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PERSONALITY AND BODY MASS INDEX IN ELDERLY PEOPLE LIVING IN THE COMMUNITY IN JAPAN

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Abstract: *Objective:* To examine the relationship between personality and body mass index (BMI) in a sample of elderly Japanese people living in the community. *Design:* We used a cross-sectional study design. *Setting:* We conducted the study in a community setting. *Participants:* We studied 950 individuals (401 men and 549 women) aged 65–77 years. *Measurements:* The participants self-reported their height and weight and we used these to calculate their BMIs. We divided the participants into three groups: underweight (BMI < 18.5), normal (BMI 18.5–24.9) and overweight (BMI ≥ 25.0). We administered the Eysenck Personality Inventory (EPI) to assess the personality traits of neuroticism and extraversion. After stratifying the data by sex, we performed multivariate logistic regressions adjusted for age, presence of chronic diseases, and instrumental activities of daily living for each personality trait to test the correlations between personality and BMI (underweight and overweight). *Results:* The proportions of underweight, normal and overweight individuals were identical between sexes, being 11.7%, 71.3% and 16.9% in men and 12.6%, 67.8% and 19.7% in women, respectively. Logistic regression showed that neuroticism was associated with being underweight both in men (1-standard-deviation [SD] increment; odds ratio [OR] = 1.59, $p < 0.01$) and women (OR = 1.37, $p < 0.01$), and that extraversion was associated with being overweight in men (OR = 1.32, $p < 0.05$), and negatively associated with being underweight in women (OR = 0.70, $p < 0.01$). *Conclusion:* Our results suggest that neurotic older men and women are more likely to be underweight, that extraverted elderly men are more likely to be overweight, and that extraverted elderly women are less likely to be underweight.

Key words: Body mass index, community elderly, extraversion, neuroticism, personality.

Introduction

Body mass is known to be associated with major health issues in the middle-aged and elderly, including mortality (1, 2), cancer (3), heart disease (4), and diabetes (5). Therefore, it is important to understand the factors that affect body mass and to apply interventions that have been shown to be effective in achieving weight control (6, 7). Previous studies have shown that not only genetic, but also environmental and behavioral factors, have important impacts on body mass (8, 9).

Personality is one of the behavioral factors that has an impact on body mass, because it is a critical determinant of eating behaviors, including problematic ones such as overeating and refusal of food (10, 11), and of health behaviors such as smoking (12), alcohol consumption (13), and regularity of exercise (14). Personality refers to an enduring set of traits and characteristics that influence one's thoughts, feelings and behavior. Of the personality traits, "neuroticism" and "extraversion" have been widely studied in health science research (15). Neuroticism denotes a tendency to be vulnerable to psychological distress; neurotic people are more prone to experiencing negative emotions, such as depression, anxiety and anger. Extraversion indicates a tendency to be sociable, active and to experience positive emotions; extraverted individuals are more inclined to engage in social interactions.

Recent studies of adults have reported correlations between personality and body mass as assessed by body mass index (BMI) (16–21). In Japan, Kakizaki (22) examined the relationships between personality and BMI in middle-aged subjects and showed that various personality factors are associated with being both over- and underweight. However, the application of findings from middle-aged subjects to the elderly is problematic, because studies in geriatrics have found that different factors contribute to the health status of younger and older people (23–25). Thus, investigation of the relationship between personality and BMI in the elderly

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is necessary. The present study used a cross-sectional design to examine the relationships between two domains of personality traits (neuroticism and extraversion) and being under- and overweight, as assessed by BMI, in elderly Japanese subjects living in the community.

Methods

Participants

Data for the present study were derived from the Longitudinal Interdisciplinary Study on Aging conducted by the Tokyo Metropolitan Institute of Gerontology (26, 27). This study aimed to clarify longitudinal changes in psychological and physical functioning in middle-aged and elderly people living in the community, and to explore healthy lifestyles and ways of coping with many of the challenges of old age, such as stressful life events, chronic diseases, disabilities and bereavement. The study took place in Itabashi ward, which is located in northern Tokyo. In 1991, we systematically selected a sample of 4440 residents (aged 50–74 years) from the municipal resident registration files in Itabashi ward. We acquired 3097 complete sets of data in a first-round home-visit survey in 1991. We then carried out follow-up interviews every year until 2000.

We acquired 2480 complete sets of data in the third round of the survey in 1993. Of the 2480 participants who took part in the third round of the survey, we used only data from the 963 who were aged 65 years and over in 1993. Of these, we excluded 13 people for whom measurements of height were missing. After these exclusions, we analyzed the data of the remaining 950 individuals (401 men and 549 women).

Personality traits

We administered the Japanese version of the Eysenck Personality Inventory (EPI) (15) to assess the personality traits of neuroticism and extraversion. The EPI requires participants to answer "yes" or "no" to each of 48 statements. We totaled their responses to get scores for each trait (range from 0–24). Higher scores indicate stronger expression of the trait. In our study, Cronbach's alpha coefficients for neuroticism in men and women and extraversion in men and women were 0.84, 0.86, 0.63 and 0.64, respectively.

