



Effects of the COVID-19 Pandemic on Dietary Practices for Mothers in Japan

Wu, Lin

Wu, Miao

Ishida, Akira

(Citation)

Women, 2(3) :264-273

(Issue Date)

2022-08-25

(Resource Type)

journal article

(Version)

Version of Record

(Rights)

© 2022 by the authors. Licensee MDPI, Basel, Switzerland.
Creative Commons Attribution license

(URL)

<https://hdl.handle.net/20.500.14094/0100483392>





Article

Effects of the COVID-19 Pandemic on Dietary Practices for Mothers in Japan

Lin Wu , Miao Wu and Akira Ishida *

Graduate School of Agricultural Science, Kobe University, Kobe 657-0013, Japan

* Correspondence: akira_ishida@people.kobe-u.ac.jp; Tel.: +81-78-803-5844

Abstract: To the best of our knowledge, changes in mothers' dietary behaviors or perceptions of dietary intake during the COVID-19 pandemic have not been extensively discussed. Therefore, the present study aimed to clarify how the dietary behaviors of mothers living with their children changed during the pandemic in Japan. Ordered probit and interval regressions were applied to individual data for mothers living with children under 18 years of age from five independently conducted Surveys of Attitudes toward Food and Nutrition Education (*Shokuiku* in Japanese). The estimation results showed that although mothers were more likely to eat dinner with their families during the pandemic, attention to healthy dietary practices, frequency of eating nutritionally balanced food, and dietary practices for preventing lifestyle-related diseases were negatively affected by the pandemic. In conclusion, mothers were more likely to decrease their commitment to a healthy and well-balanced diet during the pandemic than before it. Further research based on the latest datasets with detailed information over the long-term is required.

Keywords: COVID-19; dietary practice; mothers; Japan



Citation: Wu, L.; Wu, M.; Ishida, A. Effects of the COVID-19 Pandemic on Dietary Practices for Mothers in Japan. *Women* **2022**, *2*, 264–273. <https://doi.org/10.3390/women2030025>

Academic Editor: Mary V. Seeman

Received: 16 July 2022

Accepted: 17 August 2022

Published: 25 August 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has rapidly spread worldwide since the first case of the infectious disease was recognized in December 2019 in Wuhan, China. Consequently, the World Health Organization (WHO) declared the outbreak of COVID-19 a global pandemic on 11 March 2020 [1]. A state of emergency was declared in many countries where confinement measures to prevent the spread of infectious diseases among the public were taken not only to encourage them to stay at home and practice social distancing but also to limit public gatherings, suspend events with audiences, and/or lockdown cities in the worst case. This was also the case in Japan. To cope with the increasing number of people infected with COVID-19 at the end of March and beginning of April 2020, the first quasi-state of emergency related to COVID-19 was declared nationwide in April 2020. The government required the public to refrain from travelling and moving around unnecessarily, various facilities to close or shorten their operational hours, firms to increase the share of employees working from home, and bars and restaurants to stop serving alcoholic beverages to customers. Although it was fully lifted by the end of May 2020, the quasi-state of emergency was reinstated to cope with the third wave of the pandemic in January 2021, and the three additional waves prevented from fully lifting preventive measures as of May 2022.

Many studies have pointed out that measures of movement and behavioral restrictions during the COVID-19 pandemic have caused various and sometimes contradictory effects on dietary practices among the public [2]. For example, some studies pointed out favorable changes in dietary practices, such as an increased consumption of vegetables and fruits [3–5]; a decreased consumption of sugary drinks [3], alcoholic beverages [4], fried foods [4,5], and processed foods [6]; a decline in the desire for sweet and fatty foods [7]; a decreased frequency of uncontrolled and emotional eating [7]; and an increased number

of people improving their dietary practices during the COVID-19 pandemic compared to before it [4,8]. Conversely, decreased consumption of fresh foods such as fresh fruit and vegetables [9,10]; increased consumption of fast food [9], convenience food [10], comfort foods such as chocolate, ice cream, and desserts [11], and energy-dense unhealthy foods [12]; and a higher degree of emotional or binge eating [13,14] have been reported. Increased snacking, mainly because of increased time spent at home, has also been reported [13–15].

As for gender differences, several studies pointed out that women were more likely to eat more [3] and to increase the intake of ultra-processed foods [12], high-calorie snacks [12,16], sweets [15], and fruit/vegetables [10,12] in a situation of confinement where they were prone to feeling pressure and depression. Giacalone et al. [13] concluded that women were more affected by confinement than men. However, to the best of our knowledge, few studies have analyzed the effects of COVID-19 on the dietary practices of mothers living with their children. This is also the case in Japan, where mothers are the main person in charge of cooking in a family with children in most cases. Many studies [17–19] point out that mothers’ dietary behaviors or perceptions of dietary intake affect those of their children directly or indirectly, indicating that changes in mothers’ dietary behavior during the pandemic could affect the dietary behavior and nutrition intake of school or preschool children. Therefore, the present study aimed to clarify how the dietary behaviors of mothers living with their children changed during the pandemic in Japan.

