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Original article

Personality traits, self-efficacy for exercise, and exercise levels in older Japanese adults

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Abstract

Objective: This study aimed to examine the association between the five factor model of personality and exercise level and self-efficacy (SE) for exercise in older Japanese adults. This study also examined whether SE mediates the association between personality and exercise behavior. **Methods**: A questionnaire survey was distributed that determined age, sex, physical health, exercise level, SE for exercise, and personality traits of 1,515 older Japanese adults. Of these 1,515 people, 876 aged 60–92 years completed the questionnaire survey. **Results**: Extraversion and conscientiousness were significantly and positively associated with exercise level after controlling for age, sex, and physical health. All domains of personality traits (extraversion, openness, agreeableness, and conscientiousness were positive, but neuroticism was negative) were significantly correlated with SE for exercise. Structural equation modeling showed that only extraversion was directly affected by exercise level, all personality traits showed significant pathways to SE for exercise, and SE for exercise was the greatest predictor of exercise level in all pathways in the final model. **Conclusion**: Extraversion is directly associated with exercise level, extraversion, and other personality traits that are affected by SE for exercise. Additionally, SE for exercise is the greatest predictor of exercise level in older Japanese adults.

Key words: exercise, older adults, personality, self-efficacy, structural equation modeling

Introduction

As in many developed countries, a high proportion of Japan's population is aged (population aged 65 years or older was approximately 23% in 2012). Maintaining better physical and psychological health is an important issue along with the extension of life expectancy for elderly people. Regular physical activity, such as exercise and sports, is an important determinant of health in later life. Many previous studies have consistently demonstrated associations of habitual physical activity with the prevention of chronic disease, such as hypertension, diabetes, and cardiovascular diseases, delay of functional loss, and maintaining better psychological health (Buchner, 1997; Fox, Stathi, McKenna, & Davis, 2007; Larson, Wang, Bowen, McCormick, Teri, Crane, & KuKull, 2006; Nelson, Rejeski, Blair, Duncan, Judge, King, Macera, & Castaneda-Sceppa, 2007; Windle, Hughes, Linck, Russell, & Woods, 2010). However, the prevalence of participation in regular leisure-time physical activity (30 minutes or

more of moderate-intensity physical activity at least two times per week) for Japanese adults is approximately 35% in men and 29% in women (Japan Ministry of Health, Labour and Welfare, 2012). With regard to older adults, daily physical activity assessed by step counts of men and women is 7,092 and 6,234 steps/day in those aged 60–69 years, and 4,890 and 3,872 steps/day in people older than 70 years, respectively (Japan Ministry of Health, Labour and Welfare, 2012). All of these values fall far short of national health objectives. Therefore, it is important to understand factors that affect physical activity levels prior to designing strategies for bringing physical activity closer to optimal levels across all age groups, including older adults.

Many researchers have reported that personality traits are associated with health outcomes and behavior. In studies investigating this association, personality traits are often assessed adopting the five factor model (FFM) of personality as a comprehensive measurement of basic independent personality factors, including neuroticism, extraversion, openness, agreeableness, and conscientiousness (McCrae & Costa, 1987; McCrae & John, 1992). Generally, previous studies have shown that people who have high extraversion, openness, agreeableness, and/or conscientiousness, and low neuroticism have better health outcomes (e.g., lower mortality, better self-rated health, and lower perceived stress) (Ebstrup, Eplov, Pisinger, & Jorgensen, 2011; Turiano, Pitzer, Armour, Karlamangla, Ryff, & Mroczek, 2012; Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004) and a favorable health behavior (e.g., non-smoking, healthy eating habits, and engaging in physical activity) (Brummett, Siegler, Day, & Costa, 2008; Rhodes & Smith, 2006; Terracciano & Costa, 2004).

