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Article

How did Japanese households change their food purchasing behavior at the initial period of the COVID-19 outbreak?

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How did Japanese households change their food purchasing behavior at the initial period of the COVID-19 outbreak?

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ABSTRACT

Fearing the COVID-19 infection, people began to avoid eating out and eating at home. Simultaneously, they began using meal delivery services. Numerous studies have assessed the impact of COVID-19 on various economic activities. However, its effects on food consumption patterns have not yet been fully examined. By analyzing household spending data from 1448 households in Tokyo, Tokai, and Kinki areas of Japan, we observed changes in food spending before and after the pandemic. During the emergency, the share of expenditures on food-away-from-home (FAFH) decreased by 1.8%, the share of expenditures on food-at-home (FAH) increased by 0.5%, and the share of expenditures on food delivery services (FDS) increased by 1.3% for all eligible households. However, the extent of the shift from FAFH to FAH and FDS varied widely across households. Single-person and single-parent households continued to rely on FAFH during the pandemic, whereas parent-child households shifted more to FAH. This suggests that time-constrained households could not prioritize meal preparation even during the pandemic. While various policies have recently been introduced to promote healthy eating at home, our empirical findings suggest that policies to ease household time constraints are simultaneously required for these programs to work.

IMPACT STATEMENT

During the COVID-19 pandemic, people spent more time at home, ate out less frequently, and started cooking at home. However, the extent to which eating habits changed during the pandemic varied greatly among households. Households with parents and children substantially shifted towards eating at home, while single-person households and households with single parents continued to eat out during the pandemic. These results indicate that people with limited time found it very challenging to change their eating habits.

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1. Introduction

Coronavirus disease (COVID-19) quickly spread throughout the world after the first infection case was reported in Wuhan, China, in December 2019, and unprecedentedly impacted our social and economic life. COVID-19 had a substantial impact on many demographic indicators during the first two years of the pandemic (Schumacher et al., 2024). More than 500 million people were infected as of 1 July, 2022, and more than 6 million people had died (World Health Organization, 2022).

In 2019, at the onset of the COVID-19 pandemic, USD 9.2 trillion was spent on health worldwide (Micah et al., 2023). Governments have urged the public to refrain from going out to curb the spread of COVID-19. They even issued stay-at-home orders during periods of serious infection, prohibiting people from leaving the house for anything other than essential daily purchases and medical care. Such COVID-19 countermeasures caused significant economic harm to the nation. Several international

organizations predicted that COVID-19 could cause the greatest economic harm to the world since the Great Depression.¹

COVID-19 measures have had a significant impact on the country's economy and daily lives.² Older adults began to take isolation measures on their own as medical facilities became overburdened with COVID-19 patients and less accessible. They stayed at home much longer than they had previously and started to avoid seeing their children and grandchildren. Meanwhile, companies encouraged employees to work from home, and many people began working from home.³ When schools closed, parents had to stay at home to care for their children. These changes in daily activities have significantly affected how people consume food.

People were concerned about the risk of infection and voluntarily avoided eating out. Subsequently, governments asked restaurants to reduce their operational hours. Some families increased their cooking time at home because they spent more time at home. As the cost of eating out increased and more home time became available due to the COVID-19 pandemic, households reduced food-away-from-home (FAFH) and increased food-at-home (FAH).

Several studies have investigated the effects of COVID-19 on household food consumption behavior. In the early stages of the COVID-19 pandemic, Goddard (2021) assessed the impact of COVID-19 on food retail and services in Canada, speculating that approximately 30% of the food dollars spent on FAFH would shift to FAH. Chenarides et al. (2021) conducted an online consumer survey in the United States (US) in May 2020 to investigate food shopping behavior and consumption during the lockdown. They confirmed that people bought more groceries than usual due to food-service closures. They also discovered that people increased their use of grocery deliveries and pickup services. Ellison et al. (2021) conducted a household survey from mid-March to late April 2020 in the US to learn how the COVID-19 pandemic altered food purchasing decisions. They noticed a decrease in FAFH expenditure and an increase in online grocery shopping.

These studies were conducted to better understand the changes in household food consumption behavior during the initial period of the COVID-19 outbreak. However, the impact of COVID-19 was assessed based on surveys conducted during the year of the outbreak. Given the seasonality of eating habits, we believe that it would be difficult to accurately assess the impact of the COVID-19 pandemic based on surveys conducted over a relatively short period. A more accurate assessment of the impact of COVID-19 requires a comparison of pre- and post-occurrence household food consumption behaviors.

People who stayed at home during the COVID-19 pandemic shopped online more frequently than before. Chang and Meyerhoefer (2020) used data on the food shopping services of Taiwanese households during the COVID-19 pandemic to assess this change. They confirmed that online service sales were strongly influenced by media coverage, reporting that one additional confirmed case of COVID-19 increased online service sales by 5.7%. More recently, Zeballos and Dong (2021) used long-term US sales data to examine the impact of employment conditions and economic trends on FAH and FAFH sales. They reported that the deteriorating employment conditions led to a 1.3% increase in FAH sales and a 0.5% decrease in FAFH sales during the COVID-19 outbreak.

The present study also aims to demonstrate how the COVID-19 outbreak has affected household food consumption behavior. We analyze household spending panel data from 1448 households in Japan's most densely populated areas: Tokyo, Tokai, and Kinki. We divide food expenditure into three categories: (1) FAH expenditure, (2) FAFH expenditure, and (3) food delivery service (FDS) expenditure. We then examine how household expenditures changed among these three categories before and after COVID-19.