2. Results

2.1. Subjects’ Characteristics

The frequencies and means of each independent variable are listed in Table 1. Of the 1209 mothers, 97 (8.0%) were single mothers; and 73 (6.0%) were in their 20s; 409 (33.8%) in their 30s; 591 (48.9%) in their 40s; and 136 (11.3%) in their 50s; and 204 (16.87) were living in Tokyo Metropolitan area or ordinance-designated cities in Kanto and Kansai regions. The 5-point Likert scales of subjective economic situation and subjective time to spare in daily life were 3.17 ± 0.95 and 2.75 ± 1.12 , respectively.

Table 1. Subject characteristics.

Characteristics	Total = 1209	
Age		
20–29 years old	73	(6.04)
30–39 years old	409	(33.83)
40–49 years old	591	(48.88)
50–59 years old	136	(11.25)
Single parent		
Yes	97	(8.02)
No	1112	(91.98)
Likert scale for subjective economic situation	3.17	SD = 0.95
Likert scale for subjective time to spare in daily life	2.75	SD = 1.12
Dummy for region densely populated		
Kanto and Kansai 1 (Tokyo Metropolitan area and ordinance-designated cities such as Saitama, Chiba, Yokohama, Kawasaki, Sagamihara, Kyoto, Osaka, Sakai, and Kobe)	204	(16.87)
Others	1005	(83.13)
Dummy for survey years		
During the COVID-19 (2020)	262	(21.67)
Before the COVID-19 (2016–2019)	947	(78.33)

The Kanto region comprises the Tokyo Metropolitan area and the six prefectures of Ibaraki, Tochigi, Gunma, Saitama, Chiba, and Kanagawa; the Kansai region includes the six prefectures of Nara, Wakayama, Kyoto, Hyogo, Shiga, and Osaka.

Table 2 shows the mean scores of dietary practices and *p*-values using the *t*-test with 1209 degrees of freedom before and during the COVID-19 pandemic. Although there were no differences in the frequency of eating breakfast, practice of chewing food, and frequency of eating breakfast with family before and during the pandemic, mothers were likely to pay less attention to healthy dietary practices, eat nutritionally balanced food less frequently,

practice diet for preventing lifestyle-related diseases less frequently, and eat dinner with family more frequently during the pandemic compared to before the pandemic.

Table 2. Mean scores of dietary practices before and during the COVID-19 pandemic.

Dietary Practice	Before the Pandemic	During the Pandemic	t-Value ¹	p-Value ¹
Attention to healthy dietary practices	3.05 ± 0.60	2.90 ± 0.59	3.4626	0.001
Frequency of eating nutritionally balanced food	4.56 ± 1.84	3.90 ± 1.94	5.0317	0.000
Frequency of eating breakfast	5.37 ± 1.60	5.15 ± 1.87	1.9273	0.112
Dietary practices for preventing lifestyle diseases	2.78 ± 0.72	2.60 ± 0.66	3.5014	0.001
Practice of chewing food slowly	2.45 ± 0.83	2.34 ± 0.75	1.9199	0.055
Frequency of eating breakfast with family	4.25 ± 2.44	4.17 ± 2.42	0.4719	0.637
Frequency of eating dinner with family	5.20 ± 1.61	5.52 ± 1.23	-2.9265	0.004

¹ Calculated by t-test (df = 1207).

2.2. Estimation Results by Ordered Probit and Interval Regressions

Tables 3 and 4 present the estimation results. The null hypothesis that “the coefficients of all explanatory variables except the constant term are equal to zero” was rejected at the 1% level (the test statistic following a chi-square distribution with 49 degrees of freedom was 242.35). Additionally, the signs of the estimated coefficients are generally consistent with those reported in previous studies, suggesting that the estimation results are relatively good. As for the correlations among the error terms across seven estimated equations, 19 of the 21 correlation coefficients (rho) were significant at the 1% or 5% level. Therefore, it seems more appropriate and accurate to use the method presented by Roodman [20] to estimate the parameters simultaneously rather than solve the seven equations separately.

Table 3. Estimation results (ordered probit regression).

