

Brief report

Eating Alone Yet Living With Others Is Associated With Mortality in Older Men: The JAGES Cohort Survey

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Abstract

Objectives: Eating by oneself may be a risk factor for poor nutritional and mental statuses among older adults. However, their longitudinal association with mortality in relation to coresidential status is unknown.

Method: We conducted a 3-year follow-up of participants in the Japan Gerontological Evaluation Study, a population-based cohort of 65 years or older Japanese adults. We analyzed mortality for 33,083 men and 38,698 women from 2010 to 2013 and used. Cox regression models were used to estimate hazard ratios (HR) for mortality.

Results: A total of 3,217 deaths occurred during the follow-up. Compared with men who ate and lived with others, the HRs after adjusting for age and health status were 1.48 (95% confidence intervals [CI]: 1.26–1.74) for men who ate alone yet lived with others and 1.19 (95% CI: 1.01–1.41) for men who ate and lived alone. Among women, the adjusted HR was 1.18 (95% CI: 0.97–1.43) for women who ate alone yet lived with others and 1.10 (95% CI: 0.93–1.29) for women who ate and lived alone.

Discussion: A setting in which older adults eat together may be protective for them. Promotion of this intervention should focus on men who eat alone yet live with others.

Keywords: Eating alone—Living alone—Mortality—Social isolation

Recent studies of mealtime environments suggest that eating alone is a risk factor for unhealthy dietary behaviors, underweight, and depressive symptoms among older adults (Hughes, Bennett, & Hetherington, 2004; Kuroda et al., 2015; Shahar, Shai, Vardi, & Fraser, 2003; Tani, Kondo, et al., 2015; Tani, Sasaki, Haseda, Kondo, & Kondo, 2015). An intervention study among nursing home residents reported that family-style mealtimes (i.e., staff members sit down at tables and chat with residents) increased energy intake and prevented body weight loss (Nijs, de Graaf,

Kok, & van Staveren, 2006). Previous small-scale studies found a significant association between eating alone and mortality among older adults (Clausen, Wilson, Molebatsi, & Holmboe-Ottesen, 2007; Sahyoun, Jacques, Dallal, & Russell, 1997). However, these studies failed to account for potentially confounding or modifying factors such as coresidential status, history of disease, socioeconomic status, and social relationships.

The association between eating alone and mortality among older people may differ across regions. One

study, although it did not focus exclusively on older people, reported that, among 17 Organization for Economic Co-operation and Development countries, people in France spent the longest, and those in Japan spent the third-longest, total amount of time eating and drinking (OECD, 2009). This suggests that mealtimes play a central role in the daily social activities of French and Japanese people. Additionally, older adults spend more time eating than do younger adults (NHK Broadcasting Culture Research Institute, 2016), and about 90% of older adults in Japan find mealtimes to be enjoyable (Oda et al., 2008). Therefore, we examined the association between eating alone and mortality accounting for confounding factors among older Japanese adults.

Methods

Study Design and Participants

We have reported the details of the study design and participants elsewhere (Tani, Kondo, et al., 2016). Briefly, this research drew on data from the Japan Gerontological Evaluation Study (JAGES), a large-scale, population-based cohort study of Japanese people aged 65 or older who were physically and cognitively independent. The present analyses used data on 71,781 participants, after excluding participants with missing information on sex, age, mortality, eating status, or coresidential status, as well as those who reported limitations in activities of daily living, defined as being unable to walk, take a bath, or use the toilet without assistance.

Mortality Outcome

We retrieved information on death records from 2010 to 2013 from the government database of public long-term care insurance. Among these records, there were 3,217 deaths identified in the analysis sample (Supplementary Table 1).

Eating and Living Status

The present study assessed eating status using the question, "Who do you usually have meals with?" The possible responses were: *no one*, *spouse*, *children*, *grandchildren*, *friends*, and *other* (Tani, Sasaki, et al., 2015). Multiple responses were possible. For the analysis, we classified eating status as *eating with others* (for all but the first response), or *eating alone* (for *no one*). To determine respondents' coresidential status, we used their responses to the question of whether they lived with someone else or alone.

Covariates

Supplementary Table 2 displays the participants' characteristics. We gauged health status using the medical treatment of disease(s)/symptom(s) (Tani, Fujiwara, et al., 2016) and limitation in instrumental activities of daily living (IADL). Our assessments of IADL come from the Tokyo Metropolitan

Institute of Gerontology Index of Competence, which comprises the following five items: "Can you use public transportation (bus or train) by yourself?" "Are you able to shop for daily necessities?" "Are you able to prepare meals by yourself?" "Are you able to pay bills?" and "Can you handle your own banking?" These items have a "yes" or "no" response format (Koyano, Shibata, Nakazato, Haga, & Suyama, 1991). Annual equivalized household income was adjusted for household size, dividing the income by the square root of the number of people in that household. To measure social relationships, we included five questions about: marital status; social participation; frequency of meeting friends (Tani, Sasaki, et al., 2015); and providing and receiving instrumental social support. Variables representing nutritional status included body mass index, daily meal frequency, frequency of meat/fish intake, and frequency of vegetable/fruit intake (Tani, Kondo, et al., 2015). We assessed homeboundness using the frequency of going out, and we assessed depressive symptoms with the Japanese short version of the Geriatric Depression Scale (GDS-15) (Takagi et al., 2013; Wada, Ishine, Kita, Fujisawa, & Matsubayashi, 2003).