Outcome measures

The participants self-reported their body weights and heights. We calculated BMI as follows: weight in kilograms divided by height in meters squared (kg/m^2). We divided participants into the following three categories: underweight (BMI < 18.5), normal (BMI: 18.5–24.9), overweight (BMI ≧ 25.0), according to World Health Organization guidelines (28, 29).

Covariates

Data collected in 1993 on age, presence of chronic disease and instrumental activities of daily living (IADL, measured by the Tokyo Metropolitan Institute of Gerontology Index of Competence) (30), were used as covariates in tests for independent associations between personality traits and BMI. The participants self-reported the presence of chronic disease, which we defined as having at least one of the following: cancer, diabetes, heart disease or stroke.

Statistical analysis

To clarify the significance of differences between sexes in the measured characteristics, we used Student's t-tests for continuous measures and χ^2 tests for categorical measures. After stratifying by sex, we used logistic regression analyses controlled for age, presence of chronic disease and IADL to test for independent relationships between each personality trait and BMI. We conducted logistic regression analyses according to each personality trait. We performed all statistical procedures with SAS version 9.2 software (SAS Institute, Cary, NC).

Ethical considerations

The study was explained to all participants, who were advised that: 1) their participation would be entirely voluntary; 2) they could withdraw from the study at any time; and 3) if they chose not to participate or to withdraw, then they would not be disadvantaged in any way. The study was approved by the Ethics Committee of the Tokyo Metropolitan Institute of Gerontology.

Results

Table 1 shows relevant characteristics of participants, including age, number of years of education, presence of chronic disease, proportion living alone, subjective health status, IADL score, grip strength, distribution of total scores for each personality scale and BMI. Men were more likely to have been educated to a higher level ($p < 0.01$) and less likely to be living alone ($p < 0.01$), had better subjective health status ($p < 0.01$), lower scores on the IADL ($p < 0.01$), stronger grip strength ($p < 0.01$), and lower neuroticism scores ($p < 0.01$) than women. The proportions of underweight, normal and overweight individuals were similar in each sex, being 11.7%, 71.3%,

and 16.9% in men and 12.6%, 67.8%, and 19.7% in women, respectively.

Table 1
Baseline characteristics of participants (N = 950)

	Men n=401	Women n=549	P-value [b]
Age, mean±SD (years)	69.8±3.4	69.8±3.3	0.88
Education, mean±SD (years)	10.9±3.4	9.3±2.2	<0.01
Presence of chronic diseases, n (%) [a]	44 (10.9)	51 (9.3)	0.39
Living alone, n (%)	24 (5.9)	102 (18.6)	<0.01
Subjective health (fair/ poor%)	83 (20.7)	151 (27.6)	<0.01
IADL, mean±SD (points)	4.6±0.9	4.8±0.6	<0.01
Grip Strength, mean±SD (Kg)	36.1±8.3	22.4±5.4	<0.01
Neuroticism (points)	5.8±5.2	7.2±4.9	<0.01
Extraversion (points)	10.6±3.3	10.3±3.3	0.13
BMI, mean±SD (Kg/m^2)	22.4±3.1	22.2±3.2	0.44
Underweight (BMI<18.5), n (%)	47 (11.7)	69 (12.6)	0.48
Normal (BMI: 18.5-24.9), n (%)	286 (71.3)	372 (67.8)	
Overweight: (BMI>25.0), n (%)	68 (16.9)	108 (19.7)	

a. We defined presence of chronic disease as having at least one of the following: cancer, diabetes, heart disease or stroke; b. Student's t-tests for continuous measures and χ^2 tests for categorical measures were used to clarify the sex differences for these characteristics.

Table 2 shows the correlations between personality traits and BMI (underweight and overweight). Multivariate logistic regressions showed that neuroticism was significantly associated with being underweight both in men (1-SD increment; odds ratio [OR] = 1.59, 95% confidence intervals (CI): 1.20–2.09, $p < 0.01$) and women (OR = 1.37, 95% CI: 1.07–1.74, $p < 0.01$); and that extraversion was significantly associated with being overweight in men (OR = 1.32, 95% CI: 1.01–1.72, $p < 0.05$) and negatively associated with being underweight in women (OR = 0.70, 95% CI: 0.55–0.93, $p < 0.01$).

Discussion

Our study used a cross-sectional study design to examine the association between personality traits and BMI among elderly Japanese living in the community. Our findings indicated that neurotic older men and women are more likely to be underweight, extraverted elderly men are more likely to be overweight and extraverted elderly women are less likely to be underweight.

The relationship we identified between personality and BMI may not reflect a true correlation because other factors may have confounded our findings. However, this possibility is low because we found significant relationships between personality and BMI even after adjustment for possible confounders such as chronic disease and IADL scores.

