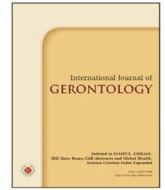




International Journal of Gerontology

journal homepage: <http://www.sgecm.org.tw/ijge/>



Original Article

Which Japanese Older Adults are Least Likely to Enjoy Favorable Dietary Practices?

Akira Ishida^{a*}, Emiko Ishida^b

^a Graduate School of Agricultural Science, Kobe University, ^b Kobe City College of Nursing

ARTICLE INFO

Accepted 25 April 2019

Keywords:

dietary practice,
family structure,
single older adults

SUMMARY

Background: With Japan becoming a super-aged society, extending healthy life expectancies resulting from favorable dietary practices in old age becomes an important policy agenda to curb the rapid increase in government healthcare expenditures. We clarify the comprehensive relationship between dietary practices among community-dwelling older adults and family structure.

Methods: Individual data on dietary practices of older adults aged over 65 were obtained from the 2012 Survey of Attitudes toward *Shokuiku* (Food and Nutrition Education), which was conducted nationwide by the Cabinet Office of Japan in 2012. We applied ordered logistic regression for 483 valid respondents' data.

Results: Among respondents separated by family composition and gender, dietary practices were found to be least favorable among single men. Although the majority of parameters regarding family composition were significant, no significant results were seen among single women, as compared to single men. Adjusting for possible covariates, it was found that irrespective of gender, single older adults living alone are less likely to (a) pursue well-balanced dietary habits, (b) follow a well-balanced diet, (c) attempt to enjoy eating meals, or (d) enjoy their meals. Besides family structure, subjective health status and knowledge regarding food significantly affect dietary practices among Japanese community-dwelling older adults. However, subjective economic status and place of residence were not significant predictors.

Conclusion: Poor dietary habits can have significant consequences for single older adults, especially single old men, living alone.

Copyright © 2019, Taiwan Society of Geriatric Emergency & Critical Care Medicine.

1. Introduction

Mainly owing to rapid declines in birth rates and extended longevity, Japan had the highest proportion (27.3%), worldwide, of adults aged 65 and over in 2016. It is predicted that approximately 38.4% of the Japanese population will fall within this age range by 2065.¹ As Japan is a “super-aged society,” extending healthy life expectancies in old age is an important policy agenda to curb rapid increases in government healthcare expenditures and help maintain public quality of life.

Irrespective of gender and age, healthy dietary practices have a positive effect on health in old age, and several previous studies have examined food intake and dietary practices among community-dwelling Japanese older adults. These studies deal with a wide range of topics, including the relationship between eating/chewing ability and nutritional intake,² physical activity abilities,³ mortality,⁴ and quality of life.^{5,6} Furthermore, research has investigated more specific relationships between appetite and quality of life,⁷ factors affecting decline in dietary variety with aging,⁸ and nutritional status.^{9,10} Additional work has assessed the effects of dietary intake and nutritional balance on daily life functions,¹¹ factors determining satisfaction with one's daily diet,¹² comparisons of dietary practices

between urban and rural-dwelling older adults,¹³ and the effects of nutritional intake and dietary patterns on one's health status.¹⁴ Finally, studies have examined the impact of deserts on food sufficiency and diversity.^{15,16}

While several case studies in Japan have revealed that an older adult living solely with his/her spouse has the highest satisfaction with his/her daily diet,¹⁷ older adults living alone tend to skip breakfast more frequently,¹⁵ eat an unbalanced or poor diet,^{13,18,19} fall short of recommended protein intake levels,²⁰ and are dissatisfied due to lack of communication partners during mealtimes.¹⁷ However, few studies based on nationwide survey data have discussed the influence of household structure on dietary practices among community-dwelling older adults. Additionally, factors determining dietary practices among a nationwide sample of Japanese older adults have been rarely discussed in detail. Therefore, using individual data from the 2012 Survey of Attitudes toward *Shokuiku* (Food and Nutrition Education) by the Cabinet Office of Japan, the present study aimed to clarify the comprehensive relationship between dietary practices among community-dwelling older adults and family structure. Factors under consideration included age, knowledge of food and nutrition, self-reported health status, self-reported economic status, and place of residence.

2. Materials and methods

Individual data for older adults aged 65 years old or over were

* Corresponding author. Graduate School of Agricultural Science, Kobe University, 1-1 Rokkodai-cho, Nada, Kobe 657-8501, Japan.