Statistical Analysis

We used Cox proportional hazards regression for evaluating the effects of eating and coresidential status on mortality during the 3-year follow-up period. Model 1 was a crude, nonadjusted model. In Model 2, we adjusted for the potential confounders of age and health status. In Model 3, we added socioeconomic status (education and equivalized household income) as another potential confounder. In Model 4, we further added social relationships as a covariate to examine whether the relationship between eating alone and mortality was independent of other social relationships. Finally, in Model 5, we also adjusted for nutritional status, homeboundness, and depressive symptoms as potential mediating factors linking eating status to mortality. We selected the explanatory variables by their clinical and epidemiological relevancies. We did not find any highly correlated covariates or any unstable estimates in any of the statistical analyses. To mitigate potential biases caused by missing information, we adopted the multiple imputation approach, under the missing at random assumption (MAR) (i.e., the missing data mechanism depends only on observed variables). We generated 200 imputed datasets using the multiple imputation by chained equations (MICE) procedure and synthesized the results using the standard Rubin's rule (White, Royston, & Wood, 2011). To conduct the analyses, we used Statistical Analysis Systems software version 9.4, R version 3.2.2, and Stata version 13.

Results

The results indicated that in both coresidential statuses, men who ate alone were more likely to die compared with those who ate and lived with others (Table 1, Supplementary Table 3).

Table 1. Hazard Ratios (HRs) (95% Confidence Interval (CI)) for Association of Mortality With Eating Alone in Older Japanese Men and Women

	Model 1 ^a	Model 2 ^b	Model 3 ^c	Model 4 ^d	Model 5 ^e
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Male					
Eat and live with others	Ref	ref	ref	ref	ref
Eat alone yet live with others	1.64 (1.39–1.93) ***	1.48 (1.26–1.74) ***	1.47 (1.24–1.73) ***	1.31 (1.09–1.56) **	1.21 (1.02–1.45) *
Eat with others yet live alone	0.84 (0.47–1.47)	0.83 (0.47–1.46)	0.84 (0.48–1.49)	0.77 (0.43–1.37)	0.74 (0.41–1.33)
Eat and live alone	1.31 (1.11–1.55) **	1.19 (1.01–1.41) *	1.18 (1.00–1.40)	1.00 (0.81–1.25)	0.97 (0.78–1.21)
Female					
Eat and live with others	ref	ref	ref	ref	ref
Eat alone yet live with others	1.62 (1.34–1.96) ***	1.18 (0.97–1.43)	1.16 (0.95–1.40)	1.03 (0.84–1.26)	0.98 (0.80–1.20)
Eat with others yet live alone	1.10 (0.76–1.59)	0.97 (0.67–1.41)	0.98 (0.68–1.43)	0.92 (0.63–1.35)	0.94 (0.64–1.37)
Eat and live alone	1.38 (1.17–1.62) ***	1.10 (0.93–1.29)	1.08 (0.92–1.27)	0.94 (0.78–1.14)	0.93 (0.77–1.12)

^aModel 1: crude. ^bModel 2: adjusted for age, medical treatment of disease(s)/symptom(s) and limitation of instrumental activities of daily living (IADL). ^cModel 3: Model 2 + adjusted for socioeconomic status (education and equivalized household income). ^dModel 4: Model 3 + adjusted for social relationships (marital status, social participation, frequency of meeting friends, given and received instrumental social support). ^eModel 5: Model 4 + adjusted for nutritional status (meal skipping, frequency of meat or fish and vegetable or fruit intake, and BMI), homeboundness and depressive symptoms.

* $p < .05$. ** $p < .01$. *** $p < .001$.

After adjustments for age, health status, and socioeconomic status, men who ate alone yet lived with others were found to be 1.47 times more likely to die compared with those who ate and lived with others (Model 3). After further adjusting for social relationships, the hazard ratio (HR) for male mortality became weaker but remained statistically significant. Men who ate and lived alone showed a 1.18 times higher HR for mortality compared with those who ate and lived with others (Model 3). However, additional adjustments for social relationships attenuated the HR toward the null. For women, after adjusting for age and health status, the HR reduced and became statistically nonsignificant. The interaction term between eating and coresidential status was statistically nonsignificant for both men and women ($p = .90$ and $p = .27$, respectively). However, the main effect of eating alone on mortality was essentially similar after accounting for the interaction term. The HR for men who ate alone compared with men who ate with others was 1.63 (95% confidence interval [CI]: 1.39–1.93, $p < .0001$) and remained statistically significant in Model 5. The HR for women who ate alone compared with women who ate with others was 1.61 (95% CI: 1.33–1.96, $p < .0001$) and became statistically nonsignificant after adjusting for age and health status.