Dependent/Independent Variables	Attention to Healthy Dietary Practices		Dietary Practices for Preventing Lifestyle Diseases		Practice of Chewing Food Slowly	
	Coef.	Std.Err ¹	Coef.	Std.Err	Coef.	Std.Err
Dummy for age (reference: 20s)						
30s	0.120	0.147	0.239	0.141	-0.167	0.138
40s	0.080	0.143	0.309	0.137 *	-0.084	0.135
50s	0.284	0.167	0.491	0.161 **	-0.004	0.157
Dummy for single-parent mother (reference: No)						
Yes	-0.296	0.124 *	0.021	0.119	0.152	0.117
Subjective economic situation	0.139	0.037 **	0.137	0.036 **	0.066	0.035
Subjective time to spare	0.024	0.031	0.033	0.030	0.106	0.029 **
Dummy for survey years (reference: 2016–2019)						
During the pandemic (2020)	-0.269	0.090 **	-0.240	0.086 **	-0.102	0.084
Dummy for region densely populated (reference: others)						
Kanto and Kansai (Tokyo and ordinance-designated cities)	0.044	0.103	0.132	0.099	-0.069	0.097
Kanto and Kansai × Survey years						
Kanto and Kansai × During the pandemic (2020)	-0.056	0.203	-0.178	0.193	-0.169	0.190
Cutoff 1	-1.990	0.222 **	-1.163	0.192 **	-0.877	0.184 **
Cutoff 2	-0.500	0.193 *	0.408	0.185 *	0.539	0.183 **
Cutoff 3	1.474	0.197 **	1.937	0.191 **	1.660	0.187 **

¹ ** and * indicate 1% and 5% significance, respectively.

For the dummies for each age group, although the coefficients were negative for frequency of eating breakfast and dinner with family for the older age group compared to their 20s counterparts, those were significantly positive for frequency of eating nutritionally balanced meals and dietary practice for preventing lifestyle-related diseases. The estimation results suggest that while older mothers are more conscious of developing healthy eating habits compared to younger mothers, they share relatively few meals with their families, especially in the 40s and 50s age group. The coefficients for single mothers were significantly negative for attention to healthy dietary practices, frequency of eating nutritionally balanced food, frequency of eating breakfast, and frequency of eating breakfast with family, indicating

that single mothers are less likely to have favorable dietary practices than married mothers. The coefficients for households' subjective economic status were significantly positive for attention to healthy dietary practices, frequency of eating nutritionally balanced food, and dietary practices for preventing lifestyle-related diseases, suggesting that subjective economic status does not affect dietary behaviors such as frequency of eating breakfast and eating meals with family, but does affect the frequency of healthy and nutritionally balanced meals.

Table 4. Estimation results (interval regression).

Dependent/Independent Variables	Frequency of Eating Nutritionally Balanced Food		Frequency of Eating Breakfast		Frequency of Eating Breakfast with Family		Frequency of Eating Dinner with Family	
	Coef.	Std.Err ¹	Coef.	Std.Err	Coef.	Std.Err	Coef.	Std.Err
Dummy for age (reference: 20s)								
30s	0.980	0.234 **	0.282	0.209	0.587	0.330	−0.180	0.260
40s	0.942	0.229 **	0.307	0.204	−0.059	0.322	−0.490	0.201 *
50s	1.179	0.266 **	0.291	0.237	−0.773	0.374 *	−0.554	0.234 *
Dummy for single-parent mother (reference: No)								
Yes	−0.717	0.199 **	−1.036	0.177 **	−0.756	0.279 **	−0.088	0.175
Subjective economic situation	0.168	0.059 **	0.041	0.053	0.148	0.083	0.100	0.052
Subjective time to spare	−0.008	0.049	0.002	0.044	0.073	0.069	0.101	0.43 *
Dummy for survey years (reference: 2016–2019)								
During the pandemic (2020)	−0.632	0.143 **	−0.103	0.128	−0.143	0.201	0.299	0.126 *
Dummy for region densely populated (reference: others)								
Kanto and Kansai (Tokyo and ordinance-designated cities)	0.218	0.163	0.133	0.146	−0.333	0.230	−0.228	0.144
Kanto and Kansai × Survey years								
Kanto and Kansai × During the pandemic (2020)	−0.187	0.320	−0.578	0.286 *	0.482	0.451	0.314	0.282
Constant	3.644	0.306 **	5.515	0.274 **	3.956	0.432 **	5.479	0.270 **
Sigma	1.801	0.038 **	1.604	0.034 **	2.556	0.052 **	1.581	0.033 **

¹ ** and * indicate 1% and 5% significance, respectively.

Regarding the discussion related to the pandemic, the coefficients for the dummy for the year 2020 (during the COVID-19 pandemic) were significantly negative for attention to healthy dietary practices, frequency of eating nutritionally balanced food, and dietary practices for preventing lifestyle-related diseases. However, the coefficient was significantly positive for the frequency of eating dinner with family, suggesting that although mothers were more likely to eat dinner with family during the pandemic, their dietary practices were negatively affected by the pandemic. Although the coefficients of the highly populated area variable show no significant effect on the explanatory variables, it is worth noting that the frequency of breakfast was negatively influenced for the mothers living in Tokyo, ordinance-designated cities in Kanto and Kansai region during the pandemic year. This shows that during the epidemic, mothers living in the above areas ate breakfast less frequently compared to other areas. Taken together, the above results indicate that more financially secure and time-committed mothers had better dietary practices, and being a single mother and dealing with the COVID-19 epidemic had a negative impact on their dietary practices to some extent, specially living in populated region may exacerbate the negative effects.

