food Stockpiling Days Before and After the Pandemic

Stockpiling Days	Before Pandemic	Early Pandemic	Dec 2020	Jan 2021	Mar 2021	Apr 2021	May 2021	Jul 2021
1 day	27.56%	0.73%	5.34%	9.89%	13.36%	15.65%	14.89%	13.16%
3 days	57.87%	0.22%	24.58%	5.21%	15.04%	14.66%	13.16%	13.16%
5 days	6.81%	0.22%	5.01%	9.60%	10.00%	14.84%	14.89%	13.16%
7 days	6.58%	0.79%	9.89%	10.00%	13.36%	14.84%	14.89%	13.16%
14 days	0.73%	7.03%	43.19%	54.21%	44.93%	22.52%	17.42%	13.16%
21 days	0.22%	14.06%	5.34%	5.01%	5.01%	12.58%	14.84%	13.16%
30 days	0.22%	43.19%	5.01%	5.01%	5.01%	14.84%	14.89%	13.16%

Note: ** indicates significance at the 1% level, ** at the 5% level, * at the 10% level.*

Regarding residents' stockpiling motivations (Figure 5 [Figure 5: see original paper]), different time points show varying motivations. Overall, motivations of "worrying about price increases" and "worrying about market shortages" have weakened, mainly due to the rapid recovery and stabilization of domestic food supply. Particularly, pork prices continued to decline in the first half of 2021 as production capacity recovered. Meanwhile, effective food supply guarantees during sporadic outbreaks have stabilized residents' expectations. As uncertain risks from domestic and international pandemic situations increase, the psychological comfort motivation of "seeking peace of mind" has strengthened, and the "reducing outdoor activities" motivation has also been reinforced. These motivations are important factors affecting the increased scale of residents' food stockpiling.

Figure 5 [Figure 5: see original paper] Residents' Food Stockpiling Motivations

3.2 Impact on Fresh Food Purchase Channel Choice

Even before COVID-19, residents' food purchase channels had become increasingly diversified (Gu et al., 2015). Although wet markets and supermarkets remained the most important fresh food purchase channels, some individual vendors moved out of wet markets to open fresh food stores in communities. Particularly, the role of "Internet+" in fresh food retail has grown increasingly

important, with new channels such as community group buying, fresh food e-commerce, and fresh food takeout developing rapidly. Survey data show (Figure 6 [Figure 6: see original paper]) that during the normalized pandemic prevention and control period, significant structural changes occurred in fresh food retail channels, with online fresh food purchase channels being strengthened. The importance of community group buying, fresh food e-commerce, and fresh food takeout in residents' fresh food purchase channels increased significantly, while the importance of wet markets, supermarkets, and fresh food stores declined to some extent.

Figure 6 [Figure 6: see original paper] Importance of Different Food Purchase Channels Before and After the Pandemic

Note: Respondents selected and ranked 3 most frequently used channels from 5 fresh food purchase channels (3=most important, 0=least important).

Foreign studies also show that online purchases increased rapidly due to pandemic travel restrictions and virus fears (Jordà et al., 2020). Does the pandemic-induced increase in online food purchasing have persistence? Can the opportunities for fresh food e-commerce during the pandemic be sustained? Survey data show (Figure 7 [Figure 7: see original paper]) that since pandemic normalization, the importance of wet markets has gradually recovered after a sharp decline, possibly due to their advantages in complete product variety, freshness, and low prices. However, supermarkets show a continuous declining trend in importance for residents' fresh food purchases, partially replaced by community group buying and fresh food takeout. Overall, this trend exhibits persistent characteristics.

Figure 7 [Figure 7: see original paper] Importance of Different Food Purchase Channels Before and After the Pandemic

Note: Respondents selected and ranked 3 most frequently used channels from 5 fresh food purchase channels (3=most important, 0=least important).

3.3 Impact on Fresh Food Quality Attribute Selection

As residents' awareness of food health and safety increases, demand for green, healthy, and safe foods has grown (Chen et al., 2019; Yu et al., 2014). The COVID-19 shock made consumers more cautious in food selection to boost their immune systems (Heng et al., 2020). Similar to the SARS period, even people who normally did not like drinking mung bean soup began consuming it. Survey data show (Table 4) that overall, residents' demand for healthy and safe fresh foods increased significantly after the pandemic. 57.53% of respondents reported increased consumption expenditure on organic or green foods, 48.04% increased expenditure on information-traceable foods, and 53.44% increased consumption of vitamin-rich foods. Meanwhile, 86.02% of respondents reduced consumption of wild products. Data from different time points show no significant differences, indicating that residents' consumption changes for different quality attributes

of fresh foods remained relatively stable during the normalized prevention and control period.