All expenditures on purchasing food at grocery stores are included in the FAH category, regardless of the type of food, degree of processing, or place where the food is consumed. However, all expenditures on restaurants and other eating places are included in the FAFH category. Finally, all expenditures on food delivered to homes are included in the FDS. For example, expenditure on a pizza bought from a supermarket is included in FAH, expenditure on a pizza eaten at a café is included in FAFH, and expenditure on a pizza delivered home is included in FDS.

Most studies have used market-level data to assess the impact of COVID-19 on food consumption patterns. Our analysis of the household-level purchase data has two advantages. The government first responded to the unknown pandemic by restricting people's activities and then introduced support

programs to help weakened sectors, such as the food and beverage and travel industries, recover. Considering that all these programs were implemented in a relatively short period of time, it is critical to track changes in food consumption patterns over a short period to accurately assess the impact of the policies. Household-level expenditure data collected every two weeks allows us to more accurately assess the impact of the government's COVID-19 countermeasures.

Several studies have observed that food consumption patterns varied among households during the COVID-19 pandemic. While some studies indicate a shift toward an unhealthy diet during the lockdown (Ammar et al., 2020; Kriaucioniene et al., 2020; Sidor & Rzymiski, 2020), others suggest that having more free time led to a healthier diet (Di Renzo et al., 2020; Filimonau et al., 2022; Scarmozzino & Visioli, 2020). Recent studies confirmed that personal characteristics influenced the adoption of social media networks (Abbas et al., 2024). Furthermore, access to information through social media has been shown to affect behavioral choices during crises (Abbas et al., 2021; Zhang et al., 2024). Given that smartphones are often used for FDS, the use of FDS during COVID-19 is likely to vary widely across individuals. By combining household characteristics and food spending data, we can compare changes in food consumption behavior at the onset of the COVID-19 pandemic across households.

The results show that the shift from FAFH to FAH and FDS was maximized when the first state of emergency was declared, and the average household decreased FAFH expenditure by approximately 2% year-on-year but increased FDS expenditure by approximately 1.3%. Additionally, the results demonstrate that the intensity of the transition from FAFH to FAH varies across households; both single-person and single-parent households exhibit a small shift, whereas households with parents and children exhibit a large shift.

The remainder of this paper is organized as follows: [Section 2](#) discusses previous research on FAFH and FAH and the new findings that the present study provides for future research in related fields. [Section 3](#) provides the context for the COVID-19 pandemic in Japan and explains the data used in subsequent empirical analyses. [Section 4](#) describes the empirical model and reports its results. [Section 5](#) summarizes the empirical findings. Finally, [Section 6](#) discusses the policy implications of FAFH and FAH.

2. Food-at-home and food-away-from-home

The transition from FAH to FAFH is a phenomenon commonly observed in developed countries, and numerous studies have examined the factors that influence it. FAH requires more time for food preparation than FAFH, although FAFH is more expensive. Previous research has demonstrated that the likelihood of and expenditure on FAFH tends to increase as the value of home time increases, particularly as induced by greater female labor force participation (Jensen & Yen, 1996; Kinsey, 1983; Lo & Tashiro, 2011; McCracken & Brandt, 1987; Nayga, 1996; Prochaska & Schrimper, 1973; Redman, 1980; Yen, 1993). Several authors confirmed that the probability and amount of production time for FAH tend to decrease as the value of home time increases (Mancino & Newman, 2007; Möser, 2010).

Additionally, research has been conducted on the interchangeability of time and money among FAH. For instance, Hamermesh (2007) analyzed time diaries and expenditure data for the US between 1985 and 2003 to determine how households combined time and goods input into FAH. These results indicate that the substitution of goods for time becomes difficult as the price of time increases. Hamermesh (2008) analyzed the relative difficulty of goods–time substitution in home food production using time-diary and expenditure data for a sample of American households in 2003 and 2004. These results indicate that goods–time substitution in food production is challenging. Huffman (2011) developed a household production model to estimate the demand for FAH and FAFH and applied it to the analysis of the US household sector during the second half of the twentieth century. The findings show that FAH and FAFH are substitutes, whereas the price and income elasticities of demand for FAH are approximately twice as large as those for FAFH.

Illnesses caused by unhealthy habits impose monetary costs on society. In recent years, considerable attention has been paid to policies designed to improve eating and exercise habits. Countries have implemented various programs to assist people in maintaining a healthy diet and transitioning from FAFH to FAH. For example, the Supplemental Nutrition Assistance Program in the US was introduced to improve the health of low-income individuals by assisting them with food purchases. Davis and You

(2011) argued that the time cost of food preparation at home was overlooked and questioned the program's effectiveness. Individuals' ability to allocate time to various activities is limited. It is essential to identify activities that are interchangeable with meal preparation. Furthermore, Scharadin and Jaenicke (2020) reported that the time spent on secondary childcare is negatively correlated with the Healthy Eating Index of the household, whereas the time spent on primary childcare is positively correlated.

All of the aforementioned studies confirmed the degree of time substitution between activities. However, they also confirmed that the degree varies among households based on income, time cost, occupation, and the presence of children.