E-mail address: akira_ishida@people.kobe-u.ac.jp (A. Ishida)

obtained from the 2012 Survey of Attitudes toward *Shokuiku*, which was conducted by the Cabinet Office in December 2012. A two-stage stratified random sampling method was used to select 3,000 participants aged 20 or older, nationwide, and trained staff conducted face-to-face interviews with those who agreed to participate. Among 537 participants aged 65 or over, 483 valid respondents provided adequate data for further analyses. Ethical approval was not required for this secondary analysis of data publicly available through the Center for Social Research and Data Archives, Institute of Social Science, the University of Tokyo.

The survey comprised the following questions regarding dietary practices: 1) To what extent do you try to make a habit of eating a well-balanced diet in your daily life? (4 = very high, 3 = high, 2 = low, 1 = very low), 2) How many days 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 during an average week? (4 = almost every day, 3 = four to five days per week, 2 = two to three days per week, 1 = less than one day per week), 3) To what extent do you try to enjoy eating meals? (4 = very high, 3 = high, 2 = low, 1 = very low), and 4) To what extent do you enjoy eating meals? (5 = very happy, 4 = rather happy, 3 = so-so, 2 = not very happy, 1 = not happy). Given that these responses regarding dietary practices were ordinal in nature, ordered logistic regression was used to examine the association between dietary practices and family structure after adjusting for all other potential factors. All data were analyzed using STATA ver.15.1, with 95% CI and a significance level of 0.05.

After confirming no multicollinearity between the independent variables, the following categories were composed: a dummy-coded age variable (65–69 years old, 70–74 years old, 75 years old or above), a dummy-coded family structure variable (single woman, married woman, married woman living with children, single woman living with children, single man, married man, married man living with children, or single man living with children), a dummy-coded self-reported health condition variable measured on a three-point Likert scale (not healthy, so-so, and healthy), a dummy-coded self-reported economic condition variable measured on a three-point Likert scale (not good, so-so, and good), the first principal component score from a principal component analysis of the 11 questions regarding “food knowledge” (details mentioned later), and a dummy-coded variable for residence (Tokyo metropolitan area, ordinance-designated city, city with more than 100,000 people, city with less than 100,000 people, and village/town).

Regarding the dummy-coded family structure variable, all subjects were broken down into the above-mentioned 8 categories by family composition and gender. However, since single men living with only children were 9 persons, they were integrated into the

“married men living with children” category in our estimation. In addition, for calculating the first principal component score regarding “food knowledge,” we used questions regarding the extent of their knowledge (1 = do not know, 2 = do not know well, 3 = know to some extent, and 4 = know well) on the following 11 items: (1) regionally specific foods, (2) in-season foods, (3) nutritional labeling, (4) flavor expiration date or expiration date for consumption, (5) food preservation, (6) prevention of food poisoning, (7) choice of food varieties and suitable quantity of consumption, (8) cooking in consideration of health, (9) local or event dishes, (10) food loss and waste reduction, and (11) preparation of emergency foods at times of disaster. Estimation results for the principal component analysis are available upon request.

3. Results

Mean values for the four dependent variables (based on family structure) are shown in Table 1. All mean values were lowest for single men. Estimation results from the ordered logistic regression models on attempting to make a habit of eating a well-balanced diet (Model 1), actual frequency of a well-balanced dietary intake pattern (Model 2), attempting to enjoy eating meals (Model 3), and enjoying daily mealtimes (Model 4) are presented in Table 2.

The Model 1 odds ratios were 3.69 (95% CI = 1.48–9.19) for married women, 3.97 (95% CI = 1.54–10.22) for married women living with children, and 2.81 (95% CI = 1.18–6.67) for married men in comparison to single men. Model 1 also revealed that those with a good or ordinary self-reported health status had odds ratios of 2.97 (95% CI = 1.81–4.89) and 1.95 (95% CI = 1.01–3.77), respectively, compared with those reporting an unfavorable health status. Additionally, the odds ratio for “food knowledge” was estimated at 1.44 (95% CI = 1.30–1.58).