Most of the previous studies in the area of health science examined a direct association of personality traits on health outcomes and behavior. However, some researchers have pointed out that it is important to discuss associations between personality traits and health behavior, including social cognitive factors. Additionally, personality traits are probably stronger correlates of social cognitive factors, such as self-efficacy (SE), than actual health outcomes and behavior (Molloy, Randall, Wikman, Perkins-Porras, Messerli-Burgy, & Steptoe, 2012; Strobel, Tumasjan, & Sporrle, 2011). SE is individuals' perceptions regarding their ability to act effectively to achieve desired results, and it is well known that SE is a strong predictor of health behavior, including exercise behavior (Bauman, Reis, Sallis, Wells, Loos, & Martin, 2012; Park & Gaffey, 2007). Additionally, SE is generally considered as a task-specific nature of how people think and feel toward a particular behavior. Therefore, personality traits, which are human nature, might be influenced by SE, and not only by actual behavior. If particular personality traits are found to influence an exercise behavior through SE for exercise, it would be an effective strategy to promote the said exercise behavior by enhancing the SE for exercise for individuals with these personality traits. On the contrary, for a person without these personality traits, an intervention strategy using different mediators (e.g., social support for exercise and/or perceived neighborhood environment) may become effective in promoting an exercise behavior.

Therefore, a study incorporating personality with SE to predict health behavior is required to understand the association between personality and health behavior. However, there is currently a lack of studies examining the relationship between personality traits and exercise behavior considering social cognitive factors in Japanese people, especially older people.

The purpose of the present study was to examine the association between personality traits assessed by the FFM and exercise level and SE for exercise in older Japanese adults. This study also examined whether SE mediates the association between personality and exercise behavior (see Figure 1). We hypothesized that personality traits are indirectly influenced by exercise behavior through SE for exercise.

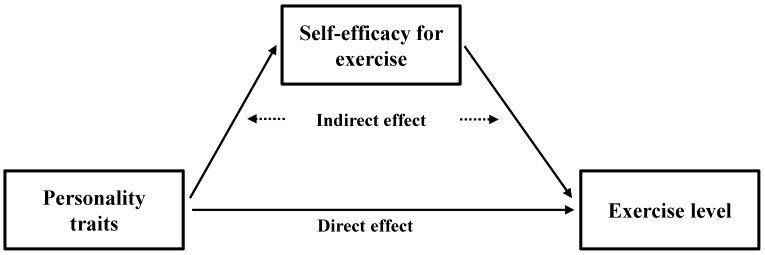


Figure 1. Interrelationship between personality traits, self-efficacy for exercise, and exercise level (hypothetical model)

Methods

Study Design and Participants

The participants in this study were older Japanese adults, aged older than 60 years, who were recruited from the federation of the senior citizen's club in Sagamihara City. All participants resided in Sagamihara, Kanagawa Prefecture, Japan. Sagamihara adjoins Tokyo, which is the capital of Japan, and in 2012 it had a population of approximately 710,000. In March 2012, questionnaire surveys were distributed to 1,515 people. The surveys were collected 2 weeks later through the federation of the senior citizens' club in Sagamihara City. Eight hundred seventy-six of the 1,515 (56%) people to whom it was administered completed the questionnaire survey (no missing values). Finally, analysis was conducted on the responses of 487 men and 389 women. All participants gave written informed consent to participate in this study and the study was approved by the Institutional Review Board of Tokai University.

Measures

Control variables. Age, sex, and physical health were measured. Physical health was assessed using the physical component summary (PCS) of the validated Japanese-language version of the SF-8 questionnaire with higher scores indicating a better physical health (Fukuhara & Suzukamo, 2004; Ware, Bjorner, & Kosinski, 2000).

Exercise level. Participants' exercise level was assessed using the exercise/sports domain of the Physical Activity Questionnaire for Elderly Japanese (PAQ-EJ) (Yasunaga, Park, Watanabe, Togo, Park, Shephard, & Aoyagi, 2007). The PAQ-EJ is a self-administered recall questionnaire that explores the frequency and duration of involvement in each of the seven categories of PA during a typical week in the past month. This questionnaire focuses on the four domains of physical activity common among elderly Japanese (and older people in many other parts of the world) as follows: personal transportation, exercise/sports (three sub-categories of light, moderate, or somewhat strenuous, and resistance), housework (two sub-categories of light and moderate or somewhat heavy), and labor. The validity of the PAQ-EJ was confirmed using an accelerometer. The subtotal score for the exercise/sports domain of the PAQ-EJ (higher intensity activities) was significantly correlated with a duration of ≥3 metabolic equivalents (r=.53) (Yasunaga et al., 2007). For the exercise/sport domain of the PAQ-EJ, the possible score ranged from 0 to 199.5, with higher scores indicating a greater exercise/sports level. Internal consistency of the exercise/sports score in this study was α=.61.

