Eating alone at each meal and associated health status by cohabitation situation among Japanese community-dwelling elderly: a cross-sectional analysis of the KAGUYA study

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Abstract

Background: This study investigated the association between eating alone at each meal and health status including functional capacity according to cohabitation situation among Japanese community-dwelling elderly.

Methods: This was a cross-sectional analysis of baseline data from the Keeping Active across Generations Uniting the Youth and the Aged (KAGUYA) study in Japan. A self-administered questionnaire was mailed to all 8004 residents aged 65 or older residing in the same Japanese town the participants in March 2016. Eating alone was assessed by first asking whether participants ate three separate meals each day (i.e., breakfast, lunch, and dinner), and those who answered affirmatively were then asked how many people were usually present at each meal. Health status was assessed in terms of subjective health, medical history, care needs, body mass index, depression, and functional capacity.

Results: Data from 3057 respondents were analyzed. Among those living with others, those who reported not being in good subjective health and a history of hypertension were significantly more likely to eat alone at breakfast (odds ratio 1.27; 95% confidence interval 1.01–1.61, and 1.26; 1.06–1.49). Depressive symptoms and many subscales of functional capacity were also significantly associated with eating alone at breakfast, lunch, and dinner ($P < 0.05$). Among those living alone, those eating alone at breakfast had lower scores for indicators of functional capacity including information practice ($P = 0.010$) and total scores ($P = 0.049$).

Conclusions: For both cohabitation situations, many health status indicators were related to eating alone at each meal, especially breakfast.

Background

Population aging is a global phenomenon. In Japan, the importance of health problems in old age has drawn increased attention due to the combined factors of a declining birth rate and an aging population. The percentage of the Japanese population aged 65 years or older reached 10% in 1985, 20% in 2005, and is expected to exceed 30% in 2025 [1]. In fact, social security costs, including pension, medical, and nursing care costs, are on the rise as life expectancy increases [2]. According to the 2014 Attitude of the elderly of Japan in the International Comparison Study, 44.9% of Japanese elderly responded that they wish to work for monetary compensation (i.e., they wish to continue working) [3]. This highlights the importance of extending healthy life expectancy for the dual purposes of a robust economy and the well-being of the elderly. These aims are in line with the Japanese term *ikigai*, which means a life worth living.

In analyses of healthy eating behaviors, several systematic reviews have reported that the frequency of family meals is positively associated with the consumption of nutritious foods, a balanced diet, and a healthy body mass index (BMI) [4–8]. However, studies examining the association between family meals or eating alone and health indicators among the elderly are limited because most examinations have involved infants, children, or adolescents. A few studies involving elderly people in Japan have reported

associations between eating alone and subjective health [9], depression [10–12], and mortality [13]. In recent years, Suthutvoravut and colleagues have suggested a relationship between frailty and living with family yet eating alone [14]. Functional capacity, such as activities of daily living and frailty are major determinants of the elderly's care needs [15]. Because the level of need for nursing care affects both social security costs and quality of life in the elderly, it is important to examine the association of eating alone with functional capacity and care needs.

People living alone are more likely to report eating alone than those living with others [10]. Studies considering cohabitation situations have suggested that living alone is associated with poor dietary intake relative to living with a spouse [16]. Because several studies have found that eating alone is associated with poor dietary intake [17, 18], the association between eating alone and health status may differ depending on cohabitation situation. Additionally, because Japanese people typically eat three meals a day, it seems likely that the situation surrounding eating alone at each meal would differ according to cohabitation situation. For example, protein intake among community-dwelling elderly is highest at dinner, intermediate at lunch, and lowest at breakfast, and it has been reported that high protein intake at lunch is associated with retention of skeletal muscle mass in men [19]. However, no studies have examined the association between eating alone at each meal and health status by cohabitation situation.

If the association between eating alone and health status in the elderly is found to be different for breakfast, lunch, and dinner, then it would be possible to suggest optimal times for eating with others. Thus, this study investigated the association between eating alone at each of the three meals and health status including functional capacity according to cohabitation situation in Japanese community-dwelling elderly.

Methods

This study used the STROBE-Nut as a reporting guideline (Additional file 1).