Model 2 revealed that the odds ratio for the frequency of a well-balanced dietary intake pattern was 2.28 (95% CI = 1.31–3.98) for those over the age of 75, as compared with those aged 65–69. As for family structure, odds ratios were 4.88 (95% CI = 1.86–12.76) for married women, 3.60 (95% CI = 1.36–9.56) for married women living with children, 3.82 (95% CI = 1.32–11.05) for single women living with children, 3.41 (95% CI = 1.42–8.18) for married men, and 5.58 (95% CI = 2.15–14.48) for married men living with children or single men living with children, as compared with single men. Model 2 also indicated that those with a good self-reported health status had an odds ratio of 2.40 (95% CI = 1.37–4.19), as compared with those reporting an unfavorable health status. Finally, the odds ratio for “food knowledge” was 1.22 (95% CI = 1.09–1.36).

Model 3 revealed an odds ratio of 1.71 (95% CI = 1.06–2.74) for trying to enjoy eating meals among those over the age of 75, as compared with those 65–69 years old. As for family structure, odds ratios were 2.79 (95% CI = 1.14–6.81) for married women, 3.09 (95% CI = 1.22–7.84) for married women living with children, 3.55 (95% CI

Table 1
Mean values of the dependent variables by family structure.

	Y1	Y2	Y3	Y4
Single women	3.42	3.54	3.51	4.00
Married women	3.70	3.79	3.67	4.43
Married women living with children	3.69	3.70	3.69	4.51
Single women living with children	3.33	3.71	3.69	4.48
Single men	2.89	3.00	3.00	3.70
Married men	3.37	3.65	3.48	4.36
Married men living with children or single men living with children	3.19	3.67	3.33	4.28

Notes: Y1 = attempting to make a habit of eating a well-balanced diet. Y2 = actual frequency of a well-balanced dietary intake pattern. Y3 = attempting to enjoy eating meals. Y4 = enjoying daily mealtimes.

Table 2
Results from the ordered logistic regression analyses.

	Y1 (Model 1)			Y2 (Model 2)			Y3 (Model3)			Y4 (Model4)			Mean
	OR	CI (95 percent)		OR	CI (95 percent)		OR	CI (95 percent)		OR	CI (95 percent)		
Age (Reference: 65–69)													
70–74	0.738	0.450	1.212	1.596	0.922	2.764	1.634	0.994	2.685	1.033	0.665	1.604	0.296
75 and above	1.010	0.626	1.629	2.283**	1.311	3.975	1.705*	1.061	2.740	1.716*	1.099	2.681	0.389
Family structure (Reference: Single men)													
Single women	1.789	0.704	4.551	1.841	0.698	4.856	1.934	0.756	4.944	1.184	0.484	2.896	0.122
Married women	3.691**	1.483	9.186	4.877**	1.863	12.764	2.787*	1.141	6.807	3.165**	1.361	7.362	0.184
Married women living with children	3.965**	1.539	10.215	3.601**	1.357	9.559	3.094**	1.222	7.837	4.059**	1.677	9.823	0.147
Single women living with children	1.703	0.655	4.428	3.822**	1.322	11.052	3.550**	1.294	9.742	4.433**	1.707	11.510	0.094
Married men	2.809*	1.183	6.669	3.409**	1.420	8.181	2.352*	1.008	5.485	3.814**	1.660	8.764	0.209
Married men living with children or single men living with children	2.062	0.864	4.919	5.580**	2.150	14.480	1.965	0.825	4.678	3.372**	1.447	7.858	0.182
Health status (Reference: Not healthy)													
So-so	1.951*	1.010	3.768	1.164	0.566	2.393	1.737	0.887	3.400	1.199	0.642	2.237	0.124
Healthy	2.972**	1.807	4.889	2.396**	1.371	4.185	1.827**	1.103	3.029	1.694*	1.056	2.716	0.692
Economic status (Reference: Not good)													
So-so	0.924	0.535	1.595	1.293	0.685	2.440	0.804	0.468	1.380	0.922	0.555	1.532	0.263
Good	0.898	0.537	1.500	0.882	0.499	1.558	1.436	0.860	2.397	1.278	0.793	2.061	0.520
Food knowledge (factor score from a principal component analysis)	1.436**	1.302	1.583	1.220*	1.093	1.362	1.279**	1.159	1.413	1.173*	1.074	1.280	0.000
Residence (Reference: Tokyo metropolitan area)													
Ordinance-designated city	0.780	0.286	2.128	0.605	0.217	1.683	1.179	0.485	2.866	0.648	0.278	1.514	0.191
City with more than 100,000 people	0.581	0.225	1.499	0.865	0.327	2.287	1.326	0.573	3.069	0.795	0.359	1.763	0.398
City with less than 100,000 people	0.530	0.202	1.388	0.786	0.290	2.131	1.568	0.661	3.717	0.655	0.289	1.485	0.248
Village/town	0.534	0.181	1.572	0.939	0.287	3.079	1.263	0.467	3.419	0.657	0.263	1.643	0.101
Threshold between Y = 1 and Y = 2		-3.193			-1.794			-2.223			-3.873		
Threshold between Y = 2 and Y = 3		-0.986			-0.411			-0.101			-2.879		
Threshold between Y = 3 and Y = 4		0.626			0.792			1.393			-0.129		
Threshold between Y = 4 and Y = 5		---			---			---			1.378		
Log likelihood		-420.532			-338.488			-405.647			-489.474		
Log likelihood test $\chi^2(17)$		132.746**			57.950**			76.721**			64.068**		
Pseudo R ²		0.136			0.079			0.086			0.061		