SE for exercise. SE for exercise was measured using a four-item scale (Oka, 2003). This scale

focuses on SE expectations relating to the degree of confidence to exercise in the face of barriers (bad weather, being busy, tiredness, and being lazy), rated on a five-point Likert scale ranging from 1 (not at all confident) to 5 (very confident). The total scores on this scale ranged from 4 to 20, with higher scores indicating a higher level of SE for exercise. Internal consistency of SE for exercise in this study was α=.92.

Personality traits. Personality was assessed using the Japanese version of Neo-Five Factors Inventory (Neo-FFI) (Costa & McCrae, 1992; Shimonaka, Nakazato, Gondo, & Takayama, 2011). Neo-FFI is essentially an authorized short form of the Neo PI-R (240 items) and consists of a 60-item scale, with 12 questions defining each of the five domains: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Neo-FFI is rated on a five-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). The total scores for each dimension ranged from 0 to 48, with higher scores indicating a higher level of the trait. Internal consistency values for neuroticism, extraversion, openness, agreeableness, and conscientiousness were α=.80, .75, .54, .77, and .78, respectively.

Statistical Analyses

Non-paired *t*-tests were used to analyze sex differences in age, physical health, exercise level, SE for exercise, and the five domains of personality (neuroticism, extraversion, openness, agreeableness, and conscientiousness). After adjusting for control variables, partial correlation coefficients were calculated between exercise level and SE for exercise and the five domains of personality. Finally, a hypothetical model to test the interrelationship among personality, exercise level, and SE for exercise was assessed by structural equation modeling (SEM). All statistical contrasts were made at the .05 level of significance. All analyses, except for the SEM, were conducted using IBM SPSS Statistics 20.0 (IBM Japan Corp., Tokyo, Japan). SEM was performed using IBM AMOS 21.0 (IBM Japan Corp.).

Results

Sex differences in characteristics of the participants are shown in Table 1. The non-paired *t*-test showed that age ($p<.05$) and exercise level ($p<.05$) were significantly higher in men than in women. Women had significantly higher scores than men in the four domains of personality; neuroticism ($p<.05$), extraversion ($p<.01$), openness ($p<.05$), and agreeableness ($p<.01$).

The relationships between the degree of exercise level and SE for exercise and personality are shown in Table 2. Partial correlation analysis controlling for age, sex, and physical health showed significant and positive relationships between exercise level and two personality domains (extraversion, r=.21; conscientiousness, r=.14), and SE for exercise and four domains of personality (extraversion, r=.21; openness, r=.21; agreeableness, r=.07; and conscientiousness, r=.16). SE for exercise was negatively associated with neuroticism (r=−.13).

The interrelationship among three factors, personality, SE for exercise, and exercise level, is shown in Figures 2 and 3. First, we established a hypothetical model to determine whether personality traits exert a direct influence on actual exercise level and SE for exercise (model 1; Figure 2). SEM showed that model 1 provided a relatively good fit for the data as follows: χ^2=32.84 (df=4, $p<.001$), the goodness of fit index (GFI) =.99, the adjusted goodness of fit index (AGFI) =.93, the comparative fit index (CFI) =.97, and the root mean square error of approximation (RMSEA)=.09. However, pathways from exercise level to neuroticism, agreeableness, and

Table 1　Sex Differences in Characteristics of the Participants

	All (n=876)	Men (n=487)	Women (n=389)
Age (years)	73.0±5.4	73.4±5.3	72.6±5.4*
Physical health	60.2±7.0	60.1±6.9	60.3±7.0
Exercise level	33.7±30.7	35.9±31.1	30.9±30.0*
Self-efficacy for exercise	12.7±4.4	12.7±4.2	12.6±4.7
Personality traits			
Neuroticism	20.3±6.0	19.8±5.5	20.9±6.6*
Extraversion	27.8±5.5	27.4±5.5	28.4±5.5**
Openness	25.4±4.2	25.1±4.3	25.7±4.1*
Agreeableness	31.8±4.9	31.0±4.8	32.8±4.8**
Conscientiousness	30.2±5.2	30.1±5.0	30.4±5.4

Note. Values are mean±standard deviation.
*p<.05; **p<.01.