We do not encounter a circumstance in which an exogenous shock uniformly alters time allocation, because time allocation is the ultimate choice for an individual. Additionally, we do not encounter a situation in which the value of time decreases as economic development tends to increase its value. Therefore, we believe that the COVID-19 pandemic presents a unique opportunity to examine how the relaxation of time constraints influences household food consumption behaviors. Did people return from FAFH to FAH when the COVID-19 outbreak eased the time restrictions? If so, what type of person returned? The following empirical analysis aims to answer these questions.

3. Background information regarding the COVID-19 outbreak in Japan

Time-series changes in the number of newly infected individuals in Japan are shown in Figure 1. The first person was confirmed to have been infected on 15 January 2020. As the number of infected people increased rapidly by the end of March 2020, the government proclaimed the first state of emergency in the Kinki and Tokyo metropolitan areas. On 16 April, the government expanded its coverage nationwide. Although strict prevention measures, including the closure of elementary and junior high schools, were introduced during the first state of emergency, they were completely lifted on 25 May. The government continued to urge the public to refrain from moving between prefectures but eased such self-restraint of movement on 19 June. Although the number of infected people started to increase again soon after the movement restriction was relaxed, the government started the "Go-to-travel campaign," a subsidized travel promotion program, on 22 July in the regions outside of Tokyo. This was done to assist the

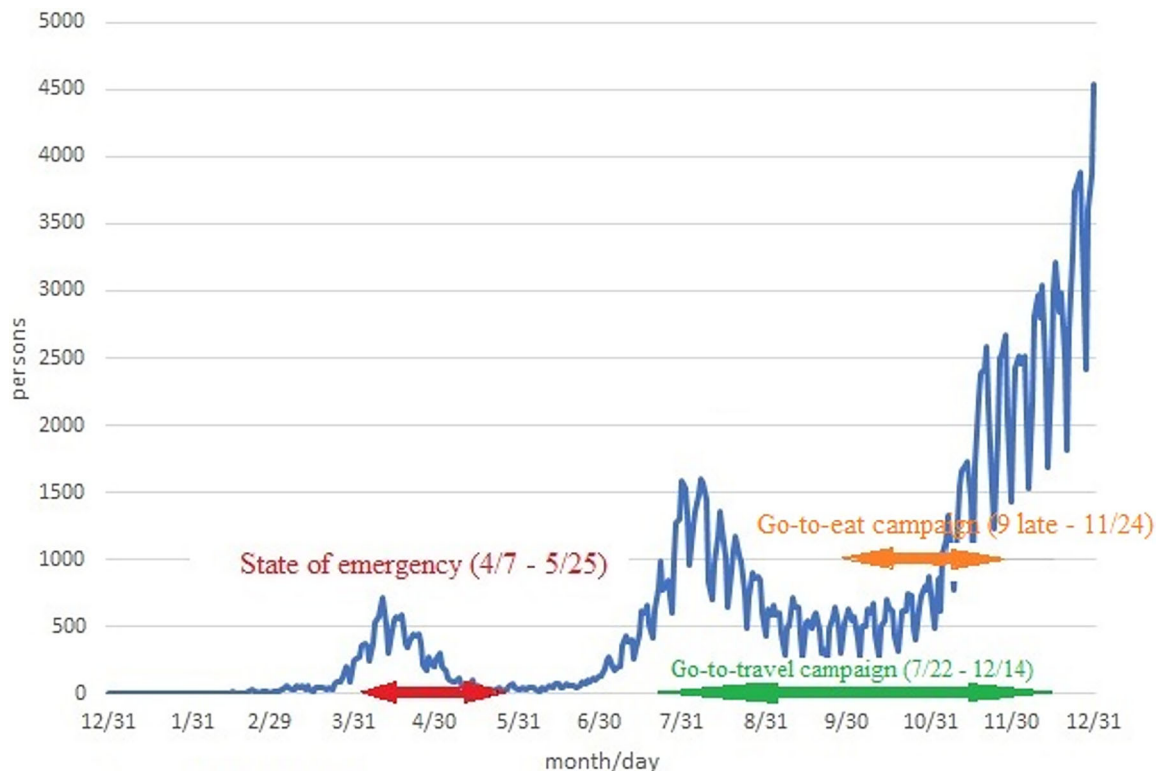


Figure 1. The number of infected persons in 2020. Source: NHK (2022).

damaged tourism industry.⁴ Tokyo residents were allowed to use this travel campaign program, beginning on 1 October and running until 14 December. After the second outbreak in the summer, the government urged restaurants to implement voluntary infection control measures. For instance, restaurants were asked to shorten their service hours from 3 August to 31 August. Despite beginning in late September, the “Go to eat campaign,” which distributed coupons redeemable at restaurants, ended on 24th November.

Although there was a temporary increase in eating out as COVID-19 subsided, the food service industry remained depressed until 2020. Similar to other countries, the Japanese government provided a support fund for the food service industry. However, because the support fund was provided in a form that did not accurately reflect the business scale, large-scale firms received less support than small firms. For example, there was little difference in funding between small and large restaurants.

4. Data

We analyze panel data on household spending purchased from Macromill, Inc.⁵ Macromill Household Spending (MHS) data consists of spending information for survey monitors gathered via online surveys.⁶ Macromill requests that the survey monitors download a household account book application to scan receipt data. Survey monitors must enter pertinent information manually if the receipt information cannot be scanned using the application. Macromill compensates the panel survey monitors more than usual for online surveys to obtain reliable information. In this study, we utilize biweekly food expenditure data. While Macromill, Inc. retains the right to distribute the data, purchasers have the right to analyze and report the results.

