

Association of Lifestyle Factors With the Risk of Frailty and Depressive Symptoms: Results From the National Survey of Older Adults

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Abstract

Objective : This study aimed to investigate the association between lifestyle factors and risk of frailty and depressive symptoms among older South Korean adults.

Methods : This study included 10,072 individuals aged 65 or older from the 2017 National Survey of Older Koreans, a cohort of community-dwelling older South Koreans. The following lifestyle factors were assessed: physical activity, nutrition management (NM), and leisure/social activity participation (AP). Frailty was measured using the frail scale and depressive symptoms were measured using the Geriatric Depression Scale. Logistic regression analyses were performed to determine the odds ratios.

Results : All lifestyle factors were associated with the risk of frailty and depressive symptoms in the study population. Regular exercise (≥ 3 times/wk, odds ratio [OR] = 0.59, 95% confidence interval [95% CI] = 0.52~0.91; OR = 0.66, 95% CI = 0.59~0.75), active NM (OR = 0.86, 95% CI = 0.80~0.91; OR = 0.81, 95% CI = 0.76~0.86), leisure AP (OR = 0.79, 95% CI = 0.74~0.84; OR = 0.71, 95% CI = 0.66~0.77) and social AP (OR = 0.92, 95% CI = 0.88~0.96; OR = 0.82, 95% CI = 0.78~0.87) were correlated with lower odds ratios of frailty and depressive symptoms.

Conclusion : Adopting a healthier lifestyle characterized by regular exercise, balanced nutrition, and active engagement in various activities can effectively reduce the risk of frailty and depressive symptoms among the older population. Ultimately, this study emphasized the essential role of lifestyle choices in promoting the physical and mental well-being of older adults.

Keywords : Depressive symptoms, Frailty, Lifestyle, Older adults

I. Introduction

Recent studies have shown a growing interest in understanding the overlap between frailty and depressive symptoms, which share similar symptoms and risk factors (Brown et al., 2014; Collard et al., 2014; Mezuk et al., 2013). Frailty is defined as a state of vulnerability that results from age-associated decline in physiological reserves and function (Fried et al., 2005). Fried et al. (2001) identified the phenotypes of frailty as the presence of three or more of the following components: unintentional weight loss, reduced grip strength, slowed walking speed, low physical activity, and self-reported exhaustion. These indicators were developed based on the Center for Epidemiological Studies Depression Scale (Orme et al., 1986), which measures depressive symptoms in older adults.

Pegorari and Tavares (2014) found that older adults with depressive symptoms were 80% more likely to be frail than those without depression. Additionally, it has been noted that depressive symptoms have a significant influence on behavior and activity levels, leading to frailty (Chu et al., 2019). Furthermore, people with depression have been reported to be more susceptible to frailty syndrome owing to lifestyle factors associated with depression, such as reduced physical activity and inactivity (Buigues et al., 2015). Although the impact of lifestyle on depressive symptoms and frailty in older adults is broadly acknowledged, research explicitly explaining the particular lifestyle factors that can reduce the risk has not yet been confirmed.

Lifestyle refers to an individual's multifaceted health habits (Dause & Kirby, 2019) including physical activity (Bhandari & Paswan, 2021; Lin et al., 2014;

Wang & Geng, 2019), nutrition management (Lin et al., 2014; Sapranaviciute-Zabazlajeva et al., 2022; Tamura et al., 2020), and leisure and social activity participation (Sapranaviciute-Zabazlajeva et al., 2022; Zhang et al., 2022). These lifestyle factors significantly benefit overall health, including the physical and psychological well-being of older individuals (Atallah et al., 2018; Knoops et al., 2004; Park et al., 2019).

Although frailty is considered a physical issue (Matias et al., 2022; Zhao et al., 2022), research examining its association with lifestyle factors is limited. Furthermore, while some studies have reported on the relationship of physical activity (Blodgett et al., 2015; Park et al., 2019), nutrition management (Ekinci & Sanlier, 2023; Ni Lochlainn & Robinson, 2022) and leisure and social activity participation (Du et al., 2022; Guo et al., 2022; Katayama et al., 2022; Zhou et al., 2023) with physical frailty and psychological depressive symptoms, research that clearly specifies the extent to which these lifestyle components impact the risk of frailty and depressive symptoms through odds ratios remains insufficient.