Notes: For Y1–Y4, see notes from Table 1.

** and * denote 1% and 5% significant, respectively. “Mean” in the most left column shows the mean value of each independent variable. In case of a dummy variable, the mean value is equal to composition ratio (cf., single women account for 12.2% of 483 respondents).

= 1.29–9.74) for single women living with children, and 2.35 (95% CI = 1.01–5.49) for married men, as compared to single men. Furthermore, those with a good self-reported health status had an odds ratio of 1.83 (95% CI = 1.10–3.03), as compared with those reporting an unfavorable health status. Finally, the odds ratio for “food knowledge” was 1.28 (95% CI = 1.16–1.41).

Model 4 revealed an odds ratio of 1.72 (95% CI = 1.10–2.68) for enjoying daily mealtimes for those over the age of 75, as compared with those 65–69 years old. As for family structure, odds ratios were 3.17 (95% CI = 1.36–7.36) for married women, 4.06 (95% CI = 1.68–9.82) for married women living with children, 4.43 (95% CI = 1.71–11.51) for single women living with children, 3.81 (95% CI = 1.66–8.76) for married men, and 3.37 (95% CI = 1.45–7.86) for married men living with children or single men living with children, as compared to single men. Those with a good self-reported health status had an odds ratio of 1.69 (95% CI = 1.06–2.72), as compared with those reporting an unfavorable health status. Finally, the odds ratio for “food knowledge” was 1.17 (95% CI = 1.07–1.28).

4. Discussion

As shown in Table 2, although a majority of parameters regarding family composition were significant, there were no significant results among single women. This indicates that, irrespective of gender, single older adults living alone are less likely to pursue well-balanced dietary habits, follow a well-balanced diet, attempt to enjoy eating meals, and enjoy their meals after adjusting for possible covariates, including age, self-reported health, food knowledge, and residence location. Considering together with several case studies in Japan reporting that single older adults tend to follow unhealthy daily dietary behaviors,¹⁸ skip breakfast more frequently,¹⁵ eat a poor diet,⁹ and fall short of protein,²⁰ vegetable,¹⁹ and fruit intake guidelines,^{13,19} we may conclude that poor dietary habits could have negative consequences for this population. Additionally, we observed that single older adults were less likely to enjoy mealtimes. This is consistent with findings from previous studies revealing that single older adults feel less pleasant during meals²¹ and are dissatisfied with a lack of partners for communication during mealtimes.¹⁷ It should also be noted that the odds ratios for married men living with children or single men living with children in Models 1 and 3, and single women living with children in Model 1, were not significant. However, these odds ratios were significantly larger than 1.0 in Models 2 and 4. These findings suggest that the existence of other family member(s) could contribute to improving balanced dietary behaviors and mealtime enjoyment, even if these individuals are less concerned with pursuing a well-balanced diet and enjoying their mealtimes.

The proportion of single older adults has steadily increased from 10.7% in 1980 to 26.3% in 2015.¹ Single older adults tend to be socially isolated and eat meals alone.²² This social isolation could also lead to malnutrition⁹ and loss of appetite,²³ and eating alone results in dissatisfaction with one’s daily dietary habits.¹² In a situation where the proportion of single older adults is on an upward trajectory, it is essential that social policy initiatives address unfavorable dietary practices among socially isolated older adults.