Participants

This cross-sectional study used baseline data from the Keeping Active across Generations Uniting the Youth and the Aged (KAGUYA) study. The KAGUYA study is a 5-year project to promote the integration of healthcare data and conduct “training courses for resident leaders in frailty prevention, health checks, and exercise guidance by a health support student team, and human resource development at dementia cafes” in collaboration with the town of Koryo, Nara Prefecture, and Kio University. The purpose of this project is to examine the impact of social capital on the health of residents and to use this information in constructing an effective community-based integrated care system. Although other articles have also assessed multiple health status such as functional capacity [20–22], the examination of the association with eating behavior is original to this study.

The baseline survey of the KAGUYA study was conducted in March 2016, using a self-administered questionnaire via a mail survey. The participants were all 8004 residents aged 65 years or older living in Koryo town. The town, located 25 km from Osaka, has a population of more than 30,000 residents in an area of 16 km² comprising rural and new residential areas. To improve response rates, a combination thank you and reminder postcard was mailed to all of the participants. The questionnaire was returned by 3871 respondents (48.3% response rate).

The eligibility criteria for this study were age 65 years or older, living at home, and regularly consuming three meals daily. Accordingly, three groups of respondents were excluded from our analysis: (1) those who did not answer questions about living situations, number of people living together, whether they ate each meal, number of people eating together, and main basic characteristics (gender and age); (2) those living in nursing homes or hospitals; and (3) those who did not usually eat one or more of the three daily meals (breakfast, lunch, or dinner). We excluded those who skipped meals because the absence of eating precludes examination of effects of eating alone or with others, which is the main target of this study.

Informed consent was obtained using the documents enclosed with the questionnaire. The protocol for the KAGUYA study was approved by the Research Ethics Committee of Kio University (approval number: H27–34).

Measures

Cohabitation situation was assessed by asking how many people lived with the respondent (cohabitation). A response of zero was classified as *living alone*, and one or more as *living with others*. The survey also asked whether they usually ate three separate meals each day (breakfast, lunch, and dinner). Those who responded that they eat each meal were then asked how many people, including themselves, were present at each meal. Responses of one person were classified as *eating alone*, whereas responses of more than one person were classified as *eating together*. The KAGUYA study asked respondents about a large number of lifestyle habits that are expected to be related to health status, so we used brief binary self-reports similar to those in previous studies to assess whether respondents ate alone [18, 23].

Health status was examined by assessing subjective health, medical history, care needs, BMI, depression, and functional capacity.

Subjective health was classified as *in good health* for those who answered “very good,” “good,” or “not bad” to the question “How is your current health condition?” and *not in good health* for those who answered “not good” or “bad.” The same classification system was used in the Comprehensive Survey of Living Conditions of the Ministry of Health, Labour and Welfare, Japan [24].

To assess medical history of hypertension, diabetes, cardiovascular disease, stroke, osteoporosis, rheumatoid arthritis, and dyslipidemia (high cholesterol, high triglycerides, etc.), the respondents were asked, “Have you ever been diagnosed by a doctor with any of the following diseases?”

Care needs were identified according to whether the respondents had been certified as requiring long-term care or support through the long-term care insurance system of Japan [25].

BMI was determined by asking height (cm) and weight (kg) as integers, and dividing weight (kg) by the square of height (m).

Depression was assessed using the Japanese version [26] of the 5-item Geriatric Depression Scale (GDS 5) [27], a shortened version of the 15- and 30-item GDS [28, 29]. The GDS 5 consists of five items such as “Are you basically satisfied with your life?” The presence of depressive symptoms was defined as two or more positive answers to the depression screening questions. Diagnosis with GDS 5 has been proven to be significantly consistent with a clinical diagnosis of depression, with good interrater and test-retest reliability [30].

Functional capacity was assessed using the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC) [31]. TMIG-IC is a 13-item index of competence comprising three subscales: Instrumental Self-Maintenance, such as “Can you use public transportation (bus or train) by yourself?” (5 items); Intellectual Activity, such as “Are you able to fill out forms for your pension?” (4 items); and Social Roles, such as “Do you visit the homes of friends?” (4 items). TMIG-IC measurements have high reliability according to alpha coefficients, test-retest, and correlation between subscale and total scores, as well as high construct, discriminant, and predictive validity [32].