Here, we estimated the extent to which the COVID-19 pandemic affected mothers' dietary practices by comparing the marginal effect when each dependent variable had the largest value (=4) in the equation applying the ordinal probit model and the value of the coefficient in the equation applying interval regression. The probability of "always paying attention to healthy dietary practice" decreased by 6.7% during the pandemic from the predicted overall mean of 18.1%. The frequency of eating nutritionally balanced meals per

week decreased by 0.82 days in Kanto and Kinki and 0.63 days in other regions during the pandemic from the predicted overall mean of 4.91 days. The probability of “paying attention to careful dietary practices to prevent lifestyle diseases” decreased by 5.1% during the pandemic from a mean of 12.8%. The frequency of eating dinner with family increased by about 0.30 days per week compared to the mean of 5.74 days. These estimates indicate that although the COVID-19 pandemic increased the frequency of people eating dinner with their families, it decreased the attention paid to healthy dietary practices and the frequency of eating nutritionally balanced meals intended to prevent lifestyle diseases.

3. Discussion

The impact of the COVID-19 pandemic on the dietary practices of mothers living with children under 18 years of age was quantitatively examined, considering the effects of covariates such as age, household attributes (whether single-mother household or two-parent household), household’s subjective economic status, mother’s subjective time allowance and the residence place.

Since working mothers and their spouses often worked from home during confinement, mothers were more likely to have sufficient time to prepare meals for their family and eat together with their family during the pandemic. In fact, according to online surveys conducted by the Japanese government in 2020, 46.0% of parents living with children under the age of 18 could spend more time with their family [21], and of adults aged 20 or above, 26.5% cooked more often at home (only 1.3% cooked less often) and 20.0% ate meals together with family (4.5% cooked less often) [22] during the pandemic than before. The estimation results in Table 2 show that mothers’ frequency of eating dinner with their families increased significantly during the pandemic, which is consistent with the results of the above government surveys. Children were more likely to be at home at dinner time in a situation where nursery schools, elementary schools, junior high schools, and high schools were closed; club activities held after school were voluntarily suspended; and some schoolchildren learning at cram schools switched from face-to-face to remote methods. Furthermore, it was more likely that mothers, fathers, and other family members who were working before the COVID-19 pandemic started working from home during the pandemic or lost their jobs in the worst cases, making it easier for families to be together at home for dinner.

However, it should be noted here that the frequency of eating breakfast did not change between before and during the pandemic with the exception of the densely populated cities in Kanto and Kansai region where mothers were proved to significantly decrease their times of having breakfasts per week. In the meanwhile, there is no significant change on the frequency of having breakfast with family. A possible explanation for why the pandemic did not affect mothers’ frequency of eating breakfast with family is that although they had more time to spare at home during the pandemic, some adults and school children increased their sleep duration and tended to wake up late in the morning [23–25], and the waking times of family members might become more varied when they did not have to go to work or school. In addition, it has been reported that school children who wake up late when they are out of school during the pandemic tend to skip breakfast [24]. However, it seems that the long staying of family members at home gradually becomes the household chores and burden for parents and even the pressure. [26] It is reasonable that the risk of infection is relatively high in the highly populated cities, and residents voluntarily comply with the related requirements to reduce the risk of infection and transmission. Thus, it can be inferred that although the available time for mothers increased in the morning, the frequency of eating breakfast decreases among the mother living in the region with highly potential risk related to COVID-19 while maintaining the frequency of family breakfast together, partly due to keep with the changes in the family’s lifestyle in order to reduce the household work.

The estimation results also showed that attention to healthy dietary practices, frequency of eating nutritionally balanced food, and dietary practices for preventing lifestyle-related diseases were negatively affected by the pandemic, suggesting that mothers were

more likely to decrease their commitment to a healthy and well-balanced diet during the pandemic than before it.

As mentioned above, mothers' frequency of eating dinner with their families increased during the COVID-19 pandemic. Many empirical studies point out that, irrespective of gender, age, and nationality, eating together with family has various positive effects on dietary behaviors and, hence, health; conversely, eating alone has negative effects [27–31]. However, the results of the present analysis showed that, while mothers' frequency of eating dinner with their family increased, their eating habits did not improve (in fact, they worsened). The first reason for this is that mothers' housework and childcare burdens increased due to the presence of their spouse and children at home, who normally went to work or attended school, nursery school, or kindergarten. According to a government survey [21], of mothers with children aged under 18 years old, 33.8% and 21.9% increased time for housework and childcare in May and December 2020, respectively. Another government survey [22] reported that among adults aged 20 or above, 16.1% faced an increased temporal and physical burden of preparing meals, and only 1.6% faced a decreased burden. An analysis using daily schedule data in Japan also found changes in overall daily life behavior, including increased childcare and cooking at home [23]. The second reason is that mothers' shopping frequency was likely to decrease due to social distancing measures, leading to increased dependence on frozen and preserved processed foods. As in other countries, an increase in the number of people refraining from going out for shopping or a decrease in the number of shopping trips has been reported in Japan [32,33], both for fear of contracting COVID-19 and for the government's request not to go out on unnecessary errands. With regards to vegetable consumption, it is reported that there was a large increase in expenditure on cut vegetables, frozen vegetables, and easy-to-store onions, potatoes, and carrots [34]. Finally, stress due to behavioral restrictions may have increased.