Additional factors affecting older adults’ dietary practices were also addressed. For instance, we generally observed that those over the age of 75 tend to eat a balanced diet and enjoyed their mealtimes. This finding is consistent with the results of the 2017 National Health and Nutrition Survey,²⁴ which reported that individuals aged over 70 years were more likely to eat fish, egg, soy and soy products, green and yellow vegetables, and other vegetables every day than were those aged 60–69 years. One possible explanation for these findings is

that, individuals living with others are more likely to eat dinner with other family members every day. Specifically, among individuals living with others, this tendency was observed in 77.4%, 76.8%, and 81.3% of those aged 65–69, 70–74, and over 75 years, respectively.

Furthermore, odds ratios for “food knowledge” were significantly greater than 1.0, indicating that more food knowledge is related to greater enjoyment of dietary practices. Although causality between the extent of enjoying dietary behaviors and “food knowledge” cannot be determined by our cross-sectional analysis, this finding does suggest that strengthening education, such as free cooking classes (especially for older men), could be an effective measure for promoting healthy dietary practices.

We also observed that self-reported health status was significantly predictive, indicating that subjective health conditions influence dietary practices. This result is consistent with previous studies revealing that health conscientious older adults are more likely to be satisfied with their dietary behaviors,²¹ eat appropriately,²⁵ and follow healthy dietary practices.¹⁸ Here, considering the findings from previous studies regarding the close relationship between eating/chewing ability or teeth health and health-related quality of life and dietary intake,^{2–6} our result suggests that maintaining a good oral hygiene could be one of the important factors for favorable dietary practices among community dwelling older people.

All odds ratios for self-reported economic status were not significant. This contrasts with findings from two previous case studies in Japan. While Adachi²¹ observed that current subjective economic conditions do not affect satisfaction with one’s dietary life, economic status does have a direct positive influence on nutritional intake,⁹ as well as an indirect influence on satisfaction.¹² Therefore, further research using larger longitudinal samples is required to better examine the effect of economic status on dietary practices among older adults.

There were no significant differences in dietary practices based on residence location, which is largely consistent with Tsumura et al.;¹³ however, there was one exception: rural-dwelling older adults (who could produce their own food), tended to consume more vegetables than individuals in urban areas. Considering our findings together with Adachi,²¹ who reported no clear difference in dietary satisfaction between urban and rural-dwelling older adults, residence does not appear to be an important factor for determining healthy dietary practices.

Overall, we can conclude that family structure, subjective health status, and knowledge regarding food significantly affect dietary practices among Japanese community-dwelling older adults. In a situation where a family safety net embedded as a social norm in Japanese society has been weakened with the rapid increase in the proportion of single older adults, community-based coping programs conducted by volunteers, non-governmental or non-profit organizations, and the Council of Social Welfare should be strengthened to prevent these single older adults from following unhealthy dietary practices. To clarify which community-based program is more effective, a well-designed intervention study is necessary in order to examine the means for improving dietary practices among this vulnerable population.

Declaration of conflicting interests

The authors declare no conflicts of interest.

Funding

This work was financially supported by a Grant-in-Aid for Sci-

entific Research (C) [grand number: 18K05865] from the Japan Society for the Promotion of Science (JSPS).

Acknowledgments

The authors thank two organizations — the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The 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 individuals' data from the Survey of Attitudes toward *Shokuiku*, 2012.