High levels of functional capacity are required due to changes in the living environment and improved competence of the elderly over the past quarter century, so the Japan Science and Technology Agency Index of Competence (JST-IC) was also used [33]. JST-IC is a 16-item index used to assess high-level competency, and consists of 4 subscales (each with four items): Social Engagement, such as “Do you participate in regional festivals or events?”; Technology Usage, such as “Can you use a mobile phone?”; Information Practice, such as “Are you interested in news and events from overseas?”; and Life Management, such as “Do you follow any measures to prevent yourself from becoming a victim of crime?” JST-IC evaluations showed moderate correlations between the size of social networks and the level of subjective health well-being, and strong correlations between TMIG-IC score, physical fitness, and health literacy [34]. For both the TMIG-IC and JST-IC, each item is scored as 1 point for “Yes” and 0 points for “No.” Higher scores therefore indicate higher functional capabilities.

The questionnaire included socio-demographic characteristics such as gender, age (years), education history (9 years or less, 10–12 years, 13 years or more), self-assessed living conditions (difficult, not difficult), area of residence (former village areas, new residential areas), and employment status (unemployed, employed). The self-assessed living condition variable was classified as *difficult* for those who answered “very difficult” or “difficult” and *not difficult* for those who answered “normal,” “somewhat comfortable,” or “very comfortable” as in the Comprehensive Survey of Living Conditions of the Ministry of Health, Labour and Welfare, Japan [24]. For employment status, respondents who answered “not working (including those without regular income, pensioners, and students)” were classified as *unemployed*, and those who indicated “farmer,” “self-employed (self-run stores, family employment, etc.),”

“working (regular),” or “working (non-regular: part-time workers, side work, etc.)” were classified as *employed*.

Data analysis

All data on eating alone were analyzed for breakfast, lunch, and dinner according to cohabitation situation. The association between socio-demographic characteristics and eating alone was examined by binary logistic regression analysis using the presence or absence of eating alone as a dependent variable to calculate odds ratios (ORs) and 95% confidence intervals (CIs). The association between eating alone and health status was examined by binary logistic regression analysis when health status was binary, and by analysis of covariance when health status was a quantitative variable. The association with health status was adjusted for gender, age (years), education history (≤ 9 , 10–12, ≥ 13), self-assessed living conditions (difficult/not difficult), area of residence (former village areas/new residential areas), and employment status (unemployed/employed) as covariates. IBM SPSS Statistics 26 (IBM Japan, Ltd., Tokyo, Japan) was used for all statistical analyses. The results are not shown when the analysis group contained ≤ 1 person because 95% CIs could not be calculated clearly. The level of significance was set at $P < 0.05$ (two-sided test).

Results

Of the 3871 respondents to the KAGUYA study baseline survey, the data of 3057 respondents were analyzed after applying the exclusion criteria. There were eight common reasons for exclusion: 278 respondents were residents in nursing homes or hospitals, 37 did not respond to the number of people living together, 251 did not answer whether they ate each meal, 184 did not answer whether they eat each meal with others, 39 did not provide their gender or age, 20 did not usually eat breakfast, and 5 did not usually eat lunch (Fig. 1).

Of the 3057 respondents analyzed, 2809 (91.9%) were living with others and 248 (8.1%) were living alone. Of the 2809 respondents living with others, 796 (28.3%) ate alone at breakfast, 753 (26.8%) ate alone at lunch, and 237 (8.4%) ate alone at dinner. Of the 248 respondents living alone, 245 (98.8%) ate alone at breakfast, 228 (91.9%) ate alone at lunch, and 239 (96.4%) ate alone at dinner.

Table 1 shows the association between socio-demographic characteristics and eating alone for each meal according to cohabitation situation. For those living with others, significant differences were reported in eating alone according to gender, age, education history, self-assessed living conditions, area of residence, and employment history. In terms of gender, eating alone was more common in women than in men for breakfast (OR 1.26; 95% CI 1.07–1.48), lunch (OR 1.33; 95% CI 1.13–1.58), and dinner (OR 1.41; 95% CI 1.07–1.84). By age, eating alone was less common in those aged 70–74 and 75–79 years for breakfast (OR 0.67; 95% CI 0.54–0.83 and 0.68; 0.54–0.87) and lunch (OR 0.61; 95% CI 0.49–0.76 and 0.69; 0.55–0.88) and higher in those aged 80 years or older for dinner (OR 1.72; 95% CI 1.21–2.43) compared with those aged 65–69 years. In terms of education history, eating alone was lower in those with 10 years or more of education than in those with 9 years or less for dinner (OR 0.66; 95% CI 0.48–