Table 2　Relationships between Exercise Level and Self-Efficacy for Exercise and Personality

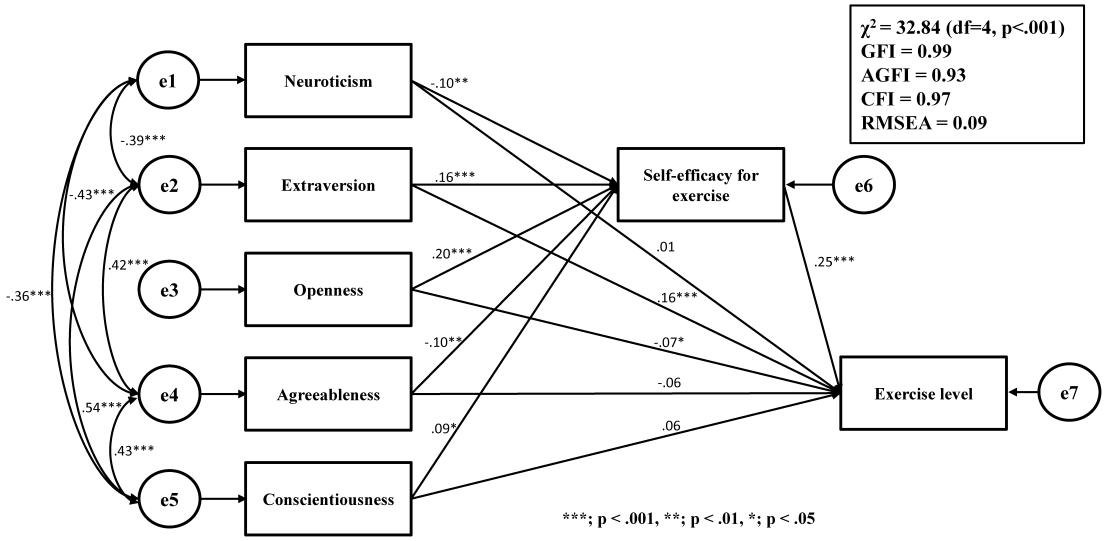
	Exercise level	Self-efficacy for exercise
Personality		
Neuroticism	−.050	−.129**
Extraversion	.206**	.208**
Openness	.001	.211**
Agreeableness	.033	.067*
Conscientiousness	.141**	.158**

Note. Values are correlation coefficients.
*p<.05; **p<.01.

conscientiousness were not statistically significant. Therefore, we reestablished a modified model (model 2; Figure 3) by deleting these three pathways from model 1 and re-conducted the analysis. The reanalysis was a better fit of the data compared with model 1: χ^2=37.59 (df=7, p<.001), GFI=.99, AGFI=.95, CFI=.97, and RMSEA=.07. In addition, all path coefficients were statistically significant (all p<.05).

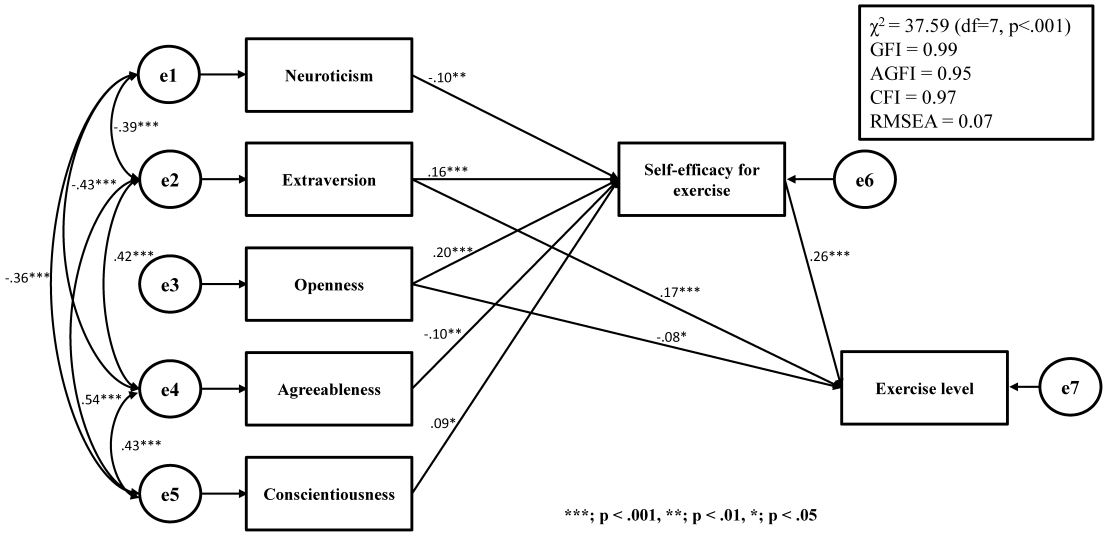
Discussion

This study examined the cross-sectional relationships between exercise level, SE for exercise, and personality traits assessed by FFM in older Japanese adults. This study also analyzed whether SE for exercise mediates the association between personality traits and exercise behavior.