Table 4 Changes in Residents' Consumption of Foods with Different Quality Attributes Before and After the Pandemic

Food Quality Attribute	Increased Consumption (%)
Organic or green food	57.53%
Information-traceable food	48.04%
Vitamin-rich food	53.44%
Wild products	-86.02% (decreased)

3.4 Impact on Dining Style Choice

With rising incomes and faster-paced lifestyles, dining styles such as takeout and eating out have continuously increased, gradually substituting for home cooking (Yao et al., 2019). During the normalized prevention and control period, both income and infection risk factors affect dining style choices. Foreign studies show that during the pandemic, increased leisure time led to surging demand for flour and increased pastry making (Chang et al., 2020). Survey data show (Table 5) that before the pandemic, residents cooked at home an average of 4.53 days per week, ordered takeout for 1.76 days, and dined out for 1.99 days. After the pandemic, home cooking increased as a substitute behavior due to restaurant closures and reduced outdoor activities. However, during the normalized prevention and control period, takeout and dining out days only decreased slightly, indicating that these consumption behaviors have certain stickiness.

Table 5 Changes in Dining Style Choices Before and After the Pandemic

Dining Style	Before Pandemic (days)	After Pandemic (days)
Home cooking	4.53	[value from table]
Takeout	1.76	[value from table]
Dining out	1.99	[value from table]

Note: Dinner dining style choices completed in the most recent week.

3.5 Impact on Imported Cold-Chain Food Purchase Behavior

Since October 2020, when the Chinese CDC isolated active novel coronavirus from cold-chain food packaging and confirmed that contact with contaminated packaging could cause infection, multiple provinces have detected positive COVID-19 cases in cold-chain products. Outbreaks in Beijing, Dalian, and Qingdao were all related to cold-chain links. Experiments found that under cold-chain conditions at 4°C and -20°C, the novel coronavirus could survive for

3 weeks after 21 days (Fisher et al., 2021). Increasing reports of positive tests in imported cold-chain foods have raised consumer concerns. The December 2020 survey found that 89.38% of respondents reported reduced purchase of imported cold-chain foods compared with before the pandemic, and this figure grew to 93.15% in January 2021.

Subsequently, official media such as People's Daily conducted extensive publicity on cold-chain food risks, while enterprises strengthened testing of imported cold-chain foods and added "nucleic acid tested" labels, boosting consumer confidence. Data from a follow-up survey in July 2021 showed that 80.83% of respondents reported reduced purchase of imported cold-chain foods compared with before the pandemic. Survey data also show (Figure 8 [Figure 8: see original paper]) that before the pandemic, only 5.34% of respondents did not purchase imported cold-chain foods; this proportion increased to 63.01% in January 2021 and then gradually declined to 42.48%. This indicates that residents' purchase behavior regarding imported cold-chain foods is influenced by information, and rebuilding confidence is a slow process.

Figure 8 [Figure 8: see original paper] Changes in Imported Cold-Chain Food Purchase Behavior Before and After the Pandemic

5. Conclusions and Policy Implications

Although the pandemic has not ended and there is much discussion about whether the novel coronavirus will exist long-term, research shows that disaster experiences make consumers more risk-averse and increase risk avoidance, with effects that may last up to 6 years (Kuroishi et al., 2019). Based on data collection at six time points after the outbreak, this study outlines the dynamic changes in residents' food consumption behavior during the normalized pandemic prevention and control period, providing critical information for food industry policy and urban food supply management under normalized pandemic prevention and control.

The food industry must adapt to changes in residents' food consumption behavior under normalized pandemic prevention and control, promote industrial upgrading, and ensure stable and secure supply. First, improve fresh agricultural product preservation and packaging technologies, and increase the supply of fresh agricultural products suitable for long-term storage to accommodate the extended stockpiling duration of residents' fresh agricultural products and the volatile pandemic situation. Second, promote the digital transformation of wet markets and supermarkets for fresh food retail to adapt to the increasing trend of online agricultural product purchases. Third, extensively publicize green and healthy food consumption, correct the bad habit of wild product consumption, continuously enhance the quality value of agricultural products, and promote high-quality agricultural development. Fourth, develop foods suitable for takeout and innovate dining-out models under normalized pandemic prevention and control to meet residents' demand for diversified dining styles. Fifth, strengthen

publicity and promotion of domestic cold-chain foods such as seafood and steak, fully utilize the domestic substitution effect, and promote the high-quality development of domestic cold-chain foods.

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Note: Figure translations are in progress. See original paper for figures.