0.90 and 0.59; 0.41–0.84). Self-assessed living conditions were lower in those with no difficulty than in those with difficulty for breakfast (OR 0.80; 95% CI 0.65–0.99). By area of residence, eating alone was lower in new residential areas than in former village areas for breakfast (OR 0.84; 95% CI 0.71–1.00) and higher for lunch (OR 1.36; 95% CI 1.15–1.61). In terms of employment status, eating alone was higher in the employed group than in the unemployed group for lunch (OR 1.24; 95% CI 1.02–1.49). However, for those living alone, eating alone was lower in the employed group than in the unemployed group (OR 0.14; 95% CI 0.05–0.37), showing a contradictory association compared with those living with others.

Tables 2 and 3 show the associations between eating alone at each meal with health status by cohabitation situation. For those living with others, significant differences were observed in subjective health, history of hypertension, diabetes, and dyslipidemia, depressive symptoms, and several subscales of functional capacity. For subjective health, those who reported being not in good health were more likely to eat alone at breakfast (OR 1.27; 95% CI 1.01–1.61). In terms of medical history, hypertension was higher in those eating alone than in those eating breakfast with others (OR 1.26; 95% CI 1.06–1.49), diabetes was higher in those eating lunch alone (OR 1.38; 95% CI 1.08–1.75), and dyslipidemia was lower in those eating lunch alone (OR 0.80; 95% CI 0.67–0.96). Depressive symptoms were higher in those eating alone for breakfast (OR 1.71; 95% CI 1.40–2.09), lunch (OR 1.43; 95% CI 1.17–1.76), and dinner (OR 2.13; 95% CI 1.57–2.90). For functional capacity, scores of intellectual activity, social role, competency (total TMIG-IC), social engagement, technology usage, information practice, life management, and total JST-IC were lower in those eating alone across all meals (all $P < 0.05$), with the exception of associations between eating lunch and dinner alone with technology usage and eating alone at lunch with information practice. In those living alone, scores of information practice and total JST-IC as indicators of functional capacity were lower in those eating alone at breakfast ($P = 0.010$ and 0.049 , respectively).

Discussion

This study investigated the associations between eating the three daily meals alone, socio-demographic characteristics, and health status including functional capacity across cohabitation situations in community-dwelling elderly. The results indicated an association between socio-demographic characteristics and eating alone, which differed according to cohabitation situation and the three daily meals. In addition, a negative association was observed between eating alone at each meal and various health statuses among those living with others and between eating alone at breakfast and some functional abilities in those living alone.

Considering socio-demographic characteristics, multiple variables were associated with eating alone in respondents living with others. By gender, women were more likely to eat alone at each meal, which is consistent with findings of previous studies examining the elderly in the United States [23]. In terms of age, those aged 65–69 years were more likely to eat alone at breakfast and lunch than those aged 70–79 years. In Japan, the employment rate of those aged 65–69 years is 54.8% for men and 34.4% for women [35]. The number of respondents eating alone at breakfast and lunch tended to be higher if employed, so it is possible that the association with age may be influenced by employment status.

However, those aged 80 years or over were more likely to eat alone at dinner than those aged 65–69 years. Although cohabitation situations differ, a study of older Japanese people living alone found that those aged 80 years or over were more likely to eat alone [9]. According to the Survey on Time Use and Leisure Activities in Japan, although elderly people aged 75 years and older begin their breakfast approximately 10 min later than the Japanese average, this age group begins their dinner approximately 60 min earlier for men and 40 min earlier for women [36]. Therefore, a discrepancy in meal times, relative to cohabitants, affects the proportion of those eating alone even though they are living with others. Those with 9 years of education or less were more likely to eat alone at dinner, and those with difficulty in self-assessed living conditions were more likely to eat alone at breakfast. The overall trend was similar to the data reported from previous studies of those living alone [9]. In residential areas, those in new residential areas are more likely to eat alone at lunch, which is similar to the findings of previous studies in the United States [23]. Those in former village areas, however, were more likely to eat alone at breakfast. The difference in employment rate between those live in former village areas versus those living in new residential areas (30% and 20%, respectively; $P < 0.001$) may have affected the probability of eating alone at lunch. Among people living alone, however, the late elderly and unemployed group tend to eat alone at lunch than the early elderly and employed group, suggesting that the early elderly and employed who are live alone eat lunch together with their colleagues.