The study areas include Tokyo (Saitama, Chiba, Tokyo, and Kanagawa), Tokai (Gifu, Shizuoka, Aichi, and Mie), and Kinki (Shiga, Kyoto, Osaka, Hyogo, Nara, and Wakayama). To focus on households that accurately report spending information using the application, we only include households that routinely spent 10,000 yen or more on food in the previous two weeks. The survey period is from 1 January 2019, to 31 December 2020, and the number of households is 1448.⁷

The MSH database contains information on socioeconomic characteristics. Table 1 summarizes the information regarding the survey monitors and their households. The average age of the survey monitors is 49.3 years old, and their average family size is 2.9 members. The table reveals that 70% of monitors are female, 80% are married, and 80% have children younger than 19 years. As the primary food shoppers in numerous households, the proportion of women naturally increases relative to men. There are differences in food consumption behaviors between men and women, with men being more likely to dine out.

Table 2 demonstrates the family and job types of the survey monitors. Approximately half the monitored households consist of couples and children. Approximately 13.5% of households are single-person households, whereas approximately 22.3% of households are couple-only. Owing to the urban setting of the survey area, the household size of the survey monitor is relatively small. In terms of occupation, 34.2% of the survey monitors are homemakers and 25.4% hold part-time jobs. Approximately one-third of the survey monitors have full-time jobs.

This study examines the aforementioned food spending panel data to determine whether dietary habits have changed due to COVID-19. Table 3 demonstrates that the average household’s annual total food spending is 747,825.4 and 772,267.6 JPY in 2019 and 2020, respectively. Therefore, annual spending on all foods increases by 3.2%. In 2019 and 2020, the average household FAH spending is 637,382.0 and 686,684.6 JPY, respectively. Therefore, annual spending on FAH increases by 7.5%. FAFH spending decreases dramatically between 2019 and 2020. On average, it decreases by 36.9%. Finally, there is a

Table 1. Descriptive statistics of the survey monitors.

	Average or share	Standard error	Minimum	Maximum
Age	49.3	9.7	27	65
Number of persons in a family	2.9	1.2	1	5
Female dummy	0.7		0	1
Marriage dummy	0.8		0	1
Children under 18 dummy	0.7		0	1

Table 2. Family type, job type, and prefecture (%).

Family type		Job type		Prefecture		
		Male	female			
Single-person	13.5	No job	0.4	46.2	Saitama	10.6
Couple-only	22.3	Homemaker	12.7	1.7	Chiba	6.5
Parents-and-children	49.3	Student	0.2	0.0	Tokyo	20.0
With seniors	4.6	Part-time job	7.7	31.7	Kanagawa	14.2
Single-parent	6.7	Freelance	2.7	1.1	Gifu	2.0
With non-relatives	1.2	Self-employed	6.7	1.7	Shizuoka	3.3
Others	2.6	President or executive	3.9	0.2	Aichi	11.0
		Office worker (clerk)	15.2	9.9	Mie	2.0
		Office worker (technical)	25.8	2.0	Shiga	1.7
		Office worker (other)	19.6	3.7	Kyoto	3.7
		Public servant	3.4	0.4	Osaka	14.6
		Other	1.8	1.5	Hyogo	7.8
					Nara	1.3
					Wakayama	1.2
Total	100.0	Total	100.0	100	Total	100.0

Table 3. Annual food spending before and after COVID-19.

	Before (2019) JPY	After (2020) JPY	Change %
Total	747,825.4	772,267.6	3.2%
Food-at-home (FAH)	637,382.0	686,684.6	7.5%
Food-away-from-home (FAFH)	95,150.3	65,804.2	-36.9%
Take-out and delivery (FDS)	15,293.1	19,778.8	29.3%

29.3% increase in FDS spending. The data clearly show that people stopped eating at restaurants and began consuming food at home.⁸

5. Empirical model and results

5.1. Time series change in food spending expenditure

We compare FAH, FAFH, and FDS expenditure shares for two weeks between 2019 and 2020. During the two weeks of the survey, households could not purchase storable foods such as seasonings and rice. Therefore, the analysis below is based on average spending over four weeks.⁹

Let $y_{h,p,k}^{19}$ and $y_{h,p,k}^{20}$ be household h 's expenditure for the k th type of food consumption in period p in 2019 and 2020, respectively. We approximate the expenditure share of the k th type of food consumption in 2020 using the following logarithmic rate formula:

$$s_{h,p,k}^{20} = \ln \left(\frac{y_{h,p,k}^{20} + 1}{\sum_k y_{h,p,k}^{20} + 1} \right). \quad (1)$$

As a household may not eat out or use delivery food services during the corresponding period, we add 1 to both the numerator and denominator.