According to previous studies, measures on movement and behavioral restrictions under the COVID-19 pandemic have caused various and sometimes contradictory effects on dietary practices among the public. Considering the above estimation results, we can conclude that the pandemic was more likely to deteriorate mothers' dietary behavior to some extent as of December 2020, when an online or mail survey was conducted in Japan.

This study had several limitations. First, the main limitation was that we used individual data from several cross-sectional surveys independently conducted before and during the outbreak of the COVID-19 pandemic to measure the effects of the pandemic on dietary practices for mothers with children under 18 years. Since the data used in the analysis were not longitudinal, but pooled data from each survey year, panel data analysis could not be applied. Second, we did not examine how the dietary practices of socially vulnerable children have been affected by the pandemic. Third, the 2016–2019 surveys were conducted in person by surveyors, while respondents answered mailed or online questionnaires themselves in the 2020 survey. The possibility that these differences in survey methods may have affected the results cannot be completely ruled out. Fourth, since objective data such as actual nutritional intake were not available from the obtained survey data, there was no other choice to use subjective responses regarding the mothers' dietary habits. Mothers' subjective answers did not always fully match the objective assessment. Finally, given that the pandemic did not end in 2021, a longer-term analysis using survey data from 2021 or 2022 would be necessary. Therefore, caution should be exercised when interpreting the results of the present study. Further research based on the latest dataset with more long-term detailed information is required to examine, more accurately and in detail, the effects of the COVID-19 pandemic on the dietary habits of mothers in long-term stressful situations.

4. Materials and Methods

We combined individual data for mothers living with children under 18 years of age from five independent Surveys of Attitudes toward Food and Nutrition Education (*Shokuiku* in Japanese). Five nationwide surveys were conducted by the Ministry of Agriculture,

Forestry, and Fisheries of Japan in November 2016, November 2017, October 2018, October 2019, and December 2020, respectively. Two-stage stratified random sampling was used to select 3000 people for the 2016–2019 surveys and 5000 people for the 2020 survey, all of whom were aged 20 years or older at the time of each survey. In the first four surveys, trained members conducted face-to-face interviews with those who agreed to participate in the study. However, due to the social distancing measures during the COVID-19 pandemic, respondents were asked to answer a questionnaire by themselves, either on paper or online in the fifth survey. A total of 1209 mothers living with children under 18 years old—specifically, 243 in 2016, 241 in 2017, 240 in 2018, 223 in 2019, and 262 in 2020—provided adequate data for further analyses.

As shown in Table 5, we used the following questions regarding dietary practices in the surveys, all of which were the same for all surveys: (1) “To what extent do you usually try to follow healthy dietary practices?” (attention to healthy dietary practices); (2) “How many days in an average week do you eat a main dish (an energy source of carbohydrates such as rice, bread, or noodles), main side dishes (main sources of protein and fat such as fish, meat, eggs, or soybean products), and sub-side dishes (source of vitamins, minerals, and fiber, which are limited in main dishes and main side dishes) simultaneously more than twice a day?” (frequency of eating nutritionally balanced food); (3) “How often do you usually eat breakfast?” (frequency of eating breakfast); (4) “For the prevention or amelioration of lifestyle diseases, to what extent do you actually practice a diet that takes care to maintain an appropriate weight and reduce salt?” (dietary practices for preventing lifestyle diseases); (5) To what extent do you usually chew your food slowly and well? (practice of chewing food); (6) “How often do you eat breakfast with your family?” (frequency of eating breakfast with family); and, (7) “How often do you eat dinner with your family?” (frequency of eating dinner with family).

Given that responses regarding questions (1), (4), and (5) are ordinal in nature, ordered probit regression was used to examine the effects of the COVID-19 pandemic on the dietary practices of mothers living with children under 18 years of age. Since the responses to the remaining questions (2), (3), (6), and (7) were interval in nature, interval regression was applied. In estimating the parameters of the seven equations, correlations may exist between the error terms of each equation, which do not affect the unbiasedness but result in a decrease in the efficiency of the estimators [35]. Therefore, we applied Roodman’s [20] *cmp* command of Stata version 17.0 (StataCorp LLC, College Station, TX, USA) for data analysis with a significance level of 0.05.

Table 5. Questions and the scales used to measure various dimensions of dietary practices.