Note. Values are path coefficients. GFI; goodness of fit index, AGFI; adjusted goodness of fit index, CFI; comparative fit index, and RMSEA; root mean square error of approximation, e; error variables.

Figure 2. Interrelationship between personality traits, self-efficacy for exercise, and exercise level (model 1)



Note. Values are path coefficients. GFI; goodness of fit index, AGFI; adjusted goodness of fit index, CFI; comparative fit index, and RMSEA; root mean square error of approximation, e; error variables.

Figure 3. Interrelationship between personality traits, self-efficacy for exercise, and exercise level (model 2)

First, the score for the PAQ-EJ in our sample was 33.7, which was higher than scores of older Japanese in a previous study. Yasunaga et al. (2007) observed that the exercise/sports score of the PAQ-EJ was 18.1 in a large sample (3,084 older people) aged 65–99 years, including frail people. Also, physical health assessed by the PCS of

the validated Japanese-language version of the SF-8 questionnaire was better in our sample (60.2) than in a previous study (48.5 for ages 60–69 years and 46.6 for ages 70–75 years) (Fukuhara & Suzukamo, 2004). These findings indicate that participants in our study were more active and healthy compared with a representative Japanese older sample. Accordingly, it is necessary to consider this point when interpreting our results.

Generally, previous studies have reported that leisure time and moderate or vigorous physical activity, such as exercise and sports, are more prevalent in men than in women (Caspersen, Pereira, & Curran, 2000; Yasunaga et al., 2007). In line with this expectation, our data showed that the exercise/sports score of the PAQ-EJ was approximately 16% greater for men than for women. However, for personality, women showed slightly but significantly higher scores than did men in neuroticism, extraversion, openness, and agreeableness, and conscientiousness was almost the same score in both sexes. A large-population study (3,032 persons aged 25–74 years) showed that women had significantly higher levels of neuroticism, extraversion, agreeableness, and conscientiousness than men (Goodwin & Friedman, 2006). Similarly, the Neo-PI-R and Neo-FFI manual for the Japanese version revised and enlarged edition (Shimonaka, Nakazato, Gondo, & Takayama, 2011) noted that scores for all domains of the NEO-FFI, except for openness, in Japanese adults aged over 21 years were greater in women than in men. Our results are consistent with these previous findings.

Previous studies have demonstrated that personality traits are closely related to human health behaviors (Brummett et al., 2008; Rhodes, 2006; Rhodes & Smith, 2006; Terracciano & Costa, 2004). Similar to physical activity behavior, a review article reported that extraversion and conscientiousness are consistent positive correlates of physical activity, and neuroticism is a relatively consistent negative correlate (Rhodes, 2006). The results of an epidemiological study (3,471 persons aged 18–69 years) indicated that low extraversion, conscientiousness, and openness, and high neuroticism are associated with an inactive lifestyle (Ebstrup, Aadahl, Eplov, Pisinger, & Jorgensen, 2013). Taken together, these previous studies suggest that personality traits, especially neuroticism, extraversion, and conscientiousness, are affected by exercise participation and physical activity level. The present results of the partial correlation analysis also showed positive and significant associations between extraversion and conscientiousness and exercise level; older adults who had high extraversion and conscientiousness engaged in a large amount of exercise. However, neuroticism, openness, and agreeableness were not significantly associated with exercise level in our study. A meta-analysis by Rhodes and Smith (2006) showed that neuroticism had a weaker effect on physical activity than extraversion and conscientiousness (summary r was −.11 vs. .23 and .20), and the relationships between openness, agreeableness, and physical activity were extremely weak (summary r was .08 and .01, respectively). Additionally, Lochbaum, Rhodes, Stevenson, Surles, Stevens, and Wang (2010) reported that although extraversion and conscientiousness were positively and significantly correlated with strenuous intensity of physical activity behavior in both sexes, openness in women (r=−.07; not significant) and agreeableness in men (r=−.09; significant) showed an inverse relationship. Therefore, associations between exercise level and neuroticism, openness, and agreeableness in previous studies were not consistently compared with the relationships between extraversion and conscientiousness with exercise level. Our results showed that neuroticism, extraversion, openness, and conscientiousness were significantly associated with SE for exercise (r=−.13, .21, .21, and .16, respectively), and agreeableness were slightly, but significantly, associated with SE for exercise (r=.07). In addition, correlation coefficients related to neuroticism, openness, and agreeableness were greater for SE for exercise than for exercise level (r=−.13 vs. −.05; .21 vs. .00; .07 vs. .03, respectively), but r values were almost identical for between