Therefore, this study investigated how physical activity, nutrition management, and activity participation, are associated with the risk of frailty and depressive symptoms in older adults.

II. Methods

1. Study data

Data were derived from the 2017 National Survey of Older Koreans, a nationwide survey of community-dwelling older adults with a cross-

sectional design conducted by the Korea Institute for Health and Social Affairs and the Ministry of Health and Welfare (Chung, 2018). The survey is performed every 3 years to establish the living conditions, lifestyle, and welfare status of the aging population (Chung, 2018). Multistage cluster sampling was used to select participants from households stratified into 25 districts (Chung, 2018). Specialized interviewers examined older adults' socioeconomic status, lifestyle, and health status through in-person interviews at each participant's home (Chung, 2018). In this study, data from the fourth survey with 10,072 older adults aged 65 or above in 2017 were utilized, excluding individuals who provided proxy responses to the survey items required for our analysis. This research protocol has been reviewed and approved by the Institutional Review Board of Yonsei University Mirae Campus (Approval number: 1041849-202007-SB-091-01).

2. Independent variables: lifestyle factors

Lifestyle factors assessed in this study included physical activity, nutrition management, and activity participation. Physical activity was measured by asking respondents the number of days they exercised per week. The responses were categorized as 0 (no exercise), 1 (<three times), and 2 (≥three times) according to the physical activity guidelines for older adults (Korea Health Promotion Institution, 2023).

Nutrition management was assessed using five items, including changing the type or amount of food owing to illness or health status, eating fewer than two meals a day, and not consuming fruits, vegetables, or dairy products (Park et al., 2023). Each

item was responded to with “yes” or “no,” and the total score ranged from 0 to 5. Higher scores were reverse coded to indicate a higher level of nutrition management.

Activity participation was measured by inquiring about two activities: leisure and social activities. Leisure activity participation was assessed by asking if they participated in various leisure activities, such as culture, art, sports, tourism, hobbies, entertainment, and relaxation. The responses were summed and ranged from 0 to 7, with higher scores indicating a more active leisure activity participation. Social activity participation was assessed by asking if they participated in different social activities, including learning, clubs, friendships, political involvement, volunteering, and religious activities (Lim & Park, 2020). The responses were summed, ranging from 0 to 7, with higher scores indicating more active social activity participation.

3. Dependent variables

1) Frailty

Frailty was assessed using the Frail scale with the following five domains: fatigue, resistance, ambulation, illness, and weight loss (van Kan et al., 2008). This scale has been validated for older South Korean adults (Jung et al., 2016). Firstly, fatigue was assessed by asking about feeling less motivated in the previous week. Secondly, resistance was measured by the difficulty in ascending 10 stairs alone, without resting or aids. Thirdly, ambulation was determined based on the challenges faced while walking several hundred yards without resting or aids. Fourthly, illness was identified by having five or more of the following 11 conditions: angina, arthritis, asthma,

cancer, chronic lung diseases, congestive heart failure, diabetes, heart attack, hypertension, kidney disease, and stroke. Lastly, weight loss was assessed on whether there was unintentional loss of 5 kg or more in the past 6 months. The yes or no responses were summed, ranging from 0 to 5. The total scores were dichotomized as 0 (robust) or 1~5 (frail).

2) Depressive symptoms

Depressive symptoms were measured using the Geriatric Depression Scale Short Form. The scale includes 15 items with a total score of 15 (Sheikh & Yesavage, 1986). A higher score indicates a higher level of depressive symptoms. A total score of ≤ 7 indicates normal health, and ≥ 8 indicates the presence of depressive symptoms (Sheikh & Yesavage, 1986). In this study, the estimated Cronbach's alpha was approximately .892.

4. Covariates

Age, sex (male/female), marital status (married/other), educational level (<elementary/elementary school graduate/middle school graduate/high school graduate/ \geq college graduate), residence (urban/rural), employment status (current working/other), and log-transformed household income were measured. Self-rated health was measured using a 5-point Likert scale with scores ranging from 1 (very good) to 5 (very bad). Higher scores were reverse coded to indicate higher self-rated health. Cognitive function was measured using the Korean version of the Mini-Mental State Examination (Folstein et al., 1975; Kang et al., 1997). This measure includes 19 questions with a maximum score of 30 points. Higher scores indicate better cognitive function. Alcohol consumption

was dichotomized as 1 (current drinker) or 0 (never a drinker). Smoking status responses were dichotomized as 1 (current smoker) and 0 (never smoked).