Questionnaire Sentences	Scales of Alternatives
(1) Attention to healthy dietary practices To what extent do you usually try to follow healthy dietary practices?	4 = very high, 3 = high, 2 = low, 1 = very low
(2) Frequency of eating nutritionally balanced food How many days in an average week do you eat a main dish (an energy source of carbohydrates such as rice, bread, or noodles), main side dishes (main source of protein and fat such as fish, meat, eggs, or soybean products), and sub-side dishes (source of vitamins, minerals, and fiber, which are limited in main dishes and main side dishes) simultaneously more than twice a day?	4 = almost every day (six to seven days per week), 3 = four to five days per week, 2 = two to three days per week, 1 = less than one day per week
(3) Frequency of eating breakfast How often do you usually eat breakfast?	Same as scales with 2

Table 5. Cont.

Questionnaire Sentences	Scales of Alternatives
(4) Dietary practices for preventing lifestyle diseases For the prevention or amelioration of lifestyle diseases, to what extent do you actually practice a diet that takes care to maintain an appropriate weight and reduce salt?	4 = very high, 3 = high, 2 = low, 1 = very low
(5) Practice of chewing food slowly To what extent do you usually chew your food slowly and well?	4 = very high, 3 = high, 2 = low, 1 = very low
(6) Frequency of eating breakfast with family How often do you eat breakfast with your family?	5 = almost every day, 4 = four to five days per week, 3 = two to three days per week, 2 = one day per week, 1 = rarely
(7) Frequency of eating dinner with family How often do you eat dinner with your family?	Same as scales with 6

5. Conclusions

The present study aimed to elucidate the changes in dietary behaviors of mothers living with their children during the pandemic in Japan. The estimation results showed that even with an increase in frequency of sharing dinner with family at home, the attention and dietary practices toward nutritionally balanced food of mothers in Japan has been negatively influenced by the pandemic. This change is considered to be related to behavioral changes of household members during the pandemic. Prolonged stay at home and irregular or even unsynchronized routines, resulting in accumulated physical and psychological pressure on mothers, led to a decline in the quality of their dietary practices. Furthermore, single mothers are more likely to have unfavorable dietary practices, especially, those living in densely populated areas, which may exacerbate the negative effects. Furthermore, in line with the preceding literature, mothers who are financially secure, time-committed, or of advanced age have better dietary practices.

Due to the limitations of the data analyzed in this study, recently updated data using objective indicators need to be used to verify the dietary situation of mothers in the context of the pandemic.

Author Contributions: Conceptualization, L.W. and A.I.; methodology, L.W., M.W. and A.I.; analysis, L.W. and A.I.; writing—original draft preparation, L.W.; writing—review and editing, A.I.; funding acquisition, A.I. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by a Grant-in-Aid for Scientific Research (C) [grant number 22K05849] from the Japan Society for the Promotion of Science (JSPS).

Institutional Review Board Statement: Ethical review and approval were not required for this study because we used the publicly available secondary data provided by the Ministry of Agriculture, Forestry, and Fisheries of Japan under the following conditions: (1) the individual data provided shall not be used to identify individual informants, (2) security management measures shall be taken for the provided data, and (3) the provided data shall be used only by the person who has applied for the data to the Japan Social Science Data Archive, Center for Social Research and Data Archives, Institute of Social Science, University of Tokyo, and shall not be provided again to a third party.

Informed Consent Statement: Informed consent was waived. This was because (1) the secondary data used were publicly available in such a matter that the dataset did not contain any personal information that could identify subjects, directly or through identifiers linked to the subjects, and (2) surveys were conducted by the survey company on request of the Ministry of Agriculture, Forestry, and Fisheries of Japan in compliance with Japanese domestic laws and regulations regarding the protection of personal information, and guidelines established by regulatory authorities.

Data Availability Statement: Individual data from questionnaire surveys are publicly available on request from the Japan Social Science Data Archive, Center for Social Research and Data Archives, Institute of Social Science, University of Tokyo.