To demonstrate how food consumption behavior changed following the COVID-19 outbreak, we first consider the following seemingly unrelated regression equations (SURE) model:

$$\begin{aligned} s_{h,p,FAH}^{20} &= \alpha_{FAH} s_{h,p,FAH}^{19} + \beta_{FAH} \tau_{h,p,T} + \Gamma_{p,FAH} \mathbf{D}_p + \Pi_{FAH} \mathbf{R}_i + \varepsilon_{h,i,p,FAH}, \\ s_{h,p,FAFH}^{20} &= \alpha_{FAFH} s_{h,p,FAFH}^{19} + \beta_{FAFH} \tau_{h,p,T} + \Gamma_{p,FAFH} \mathbf{D}_p + \Pi_{FAFH} \mathbf{R}_i + \varepsilon_{h,i,p,FAFH}, \\ s_{h,p,FDS}^{20} &= \alpha_{FDS} s_{h,p,FDS}^{19} + \beta_{FDS} \tau_{h,p,T} + \Gamma_{p,FDS} \mathbf{D}_p + \Pi_{FDS} \mathbf{R}_i + \varepsilon_{h,i,p,FDS}. \end{aligned} \quad (2)$$

We include the expenditure share in 2019 $s_{h,p,\cdot}^{19}$ to account for the difference in food consumption behavior among households before the COVID-19 outbreak. We would expect households to spend similar proportions on the three food categories last year if conditions were the same as last year, i.e. α is expected to be one.

When more money becomes available for food purchases, households do not increase their spending in the three food categories to the same extent. For example, wealthier households spend more time eating out. Owing to the COVID-19 pandemic, there may have been changes in retail food prices and

household income, which can affect total food expenditure. The variable $r_{h,p,T}$ is the logarithmic rate of change in total food spending. The associated parameter β quantifies the change in the expenditure share of the k^{th} type of food consumption caused by an increase in total food spending.

We include the period-specific dummy variable D_p to account for the difference between the sampling periods in 2020. The parameter Γ quantifies the period-specific effects, which are the most important variables for the present study. This parameter is the average percentage change in share among food categories observed during a given period, indicating the impact of the state of emergency and go-to campaigns.

We impose the following estimation constraints to accurately investigate how choices among the three meal types (FAH, FAFH, and FDS) changed:

$$\gamma_{p,FAH} + \gamma_{p,FAFH} + \gamma_{p,FDS} = 0. \quad (3)$$

This constraint necessitates the reallocation of funds intended to purchase a particular type of meal during each period to purchase a different type of meal. For example, if households reduce their FAFH expenditure, they would increase their FAH or FDS expenditure.

The infection status and regulatory situation differ by region; hence, we include prefecture dummies R_i in the estimation model. Finally, the error terms of $\varepsilon_{h,i,p,FAFH}$, $\varepsilon_{h,i,p,FAH}$, and $\varepsilon_{h,i,p,Deli}$ are allowed to be corrected.

Unsurprisingly, all three expenditure variables in Equation 3 reach statistical significance at the 1% level; therefore, the expenditure share in the previous year has explanatory power in the present year.

Although the logarithmic rates of change in total food expenditure reach statistical significance in the FAH and FAFH models at the 1% level, they are significant in the FDS model at the 5% level. The estimated parameters are $\hat{\beta}_{FAH} = -0.048$, $\hat{\beta}_{FAFH} = 0.209$, and $\hat{\beta}_{FDS} = -0.087$. The results suggest that the share of expenditure on FAFH increases relative to FAH and FDS as total expenditure on food increases.

Figure 2 shows the variations in the expenditure shares of FAH, FAFH, and FDS over the sampling period. Each period's vertical height of the curve is related to the value of the parameter γ_p in Equation 2. The figure shows that the share of FAFH is high at the beginning of the year compared to the previous year but begins to decline as the infection spreads. With a decrease of approximately 1.8% from the previous year, FAFH's share experiences the greatest decline during the state of emergency declaration.¹⁰ Although a portion of the decline increases FAH's share, the majority increases FDS's share because a large portion of the money spent eating out goes to FDS.

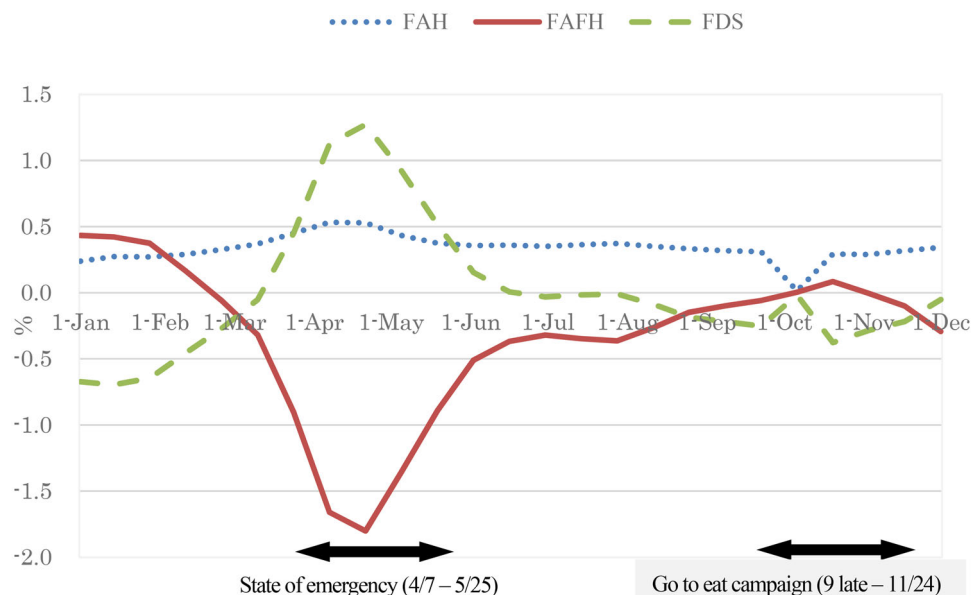


Figure 2. Change in expenditure share.