Our results show that neurotic older men and women are more likely to be underweight. These findings are consistent with a previous study that reported similar correlations in middle-aged individuals in Japan (22). Numerous studies have reported that, in the elderly, underweight individuals have a higher mortality than do those of normal weight (1, 2, 34–37). In addition, neuroticism affects health status because neurotic people are prone to experiencing more negative emotions and stressful feelings, both of which are associated with an increased risk of poor health. Previous studies also reported that neuroticism was a risk factor for mortality in the elderly (31–33). Therefore, the tendency for neurotic elderly individuals to be more prone to being underweight may be disadvantageous to their health.

Our results showed that extraverted elderly men are more likely to be overweight, whereas extraverted elderly women are less likely to be underweight. These trends are in part consistent with a previous study that reported similar correlations in middle-aged individuals in Japan (22). Both this study and the present one suggest that extraverted individuals are less likely to lose weight. Since, as formerly stated, being underweight is a mortality risk in the elderly (1, 2, 34–37), a tendency not to be underweight may be desirable in regard to maintaining good health. Is being overweight harmful to health among the elderly? According to one meta-analytic report, being overweight is no longer a mortality risk in the elderly (38). In addition, more recent studies have reported that, in the elderly, overweight individuals are likely to live longer than those of normal weight (23, 34). In addition, previous studies reported that extraversion had a protective effect on mortality (32, 33). Therefore, the tendency for extraverted elderly individuals to be less prone to losing weight may be

Table 2
Adjusted odds ratio and 95% confidence intervals for overweight and underweight by personality traits stratified by sex (N = 950)

	Underweight						Overweight					
	Men			Women			Men			Women		
	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
Neuroticism	1.59	1.20-2.09	<0.01	1.37	1.07-1.74	<0.01	0.93	0.70-1.21	0.59	1.13	0.91-1.39	0.27
Extraversion	0.87	0.64-1.19	0.40	0.70	0.55-0.93	<0.01	1.32	1.01-1.72	<0.05	1.10	0.89-1.27	0.36

After stratifying by sex, we used multiple logistic regression analyses controlled for age, presence of chronic diseases and IADL to test for independent relationships between each personality trait and BMI. We conducted logistic regression analyses by each personality trait. One odds ratio (OR) unit in personality trait corresponds to a 1-SD increment. CI=confidence interval.

advantageous to their health.

Extraversion, however, is a "double-edged sword", because this trait leads to both health-promoting and health-damaging behavioral patterns (15). Extraverted people are prone to be sociable, active and to experience positive emotions, all of which decrease the impact of stress (39). On the other hand, the behavioral patterns of extraverted individuals center, in part, on seeking stimulation and excitement, which can sometimes be a risk to health (15). Therefore, we should also pay attention to the risky aspects of extraversion. As shown by the current results, extraverted elderly men are prone to be overweight, suggesting a tendency to overeat and become obese to the point of eventually impairing health.

Caution should be exercised in generalizing our findings for two reasons: First, the self-reported evaluations of height and weight used in our study may be less accurate than objectively measured height and weight. A systematic review has shown that, compared with objective measurements, self-reported height is likely to be over-reported, whereas self-reported weight and BMI are likely to be under-reported (40). However, a recent report concluded that the accuracy of self-reported height and weight is reasonably high among elderly Japanese and useful in epidemiological studies (41). Second, in order to examine the representativeness of our study sample with regard to BMI, we compared BMI of the subjects in this study with that of the national norms in Japan in 1993 (42). The BMI of 65–69 and 70–74-year-olds was 22.8 and 22.4 kg/m^2 in men and 23.6 and 23.4 kg/m^2 in women, respectively, indicating that the BMI of male subjects in this study was almost identical and of female subjects was lower compared with that of the national norms in 1993. The national norms of BMI in 2009 of 65–69 and 70–74-year-olds were 23.7 and 23.8 kg/m^2 in men and 23.0 and 23.1 kg/m^2 in women, respectively (43). It seems that BMI has increased with a trend toward weight gain especially in elderly men. Comparing our data with the national norms in 2009, subjects in this study, of both sexes, had lower BMI than the national norms in 2009, and this may have a bearing on our results of the relationship between personality and BMI. However, as previously noted, BMI based on self-reports is likely to be under-estimated, so the difference between BMI in our samples and in the national norms might not be too great. Third, because we used a cross-sectional approach in our study, we cannot assign causality to the relationship between personality and BMI. That is, we cannot know whether our result is due to the effect of personality on BMI. A further study using a longitudinal approach is needed to ascertain any causal relationship between personality and BMI.

In conclusion, we found that neurotic older men and women are more likely to be underweight, extraverted elderly men more likely to be overweight, and extraverted elderly women less likely to be underweight. The findings should provide further insight into the association between behavioral factors, including personality, and body mass, and may contribute to development of health strategies to maintain optimal weight for good health among the elderly.

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