Acknowledgments: The authors thank the Japan Social Science Data Archive, Center for Social Research and Data Archives, Institute of Social Science, University of Tokyo; and Consumer Affairs and *Shokuiku* (Food and Nutrition Education) Division, Food Safety and Consumer Affairs Bureau, the Ministry of Agriculture, Forestry, and Fisheries of Japan, for providing data from individuals who participated in the 2016, 2017, 2018, 2019, and 2020 Surveys of Attitudes toward *Shokuiku*.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. WHO Director-General's Opening Remarks at the Media Briefing on COVID-19—11 March 2020. Available online: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--11-march-2020> (accessed on 6 April 2022).
2. González-Monroy, C.; Gómez-Gómez, I.; Olarte-Sánchez, C.M.; Motrico, E. Eating Behaviour Changes during the COVID-19 Pandemic: A Systematic Review of Longitudinal Studies. *Int. J. Environ. Res. Public Health* **2021**, *18*, 11130. [CrossRef] [PubMed]
3. Salman, A.; Sigodo, K.O.; Al-Ghadban, F.; Al-Lahou, B.; Alnashmi, M.; Hermassi, S.; Chun, S. Effects of COVID-19 lockdown on physical activity and dietary behaviors in Kuwait: A cross-sectional study. *Nutrients* **2021**, *13*, 2252. [CrossRef] [PubMed]
4. Rodríguez-Pérez, C.; Molina-Montes, E.; Verardo, V.; Artacho, R.; García-Villanova, B.; Guerra-Hernández, E.J.; Ruíz-López, M.D. Changes in dietary behaviours during the COVID-19 outbreak confinement in the Spanish COVIDiet study. *Nutrients* **2020**, *12*, 1730. [CrossRef]
5. Ruiz-Roso, M.B.; de Carvalho Padilha, P.; Mantilla-Escalante, D.C.; Ulloa, N.; Brun, P.; Acevedo-Correa, D.; Peres, W.A.F.; Martorell, M.; Aires, M.T.; de Oliveira Cardoso, L.; et al. COVID-19 confinement and changes in adolescents' dietary trends in Italy, Spain, Chile, Colombia, and Brazil. *Nutrients* **2020**, *12*, 1807. [CrossRef]
6. Zhao, A.; Li, Z.; Ke, Y.; Huo, S.; Ma, Y.; Zhang, Y.; Zhang, J.; Ren, Z. Dietary diversity among Chinese residents during the COVID-19 outbreak and its associated factors. *Nutrients* **2020**, *12*, 1699. [CrossRef] [PubMed]
7. Freitas, F.D.F.; Medeiros, A.C.Q.; Lopes, F.D.A. Effects of social distancing during COVID-19 pandemic on anxiety and eating behavior—a longitudinal study. *Front. Psychol.* **2021**, *12*, 1696. [CrossRef]
8. Shimpō, M.; Akamatsu, R.; Kojima, Y.; Yokoyama, T.; Okuhara, T.; Chiba, T. Factors associated with dietary change since the outbreak of COVID-19 in Japan. *Nutrients* **2021**, *13*, 2039. [CrossRef] [PubMed]
9. Alfawaz, H.A.; Khan, N.; Aljumah, G.A.; Hussain, S.D.; Al-Daghri, N.M. Dietary intake and supplement use among Saudi residents during COVID-19 lockdown. *Int. J. Environ. Res. Public Health* **2021**, *18*, 6435. [CrossRef]
10. Janssen, M.; Chang, B.P.; Hristov, H.; Pravst, I.; Profeta, A.; Millard, J. Changes in food consumption during the COVID-19 pandemic: Analysis of consumer survey data from the first lockdown period in Denmark, Germany, and Slovenia. *Front. Nutr.* **2021**, *8*, 60. [CrossRef]
11. Scarmozzino, F.; Visioli, F. COVID-19 and the subsequent lockdown modified dietary habits of almost half the population in an Italian sample. *Foods* **2020**, *9*, 675. [CrossRef]
12. Bhutani, S.; Cooper, J.A.; van Dellen, M.R. Self-reported Changes in energy balance behaviors during COVID-19-related home confinement: A cross-sectional study. *Am. J. Health Behav.* **2021**, *45*, 756–770. [CrossRef] [PubMed]
13. Giacalone, D.; Frøst, M.B.; Rodríguez-Pérez, C. Reported changes in dietary habits during the COVID-19 lockdown in the Danish population: The Danish COVIDiet study. *Front. Nutr.* **2020**, *7*, 294. [CrossRef] [PubMed]
14. Ammar, A.; Brach, M.; Trabelsi, K.; Chtourou, H.; Boukhris, O.; Masmoudi, L.; Bouaziz, B.; Bentlage, E.; How, D.; Ahmed, M.; et al. Effects of COVID-19 home confinement on eating behavior and physical activity: Results of the ECLB-COVID19 international online survey. *Nutrients* **2020**, *12*, 1583. [CrossRef] [PubMed]
15. Bolesławska, I.; Błaszczuk-Bebenek, E.; Jagielski, P.; Jagielska, A.; Przystawski, J. Nutritional behaviors of women and men in Poland during confinement related to the SARS-CoV-2 epidemic. *Sci. Rep.* **2021**, *11*, 19984. [CrossRef]
16. Gallo, L.A.; Gallo, T.F.; Young, S.L.; Moritz, K.M.; Akison, L.K. The Impact of isolation measures Due to COVID-19 on energy intake and physical activity levels in Australian university students. *Nutrients* **2020**, *12*, 1865. [CrossRef]
17. Larsen, J.K.; Hermans, R.C.; Sleddens, E.F.; Engels, R.C.; Fisher, J.O.; Kremers, S.P. How do parental dietary behaviors and food parenting practices affect children's dietary behaviors? *Interact. Sources Infl. Appet.* **2015**, *89*, 246–257.
18. Jeong, I.; Song, S. Relationship between the dietary behavior of young children and their mothers in Daejeon, Korea, using the nutrition quotient for preschoolers and adults. *Korean Community Nutr.* **2021**, *26*, 12–22. [CrossRef]
19. Backman, D.R.; Haddad, E.H.; Lee, J.W.; Johnston, P.K.; Hodgkin, G.E. Psychosocial predictors of healthy dietary behavior in adolescents. *J. Nutr. Educ. Behav.* **2002**, *34*, 184–193. [CrossRef]
20. Roodman, D. Fitting fully observed recursive mixed-process models with *cmp*. *Stata J.* **2011**, *11*, 159–206. [CrossRef]
21. The Cabinet Office of Japan. The 2nd Survey on Changes in Lifestyle Attitudes and Behaviors under the Influence of the New Type of Coronavirus Infection Survey on Changes in Lifestyle Awareness and Behavior under the Influence of New Strains of Coronavirus Infection. 2020; (In Japanese). Available online: https://www5.cao.go.jp/keizai2/wellbeing/covid/pdf/result2_covid.pdf (accessed on 22 June 2022).