The rapid increase in FDS usage aligns with the findings of Grashuis et al. (2020) and Chenarides et al. (2021) in the US. However, we find that this increase in FDS is temporary. People stopped using FDS after the state of emergency was lifted. Figure 2 shows that households reduce their use of FAFH and FDS while increasing their use of FAH only. As FDS includes restaurant take-out meals, restaurants are likely unable to compensate for the decline in in-store sales by increasing take-out meal sales.

Furthermore, Figure 2 shows that FAH's share remains consistently high throughout the year. However, during the "Go to Eat Campaign," FAH's share decreases. In fact, at the beginning of October, the proportions of expenditure on the three meal types are approximately the same as those in the previous year.

These findings demonstrate that while the state of emergency reduced FAFH, the "Go to Eat Campaign" increased it. Therefore, these policies were effective in persuading people to change their food consumption habits, although it is unclear whether they were also effective for infection control.

5.2. Who changed food consumption behavior?

In the previous section, we confirmed that during the state of emergency, the average household reduced its FAFH spending and increased its FAH and FDS spending. After the state of emergency was lifted, households ceased using FDS and were compensated for a significant portion of the FAFH reduction with an increase in FAH. We expect that the pattern and intensity of this shift in food consumption will vary by household type. This section classifies households into various groups and compares the patterns and magnitudes of shifts in food consumption across these groups. Using a subsample of each group, we estimate the empirical model specified in Equation 2.

We initially compare differences in food consumption patterns between married and unmarried households. Table 4 shows the change in expenditure share brought about by an increase in overall food spending. The table demonstrates that, as total food expenditure increases, married and unmarried households decrease their FAH share but increase their FAFH and FDS shares. The table also shows that the share of FAFH increases much faster in unmarried households than in married ones.

Figure 3 compares the changes in FAH, FAFH, and FDS spending shares over time. During the state of emergency, both married and unmarried households reduced their FAFH spending and increased their FDS spending. After the state of emergency was lifted, married households began spending less on FDS than in the previous year, whereas unmarried households continued to spend the same amount. It has been confirmed that married households adjusted their food consumption behavior more smoothly than unmarried households throughout the year in response to the COVID-19 pandemic.

Next, we examine how changes in food consumption behavior differed according to family type. Specifically, we compare the change in expenditure shares among single-person, couple-only, parent-child, senior, and single-parent households.

Table 4 compares the changes in the expenditure share caused by the increase in total food spending. All three expenditure share variables became statistically significant in households with a parent and children, but not all of them did in the remaining households. According to the estimated parameters shown in the table, as the total food expenditure increases, single-person households increase their FAFH the fastest, followed by couple-only households. Meanwhile, households with seniors tend to increase FDS faster than other households as the total food expenditure increases.

Table 4. Change in the expenditure share caused by the total food spending increase (β).

Comparison	Groups	Num. of households	FAH	FAFH	FDS
Marital status	Married	326	-0.048***	0.135***	-0.106***
	Unmarried	1122	-0.063***	0.636***	-0.026
Family type	Single-person	194	-0.096***	0.644***	-0.083
	Couple-only	316	-0.054***	0.349***	0.029
	Parents-and-children	722	-0.046***	0.097**	-0.151***
	With senior	65	-0.052	-0.058	0.521***
	Single-parent	96	-0.005	-0.068	-0.304**
Job type	Homemaker	578	-0.038**	0.065	-0.132**
	Part-time job	350	-0.061***	0.273***	-0.087
	Full-time job	520	-0.032*	0.082	-0.272***

Note. ***, **, and * indicate statistically significant at the 1%, 5%, and 10%, respectively.

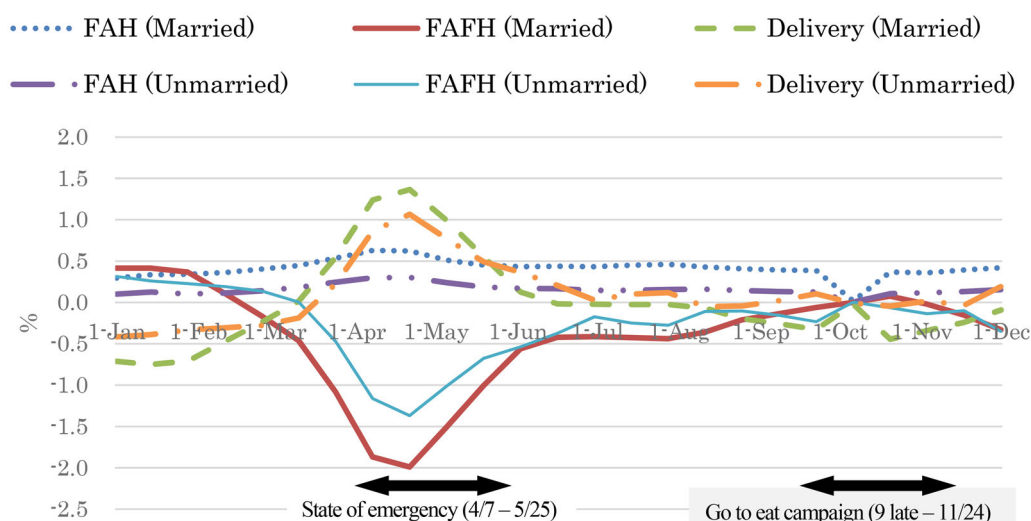


Figure 3. Married vs. unmarried households.