5. Statistical analysis

Descriptive statistics were used to examine the participants' demographic characteristics and lifestyle factors. Logistic regression models were performed to calculate adjusted odds ratios (ORs) and the corresponding 95% confidence intervals (CIs) for frailty or depressive symptoms. All reported p -values were two-tailed, and statistical significance was defined as $p < .05$. The Hosmer-Lemeshow goodness-of-fit test was utilized to evaluate the adequacy of the final regression model. Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp.).

III. Results

1. Descriptive statistics

This study was conducted on 10,072 people based on the 2017 National Survey of Older Koreans. The demographics are presented in Table 1. Most respondents were female (57.45%), married (63.71%), and urban residents (68.74%). Of the total participants, 6,306 (62.61%) exhibited frailty, and 2,123 (21.08%) displayed depressive symptoms.

Regarding lifestyle characteristics (Table 2), the participants were more likely to exercise regularly (\geq three times a week, 60.53%), practice attentive nutrition management (*mean* [M]=4.46, standard deviation [SD] = 0.83), and participate in an average

of fewer than two leisure ($M = 1.94$, $SD = 0.86$) and social activities ($M = 1.65$, $SD = 1.24$).

Table 1. General Characteristics of Participants (N = 10,072)

Variable	Statistics
Age (yr)	73.87 ± 6.54
Sex (female)	5,786 (57.45)
Marital status (married)	6,416 (63.71)
Education level	
<Elementary	2,393 (23.76)
Elementary school graduate	3,451 (34.26)
Middle school graduate	1,711 (16.99)
High school graduate	1,752 (17.39)
>College graduate	766 (7.61)
Residence (urban)	6,923 (68.74)
Employment status (currently working)	3,117 (30.95)
Household income (million Korean won)	2,404 ± 2,073.86
Self-rated health	2.95 ± 0.99
Cognitive function	25.00 ± 3.89
Alcohol consumption (current drinker)	2,681 (26.61)
Smoking status (current smoker)	1,027 (10.20)
Frailty	6,306 (62.61)
Depressive symptoms	2,123 (21.08)

Values are presented as *mean* ± standard deviation or *n* (%). The sum of the percentages does not equal 100% because of rounding.

Table 2. Lifestyle Characteristics of Participants (N = 10,072)

Variable	Statistic
Physical activity	
None exercise	3,218 (31.95)
<3 times a week	757 (7.52)
≥3 times a week	6,097 (60.53)
Nutrition management	4.46 ± 0.83
Activity participation	
Leisure activity	1.94 ± 0.86
Social activity	1.65 ± 1.24

Values are presented as *n* (%) or *mean* ± standard deviation.

2. Lifestyle factors on the risk of frailty

The results of the logistic regression analysis are presented in Table 3. In Model 3, adjusted for all covariates, all lifestyle factors were significantly associated with frailty in older adults.

Specifically, engaging in physical activity fewer than three times per week is associated with a 1.45 times reduction in the risk of frailty (OR = 0.69, 95% CI = 0.56~0.84), while engaging in physical activity more than three times per week is linked to a 1.70 times reduction in the risk of frailty (OR = 0.59, 95% CI = 0.52~0.66) compared to those who do not exercise. Higher levels of nutrition management are associated with a 1.16 times lower risk of frailty (OR = 0.86, 95% CI = 0.80~0.91). Regarding activity participation, involvement in leisure activities is associated with a 1.27 times lower risk of frailty (OR = 0.79, 95% CI = 0.74~0.84), and engagement in social activities is linked to a 1.09 times lower risk of frailty (OR = 0.92, CI = 0.88~0.96).