References

1. Cabinet Office, Government of Japan. *Annual Report on the Aging Society: 2017 (Summary)*. Tokyo, Japan: Cabinet Office. Available at http://www8.cao.go.jp/kourei/english/annualreport/2017/2017pdf_e.html. Accessed October 11, 2018.
2. Kikutani T, Yoshida M, Enoki H, et al. Relationship between nutrition status and dental occlusion in community-dwelling frail elderly people. *Geriatr Gerontol Int*. 2013;13(1):50–54.
3. Miura H, Arai Y, Sakano S, et al. Subjective evaluation of chewing ability and self-rated general health status in elderly residents of Japan. *Asia Pac J Public Health*. 1998;10(1):43–45.
4. Ansai T, Takata Y, Soh I, et al. Relationship between chewing ability and 4-year mortality in cohort of 80-year-old Japanese people. *Oral Dis*. 2007;13(2):214–219.
5. Akifusa S, Soh I, Ansai T, et al. Relationship of number of remaining teeth to health-related quality of life in community-dwelling elderly. *Gerodontology*. 2005;22(2):91–97.
6. Kimura Y, Wada T, Ishine M, et al. Community-dwelling elderly with chewing difficulties are more disabled, depressed and have lower quality of life scores. *Geriatr Gerontol Int*. 2009;9(1):102–104.
7. Yoshihara A, Seida Y, Kataoka S, et al. The relationship between appetite and quality of life in community-dwelling older adults. *Koku Eisei Gakkai Zasshi*. 2004;54(3):241–248. [In Japanese, English abstract]
8. Kwon J, Suzuki T, Kumagai S, et al. Risk factors for dietary variety decline among Japanese elderly in rural community: A 8-year follow-up study from TMIG-LISA. *Eur J Clin Nutr*. 2006;60(3):305–311.
9. Arai K, Sakakibara H. Malnutrition and social isolation among elderly residents of city public housing. *Nihon Koshu Eisei Zasshi*. 2015;62(8):379–389. [In Japanese, English abstract]
10. Iizaka S, Tadaka E, Sanada H. Comprehensive assessment of nutritional status and associated factors in the healthy, community-dwelling elderly. *Geriatr Gerontol Int*. 2008;8(1):24–31.
11. Jingu S, Egami Y, Kinukawa N, et al. Factors related to functional capacity in community dwelling elderly people. *Nihon Koshu Eisei Zasshi*. 2003;50(2):92–105. [In Japanese, English abstract]
12. Yoshida R, Hasebe Y, Shirai E. The influence of eating behavior factors on the satisfaction in dietary life and in life among elderly women living in rural areas. *Nihon Koshu Eisei Zasshi*. 2012;59(3):151–160. [In Japanese, English abstract]
13. Tsumura Y, Ogino T, Hirota N, et al. Study on dietary life of the elderly from viewpoint of food consumption pattern. *Seikatsu Kagaku Kenkyushi*. 2004;3:47–54. [In Japanese, English abstract]
14. Okubo H, Sasaki S, Horiguchi H, et al. Dietary patterns associated with bone mineral density in premenopausal Japanese farmwomen. *Am J Clin Nutr*. 2006;83(5):1185–1192.
15. Hino K. Connection between inconvenience for shopping and eating habits of old people: Analysis of shopping habit of old people in Itabashi area. *Nihon Kenchiku Gakkai Keikaku Kei Ronbunshu*. 2002;67(556):235–239. [In Japanese, English abstract]
16. Iwama N, Asakawa T, Tanaka K, et al. Analysis of the factors that disrupt dietary habits in the elderly: A case study of a Japanese food desert. *Urban Stud*. 2017;54(15):3560–3578.
17. Seto Y, Shiotani C, Sawada T, et al. Influence of household composition on diets for the elderly. *Journal of Cookery Science of Japan*. 2007;40(1):15–21. [In Japanese, English abstract]
18. Ikeda J, Asano M, Kitani T, et al. Study on food intake frequency among elderly persons. *Eiyogaku Zasshi*. 1991;49(5):257–271. [In Japanese, English abstract]
19. Tsubota-Utsugi M, Kikuya M, Satoh M, et al. Living situations associated with poor dietary intake among healthy Japanese elderly: The Ohasama study. *J Nutr Health Aging*. 2015;19(4):375–382.
20. Kitano N, Etoh H, Kitano T. Relationship between the health condition, daily lifestyle and diet of elderly people living in a rural area of Kumamoto. *Eiyogaku Zasshi*. 2010;68(2):78–86. [In Japanese, English abstract]
21. Adachi Y. Analysis of degree of satisfaction in dietary life among aged people (part 2). *Nihon Kasei Gakkaishi*. 1991;42(6):529–536. [In Japanese, English abstract]
22. Kaneko J, Hanada M. Why do elderly individuals in Japan eat alone? *Noringo Mondai Kenkyu*. 2016;52(3):166–171. [In Japanese, English abstract]
23. Fukunaga R, Abe Y, Nakagawa Y, et al. Living alone is associated with depression among the elderly in a rural community in Japan. *Psychogeriatrics*. 2012;12(3):179–185.
24. Ministry of Health, Labour and Welfare. *The National Health and Nutrition Survey in Japan, 2017*. Tokyo, Japan: Ministry of Health, Labour and Welfare. Available at <https://www.mhlw.go.jp/content/000451755.pdf>. Accessed February 18, 2019. [In Japanese]
25. Yukawa H, Suzuki T, Yoshida H, et al. Effect of psychosocial and health conditions on the energy intake adequacy of healthy elderly individuals. *Eiyogaku Zasshi*. 2001;59(3):117–125. [In Japanese, English abstract]