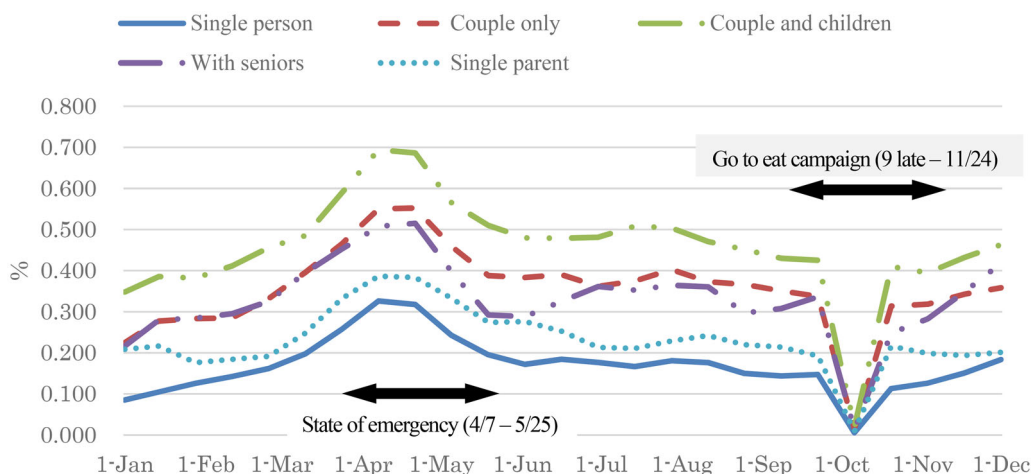


Figure 4. Change in FAH expenditure by household types.

Subsequently, we examine how food consumption habits changed by household type during the survey period. For brevity, Figure 4 shows only changes in FAH spending. This demonstrates that, although all households increased or decreased their FAH share in a similar pattern, the magnitudes of the changes varied by household type. The figure specifically shows that households with couples and children adjusted their food consumption behavior most smoothly in response to COVID-19 infection and its countermeasures. This is because the size of households comprising couples and children is often larger than that of the remaining households, and children who usually ate outside the home began eating at home after the COVID-19 outbreak. Figure 4 demonstrates that single-person and single-parent households did not significantly increase their FAH. This suggests that these households struggle to find more time to prepare meals at home.

Finally, we examine whether employment status influences food consumption behaviors. The respondents' occupations are recorded in the Macromill survey, but their spouses' occupations are not. Given that most male respondents work full-time (Table 2) and that women prepare meals more frequently than men in Japanese households, we focus on the records of female respondents. The types of employment status are further divided into three categories: homemaker (no job and homemaker), part-time job, and full-time job (all remaining). We then investigate whether differences in employment status contributed to a shift in food consumption behavior.

Table 4 compares the shift in expenditure share caused by an increase in total food spending according to employment status. Regardless of the employment status, we obtain the same sign for all three

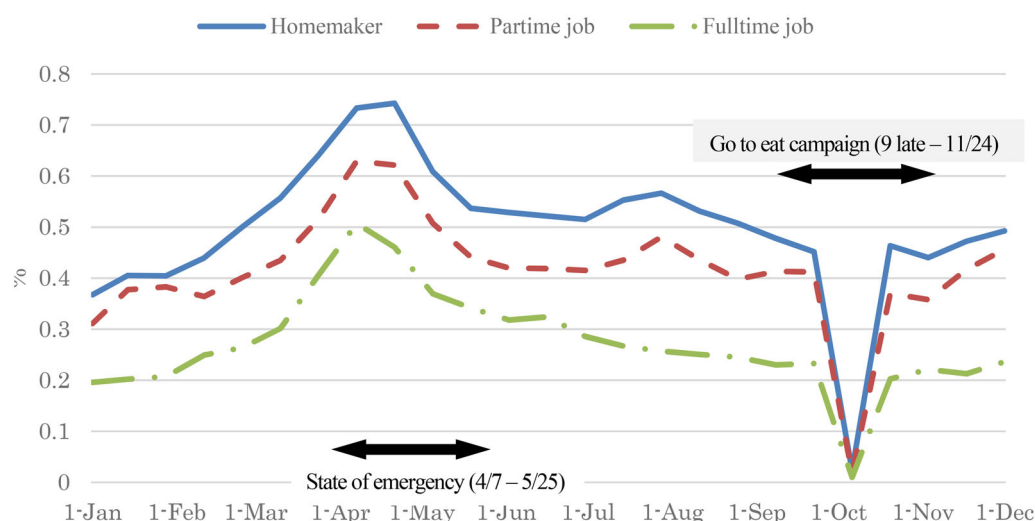


Figure 5. Change in FAH expenditure by job type (Female respondents only).

meal types: FAH, FAFH, and FDS are negative, positive, and negative, respectively. The findings imply that as the household's total food expenditure increases, it increases FAFH share but decreases FAH and FDS shares. The parameters obtained show that households with wives who work part-time experience the greatest changes in their food consumption patterns in response to an increase in overall food expenditure; they experience the greatest transition from FAH to FAFH with an increase in income.