3. Lifestyle factors on the risk of depressive symptoms

The results of the logistic regression analysis are presented in Table 4. In Model 3, which considered various covariates, all lifestyle factors showed significant associations with depressive symptoms. Engaging in physical activity more than three per week is associated with 1.52 times lower risk of depressive symptoms (OR = 0.66, 95% CI = 0.59~0.75) compared to those who do not exercise. Moreover, higher levels of nutrition management are linked to a 1.24 times lower risk of depressive symptoms (OR = 0.81, 95% CI = 0.76~0.86). Regarding

activity participation, involvement in leisure and social activities are associated with a significantly reduced likelihood of depressive symptoms, by 1.41 times (OR = 0.71, 95% CI = 0.66~0.77) and 1.22 times (OR = 0.82, 95% CI = 0.78~0.87), respectively.

Notably, exercising less than thrice per week is not significantly associated with the risk of depressive symptoms.

Table 3. Logistic Regression of Association of Lifestyle Factors With Frailty

Variable	Model 1 ^a	Model 2 ^b	Model 3 ^c
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Physical activity			
No exercise (Ref.)			
<3 times a week	0.57 (0.47~0.67)	0.58 (0.48~0.71)	0.69 (0.56~0.84)
≥3 times a week	0.50 (0.45~0.55)	0.51 (0.46~0.58)	0.59 (0.52~0.66)
Nutrition management	0.74 (0.70~0.78)	0.76 (0.71~0.81)	0.86 (0.80~0.91)
Activity participation			
Leisure activity participation	0.67 (0.63~0.70)	0.72 (0.68~0.77)	0.79 (0.74~0.84)
Social activity participation	0.90 (0.87~0.94)	0.92 (0.89~0.96)	0.92 (0.88~0.96)

Hosmer-Lemeshow test *p*-value = 0.15.

a = crude; b = adjusted for age, sex, marital status, educational level, residence, employment status, and log-transformed household income; c = adjusted for Model 2 plus self-rated health, cognitive function, alcohol consumption, and smoking status; CI = confidence interval; OR = odds ratio; Ref. = reference.

Table 4. Logistic Regression of Association of Lifestyle Factors With Depressive Symptoms

Variable	Model 1 ^a	Model 2 ^b	Model 3 ^c
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Physical activity			
No exercise (Ref.)			
<3 times a week	0.75 (0.61~0.94)	0.77 (0.62~0.97)	0.92 (0.73~1.17)
≥3 times a week	0.57 (0.52~0.64)	0.56 (0.50~0.62)	0.66 (0.59~0.75)
Nutrition management	0.69 (0.65~0.73)	0.72 (0.68~0.76)	0.81 (0.76~0.86)
Activity participation			
Leisure activity participation	0.59 (0.55~0.64)	0.65 (0.60~0.70)	0.71 (0.66~0.77)
Social activity participation	0.77 (0.73~0.81)	0.81 (0.77~0.85)	0.82 (0.78~0.87)

Hosmer-Lemeshow test *p*-value = 0.15.

a = crude; b = adjusted for age, sex, marital status, educational level, residence, employment status, and log-transformed household income; c = adjusted for Model 2 plus self-rated health, cognitive function, alcohol consumption and smoking status; CI = confidence interval; OR = odds ratio; Ref. = reference.

IV. Discussion

This study investigated the association between lifestyle factors and the risk of frailty and depressive symptoms in older South Korean adults. Logistic regression was used to estimate odds ratios. All examined lifestyle factors—physical activity, nutrition management, and activity participation—were significantly associated with the risk of frailty and depressive symptoms after adjusting for covariates. Engaging in physical activity more than thrice per week, maintaining active nutrition management, and participating in leisure and social activities showed positive associations with a reduced risk of frailty and depressive symptoms. These findings suggest that lifestyle factors are significant determinants of frailty and depressive symptoms among older adults.