extraversion and conscientiousness and SE for exercise and exercise level (r=.21 vs. .21; .16 vs. .14, respectively). Accordingly, extraversion and conscientiousness might be associated with actual exercise behavior and social cognitive factors related to exercise, and neuroticism, openness, and agreeableness might be affected by only social cognitive factors related to exercise.

Furthermore, we assessed the direct and indirect effects of personality traits on SE for exercise and exercise level using SEM. First, we conducted analyses assuming that personality traits directly influence exercise level and SE for exercise (model 1), and second, we reanalyzed the data after deleting the non-significant pathways from model 1. When analyzing both model 1 and model 2, we assumed the five domains of personality were associated with each other and covariance among error variables of the five domains were set based on the modification indices. Our results are similar to those of a previous study (Ohnogi, 2004) discussing interrelationships among the five domains of personality for young people, except the relationship between openness and other domains were not shown.

In the modified model (model 2), only extraversion showed a direct effect on exercise level in participants (path coefficient: .17). Many previous studies found that extraversion is the strongest personality trait related to exercise level, which is supported by our findings. However, although previous studies have reported an association between higher conscientiousness and higher exercise level (Rhodes & Smith, 2006), conscientiousness, which was significantly associated with the exercise level of participants in partial correlation analysis, was not significantly associated with exercise level in model 2 analyzed by SEM. In addition, all personality traits, including conscientiousness, showed significant pathways to SE for exercise, and SE for exercise was the greatest predictor for exercise level in all pathways of model 2. A study that investigated the association between personality traits and perceived stress, including general SE, suggested that SE is an important factor to consider in the link between personality and perceived stress (Ebstrup et al., 2011). As with exercise behavior, when examining the association between personality and actual behavior, SE for exercise should be considered, because it is the strongest predictor for exercise behavior. Furthermore, openness had a significant influence on SE independent of the other four personality traits (path coefficient: .20). Shimonaka et al. (2011) noted that people who have higher openness are more receptive to a behavior and will try various behaviors with a positive attitude. It is well known that mastery and successful experiences enhance SE, and having an open feeling toward a behavior and trying various behaviors increases the opportunity for mastery and successful experiences. Although there are few data showing a relationship between openness and SE, having a higher openness may lead to enhanced SE through positive attitude for a behavior. Our results showed that most of the personality traits had a greater effect on SE for exercise than did actual exercise level, and SE for exercise was affected by exercise level (path coefficient: .26). These findings suggest that SE for exercise is a significant mediator linking personality traits and exercise behavior. In addition, when analyzing men and women separately, results showed a similar tendency (data was not shown).

There are several limitations to our study. First, the cause-and-effect direction of the relationship between personality traits and exercise level cannot be inferred from a cross-sectional study. Second, although previous studies have found many psychosocial predictors (e.g., attitude, belief, and social-support) of exercise behavior, we only set SE as a mediator linking personality and exercise level. Furthermore, we must be careful in interpreting our results because some path coefficients (e.g., neuroticism, agreeableness, and conscientiousness to SE for exercise) were only barely statistically significant.

Therefore, we recommend performing a longitudinal randomized controlled study, including various psychosocial factors, to provide a more definitive interpretation of the association between personality traits and exercise behavior in older adults including frail people.

In summary, the data from this cross-sectional study show that extraversion is directly associated with exercise level, and that extraversion and other personality traits are affected by SE for exercise in older adults. The personality traits of older adults involve not only actual exercise behavior level, but also social cognitive factors, such as SE related to exercise behavior. Accordingly, we suggest that integrating behavioral science theories, such as social cognitive theory, may be effective for understanding the determinants of exercise behavior of humans and to promote exercise behavior closer to optimal levels. Further studies are required to design a strategy to determine how people who have personality traits related to lower levels of exercise (e.g., low extraversion) can promote exercise behavior.

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