We examine changes in food consumption behavior according to employment status during the survey period. Again, for brevity, Figure 5 shows only the changes in FAH spending. This demonstrates that, while all households experienced an upward or downward trend in their FAH share, the magnitudes of the changes varied depending on employment status. The figure demonstrates that FAH spending increased significantly in households where women were homemakers but only slightly in those where women worked full-time.

6. Summary of the findings and limitations of the study

We began spending more time at home during and after the COVID-19 pandemic, which significantly affected food consumption behavior. Using household spending panel data, this study examined how households changed their food consumption behaviors at the onset of the COVID-19 outbreak. We observed the shift from FAFH to FDS at the start of the COVID-19 outbreak; however, this shift stopped after the state of emergency was declared. As households became accustomed to the COVID-19 lifestyle, they began to compensate for the decrease in FAFH spending by increasing FAH spending.

The results show that the degree of the shift from FAFH to FAH or FDS varied over the sampling period. Specifically, the shift was maximized when the first state of emergency was declared. According to the estimation results, although FAFH expenditures decreased by approximately 2%, FAH and FDS expenditures increased by approximately 0.7% and 1.3%, respectively. The magnitude of the shifts among FAH, FAFH, and FDS significantly reduced after the state of emergency was lifted.

We also found that the degree of the shift from FAFH to FAH or FDS varies by household; both single-person and single-parent households exhibit a small shift, whereas households with parents and children exhibit a large shift.

This study can be extended in several directions. Although this study compares food consumption behaviors between sampling periods, changes in the time allocation for each household were not considered in detail. An analysis using more detailed data on household time allocation is necessary for more accurate empirical analysis. This study did not consider accessibility to FAFH and FDS. People who use FAFH or FDS more intensively are more likely to live in areas where such services are readily available. Therefore, it is necessary to study how accessibility to FAFH and FDS affects food consumption.

The analysis in this study assumes that each household purchases food in the same way each year unless socioeconomic conditions change. The study was conducted using a SURE model to examine how policies introduced to address COVID-19 might change food expenditure patterns. The analysis used two weeks of data from three major food categories to avoid the problem of time-series correlations in food expenditure. However, there are many types of food purchased for FAH, and given that people were trying to shop less frequently during the COVID-19 pandemic, it is possible that they were buying foods that were easier to store. Therefore, it may be necessary to look more closely at the patterns of food purchases during the COVID-19 pandemic. A panel data analysis would be helpful for this purpose.

7. Discussions

People must spend time shopping for groceries and cooking to prepare meals at home. Our analysis indicates that even during the COVID-19 pandemic, when more time was available at home, single-person and single-mother households struggled to prepare meals. These findings suggest that even if policies promote healthy and affordable foods, households with busy daily routines may not prioritize improving their eating habits. Supporting households with limited time and unassisted household chores is crucial to promote healthy eating. Without such support, it is unlikely that households, especially single-person and single-parent households, will be able to adopt healthy eating habits.

One final point concerns the use of FDS. Our analysis shows that people increased their use of FDS during the state of emergency, but as soon as the state of emergency was lifted, they reduced it. However, they began to increase their use of FAFH. Although the number of infected people increased after the state of emergency, they continued to return from FDS to FAFH. This suggests that people regard FDS as a secondary means when FAFH is unavailable.

Notes

1. International Monetary Fund (2020) projected that the global growth would be – 4.9% in 2020.
2. The COVID-19 pandemic led to health-related concerns, workplace harassment, an economic crisis, problems with energy consumption, and food security challenges worldwide (Zhuang et al., 2022).
3. According to some surveys, the residential energy consumption increased after the COVID-19 pandemic period. Sabau (2020) analyzed US energy consumption in the first three months following a lockdown and reported that energy consumption in the residential sector increased by 8%. The Jyukankyo Research Institute and Inc (2020) confirmed that energy consumption in Japan between April and June 2020 increased by 3.2% per household from the same period of the previous year.
4. The tourism and leisure industry has been affected the hardest by COVID-19 and is among the most severely impacted global industries (Abbas et al., 2021).
5. Macromill, Inc., is a Japan-based company engaged in the provision of marketing research and digital marketing solutions primarily online.
6. There are several empirical studies that use the MHS data (Kato & Hoshino, 2021; Ujiie, 2022).
7. According to the Ministry of Internal Affairs and Communications (2024), households in the bottom 20% of income spend an average of 10,000yen per week on food. Therefore, households that recorded less than 10,000yen every two weeks may have yet to report their food expenditures in the survey.
8. The rates of change in the consumer price index from 2019 to 2020 were 0% for all items, 1.3% for food, and 2.1% for eat out (Statistics Bureau of Japan, 2021).
9. For example, the sum of the expenditures from the 1st to the 14th and from the 15th to the 28th divided by 2 was defined as the expenditure from the 1st through the 28th. Similarly, the sum of the expenditures from the 15th to the 28th and from the 29th to the 12th of the following month divided by 2 was defined as the expenditure from the 15th to the 12th of the following month.
10. Table 3 shows the percentage change in FAH, FAFH, and FDS expenditures from the previous year. Equation 2, however, examines the change in the share of expenditures on FAH, FAFH, and FDS; the share of expenditures on FAH does not change much because the share of expenditures on FAH is nearly 85% of the total.

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Author's contribution

This study was conducted by two authors. The first author obtained partial funding to carry out the research, analyze the data, and write the paper. The second author obtained most of the funding to conduct the study, support the data analysis, and write the paper.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

All data used in this study can be purchased from Macromill, Inc.

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