22. Ministry of Agriculture, Forestry and Fisheries of Japan. Reiwa Ninendo Shokuiku Hakusho (White Paper on Food Education in 2020 Fiscal Year). 2021; (In Japanese). Available online: https://www.maff.go.jp/j/syokuiku/wpaper/attach/pdf/r2_index-3.pdf (accessed on 20 June 2022).
23. Takeda, R.; Komatsuzaki, R.; Taniguchi, M. Evolution of workers' daily schedules by COVID-19 pandemic: Diary data analysis before, during, and after the state of emergency declaration (April 2020). *Toshi-Keikaku-Ronbunshu* **2021**, *56*, 1191–1198. (In Japanese) [[CrossRef](#)]
24. Sugimoto, M.; Murakami, K.; Sasaki, S. Temporal patterns of sleep and eating among children during school closure in Japan due to COVID-19 pandemic: Associations with lifestyle behaviors and dietary intake. *Public Health Nutr.* **2022**; *online ahead of print.* [[CrossRef](#)]
25. Di Renzo, L.; Gualtieri, P.; Pivari, F.; Soldati, L.; Attinà, A.; Cinelli, G.; Leggeri, C.; Caparello, G.; Barrea, L.; Scerbo, F.; et al. Eating Habits and Lifestyle Changes during COVID-19 lockdown: An Italian Survey. *J. Transl. Med.* **2020**, *18*, 229. [[CrossRef](#)] [[PubMed](#)]
26. Philippe, K.; Issanchou, S.; Monnery-Patris, S. Contrasts and ambivalences in French parents' experiences regarding changes in eating and cooking behaviours during the COVID-19 lockdown. *Food Qual. Preference* **2021**, *96*, 104–386. [[CrossRef](#)]
27. Lillico, H.G.; Hammond, D.; Manske, S.; Murnaghan, D. Prevalence of eating behaviors among Canadian youth using cross-sectional school-based surveys. *BMC Public Health* **2014**, *14*, 323. [[CrossRef](#)] [[PubMed](#)]
28. Eman, S.A. Family meal associated with better dietary quality during adolescence. *Med. Sci.* **2020**, *24*, 786–792.
29. Ishida, A.; Ishida, E. Which consumers are least likely to have a balanced diet in Japan? *Pertanika J. Soc. Sci. Humanit.* **2021**, *29*, 419–438. [[CrossRef](#)]
30. Ishida, A.; Ishida, E. Effect of eating alone on dietary practices in community-dwelling elderly people in Japan. *Prog. Nutr.* **2021**, *23*, e2021056.
31. Hillesund, E.R.; Sagedal, L.R.; Bere, E.; Øverby, N.C. Family meal participation is associated with dietary intake among 12-month-olds in Southern Norway. *BMC Pediatr.* **2021**, *21*, 128. [[CrossRef](#)]
32. Hiroi, U. A study on the effect of the Japanese-style lockdown on self-restraint requests for COVID-19. *J. City Plan. Inst. Jpn.* **2020**, *55*, 902–909. (In Japanese) [[CrossRef](#)]
33. Takahashi, A.; Osaka, N.; Yasufuku, K.; Abe, H. A study on changes in shopping behavior under the influence of novel coronavirus infection in a large-scale commercial facility. *J. Arch. Plan.* **2022**, *87*, 349–359. (In Japanese) [[CrossRef](#)]
34. Yasai-shinkobu. Changes in vegetable consumption during the COVID-19 pandemic. *Veg. Inf.* **2021**, *207*, 46–53. (In Japanese). Available online: <https://www.alic.go.jp/content/001192333.pdf> (accessed on 23 June 2022).
35. Greene, W.H. *Econometric Analysis*; Pearson: New York, NY, USA, 2018.