For health status, eating alone at breakfast was the most frequently observed negative association in each meal for both those living with others and those living alone. In those living with others, only eating alone at breakfast was found to be negatively associated with subjective health, history of hypertension, and technology usage in terms of functional capacity. Previous studies in Japan and the United Kingdom have shown negative associations between eating alone and subjective health [9] and sodium intake [18], though this may have been particularly influenced by eating alone at breakfast. Because technology usage is a subscale of the JST-IC, which asks whether users can use technology such as mobile phones, ATMs, videos, DVD players, and e-mail [34], eating breakfast together in particular may help improve such functional capacities. BMI was not found to be associated with eating alone (even in analyses categorized by underweight and obese). Because depressive symptoms and other functional capacities were negatively associated with eating alone at breakfast, lunch, and dinner, it may be preferable to eating together at each meal from the viewpoint of frailty prevention, independent of energy intake. However, in those living alone, a negative association with eating alone at breakfast was observed for only information practice and total JST-IC in terms of functional capacity. Information practice is a subscale of the JST-IC that asks about interest in news and events from overseas, ability to determine the credibility of health-related information, enjoyment of art, films, or music, and participation in educational/cultural programs [34]. Those living alone who are able to eat breakfast with others may find it easier to create a social network through which such information may be shared.

This study has several limitations. First, because this is a cross-sectional study using the baseline survey of the KAGUYA study, the causal relationship between eating alone and health status cannot be examined. For example, for the positive association between eating alone at lunch and history of dyslipidemia in those living with others, the direction of causality between these variables may be in

reversal direction. Second, frequency of eating alone was not confirmed in this study because a simple self-administered questionnaire was used. However, many health statuses, including depressive symptoms, showed results consistent with those of previous studies [10–12], suggesting that at least the actual condition of eating alone was captured. Third, family structure and dining partner(s) were not investigated. In a previous study of elderly Japanese people [37], the frequency with which respondents were eating with various dining partners was reported in the following order: spouse, children, and grandchildren in those living with others; and children, friends, and others in those living alone. Future research should examine the health status in which the association with eating alone is observed according to diet, considering the dining partner. Fourth, it is not known whether the respondents want to eat meals with others. In a previous study of Japanese young adults [38], some respondents indicated that their impression of eating alone is not only lonely, but also quick and carefree. In Japan, an increase the percentage of citizens participating in *kyōshoku* (eating together) in their communities is one of the target aims of the current promotion of *shokuiku* (food and nutrition education) [39]. Among those living alone in particular, very few reported eating together, so this study was unable to examine its association with several health indicators. It is therefore important to make efforts to increase the region's percentage of people who want to eat together. Finally, there is limited generalizability because the setting of this study was limited to a single town. However, because the town encompasses both former village areas and new residential areas, the obtained data indicate that the observed phenomena apply to both urban and rural areas.

Conclusions

This study investigated the association between eating alone at each meal and health status according to cohabitation situation among Japanese community-dwelling elderly. It was found that depressive symptoms and many subscales of functional capacity were associated with eating alone at each of breakfast, lunch, and dinner in those living with others. Several health status indicators were also related to eating alone at breakfast for both those living with others and those living alone.

List Of Abbreviations

KAGUYA, Keeping Active across Generations Uniting the Youth and the Aged; BMI, body mass index; GDS, Geriatric Depression Scale; TMIG-IC, Tokyo Metropolitan Institute of Gerontology Index of Competence; JST-IC, Japan Science and Technology Agency Index of Competence; OR, odds ratio; CI, confidence interval.

Declarations

Ethics approval and consent to participate: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Research Ethics Committee of Kio University (approval number: H27–34). Written informed consent was obtained from all participants.

Consent for publication: Not applicable.

Availability of data and materials: The datasets generated and/or analysed during the current study are not publicly available due to the funding policy but are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: JM, DM, YN, and KT formulated the research questions and designed the study. JM and KT carried it out. OK analyzed the data and wrote the article. All authors read and approved the final manuscript.

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Tables

Due to technical limitations the Tables are available as a download in the Supplementary Files.

Figures

Figure 1

Participant flow in the study

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