Discussion

To our knowledge, this is the first study to examine the effect of eating alone on mortality by coresidential status among older adults. Consistent with previous studies (Tani,

Kondo, et al., 2015; Tani, Sasaki, et al., 2015), we found that the association between eating alone and mortality risk was more prominent in men than in women. The interaction term between eating and coresidential status was not statistically significant, suggesting that the effect of eating alone may not differ by coresidential status. Previous research has suggested that eating alone is associated with nutritional risk and depressive symptoms among older adults (Hughes et al., 2004; Kuroda et al., 2015; Shahar et al., 2003; Tani, Kondo, et al., 2015; Tani, Sasaki, et al., 2015). Given the attenuation of the association between eating alone and mortality following adjustments for nutritional status, homeboundness, and depressive symptoms among men in the present study, these variables may largely mediate the relation between eating alone and mortality.

However, the association between eating alone despite living with others and mortality among men remained even after adjusting for covariates, suggesting that additional unobserved factors explain this association for men. For example, eating alone yet living with others may reflect abuse, inadequate caregiving, or suicide risk. In our subsample, men who ate alone yet lived with others made up the highest percentage of those who had experienced acts that had harmed their self-esteem or taken away their savings or pension benefits, as well as those who were providing nursing care to any of their family members (Supplementary Table 4). Another explanatory mechanism may relate to suicide. A prospective study in Japan revealed that men, but not women,

living without a spouse, irrespective of coresidence with parents or children, were at increased risk of suicide (Poudel-Tandukar et al., 2011). The percentage of men living without a spouse was four times higher among those who ate alone yet lived with others compared with this percentage among those who ate and lived with others (Supplementary Table 5). Additionally, eating status as measured in this study may act as a proxy for family cohesion among older adults. Previous findings showing that older men who eat alone yet live with others have the weakest social ties with family provide further evidence of this (Kuroda et al., 2015). After World War II, it became commonplace in Japan for families to eat meals together; in 1975, about 90% of older adults ate with their families (Ministry of Health, Labour and Welfare, 1977). Home economics education stressed the importance of “happy family get-togethers around the table,” as if to supplement the poor food supply with increased social cohesion. Additionally, the popularization of low collapsible tables (*chabudai*) instead of four-legged trays for a single person (*ozen*) increased family meals in the home (Omote, 2007). Therefore, people generally consider eating alone to be a sad circumstance, and this may affect the mental health status of people in Japan.

Among men who ate and lived alone, the estimates of increased mortality risks mostly disappeared after adjusting for social relationships. This may suggest that, if one lives alone, eating alone may simply be a marker of social isolation. Japanese data have shown that, for older adults living alone, the opportunity to eat with others occurs primarily when they are meeting friends or participating in hobby groups (Takemi & Adachi, 1997).

Among women, eating alone did not predict mortality after accounting for age and health status. One possible explanation for this is that eating alone may not represent a critical risk nutritionally or psychosocially for women compared with men. Indeed, we previously found that the effects of eating alone on unhealthy dietary behaviors and underweight were more prominent among men than among women (Tani, Kondo, et al., 2015). Further, although we have hypothesized that social activities during mealtimes are important, it may be that, because women are generally better than men at seeking out and organizing social opportunities, their social activities do not depend on mealtimes.

This study has several limitations. First, we measured eating alone using a single-item question that does not contain any information about frequency, time of day, or location. Second, our analysis was limited to all-cause mortality. Third, although the participants were exclusively older people who were physically and cognitively independent, we cannot rule out the possibility of an inverse association. However, when we excluded early deaths (within 1 year) from the analysis, the results were substantially similar (Supplementary Table 6). Fourth, we lacked data on participant requirements for an invalid diet or modified meals, which may influence eating status. Nonetheless, few

participants (0.55%) reported dysphagia, and the significant association did not change after adjusting for dysphasia. Fifth, we were unable to measure participants' satisfaction with social relationships, which may have modified the association. Sixth, the follow-up period may not have been sufficient to obtain the necessary statistical power to detect the association of interest. Finally, we did not account for some potentially important details pertaining to coresidential status, such as the characteristics of those living together, the duration of coresidence, and family relationships.

One important implication that our findings have for public health is that promoting settings in which older adults eat together may be protective for their health. Such an intervention is more likely to be provided for those living alone. However, we suggest that men who live with others might also be important targets.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological and Social Sciences* online.

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Conflict of Interest

None declared.

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