Exercise duration was assessed as a key component of physical activity concerning the risk of physical frailty and depressive symptoms. Healthcare programs centered on exercise as a primary physical activity have showed positive effects on physical strength, frailty, and depression in older adults experiencing frailty (Kim, 2015). Older adults with lower levels of physical activity, such as those leading sedentary lifestyles, are more likely to experience frailty (Blodgett et al., 2023). Importantly, physical activity exerts a beneficial influence on various age-related bodily systems, including the endocrine, respiratory, cardiovascular, and musculoskeletal systems (Angulo et al., 2020). This influence may contribute to the preservation or enhancement of overall functioning (Angulo et al., 2020). Furthermore, the impact of exercise may vary depending on its frequency per week (Bray et al., 2016). In line with these findings, the Korean Ministry of Health and Welfare has

reported the recommended amounts of physical activity for the prevention of various physical and psychological health conditions, as well as the promotion of both physical and psychological well-being (Korea Health Promotion Institution, 2023). The ministry emphasizes the importance of engaging in physical activity at least three times a week, especially for the older population (Korea Health Promotion Institution, 2023). Consistent with these recommendations, it is proposed that physical activity plays a crucial role in the physical frailty and mental well-being of older adults.

This study demonstrates the preventive effects of healthy nutrition management on the risk of frailty and depressive symptoms. According to a previous study, insufficient intake of essential nutrients leads to various health problems including frailty (O'Connor et al., 2023). Moreover, a previous systematic review and meta-analysis (Matison et al., 2021) reported that the intake of fruits and vegetables, assessed as components of nutrition management in this study, was significantly associated with a reduced risk of depression. A high proportion of individuals in this study were living alone, and previous findings support that, in practical terms, older adults who dine alone showed higher levels of depressive symptoms compared to those who dined with family (Moon et al., 2022). Furthermore, several studies (Noh et al., 2021; Ohara et al., 2020; Suthutvoravut et al., 2019) indicate that eating alone tends to lead to an unhealthy and insufficiently nutritional diet, supporting our results. However, eating alone may allow individuals to control their eating habits and consume necessary food properly (Giacoman, 2016; Takeda & Melby, 2017). Although the risk of frailty and depression owing to nutrition management has not

yet been consistently reported, the characteristics of the participants in this study support the positive effects of nutrition management, as reported in most studies (Noh et al., 2021; Ohara et al., 2020; Suthutvoravut et al., 2019).

A previous study showed that social activity and frailty are moderately negatively correlated, indicating that individuals with greater social activity are less likely to experience frailty (Tallutondok et al., 2022). This is supported by evidence suggesting that factors such as living alone, social relationships, social support, and social participation are linked to frailty (Etman et al., 2015; Makizako et al., 2018; van Oostrom et al., 2017). Moreover, engagement in leisure activities has been proposed to be associated with a reduced risk of frailty among super-aged older adults with varying levels of genetic risk (Zhou et al., 2023). Furthermore, lower levels of participation in social and leisure activities are linked to a higher likelihood of depressive symptoms among older adults (Tripathi & Samanta, 2023). In line with previous research, this study highlights the significance of activity participation in the lives of older adults.

This study has several limitations. Firstly, we used single-wave data from a 2017 survey of older adults. Using data from a single time-point limits our ability to establish causation or examine changes over time. In future research, it is necessary to conduct a longitudinal study by incorporating more recent data than the present dataset to explore the dynamic relationship between lifestyle factors, frailty, and depressive symptoms. Secondly, as there is no integrated tool available to assess frailty and depressive symptoms as a combined concept, therefore, the risk of each dependent variable was analyzed separately. It is essential to establish a

framework for future studies to investigate their relationship with lifestyle factors as a unified concept. Finally, the study population consisted of older South Korean adults, and their characteristics may not be generalizable to older adults in other cultural or geographic contexts. Further studies are required to explore these associations in diverse populations.

Despite these limitations, this study holds significance as it analyzed the ORs for the risk of frailty and depressive symptoms based on lifestyle factors in a large-scale sample of older adults in South Korea. Moreover, we assessed various lifestyle factors, such as physical activity, nutrition management, leisure, and social activity participation, important for holistic well-being in older adults. The consideration of these diverse factors contributes to a more comprehensive understanding of the associations between lifestyle and health outcomes. Finally, this study addresses a gap in the literature by specifically examining the relationships between lifestyle factors, frailty, and depressive symptoms among South Korean older adults. These findings highlight the importance of promoting a healthy lifestyle to reduce the risk of frailty and depressive symptoms, which can inform public health and clinical interventions.

V. Conclusion

The key findings of this study indicate that lifestyle factors, including physical activity, nutrition management, and activity participation, have a significant positive impact on reducing the risk of frailty and depressive symptoms in older adults.

Adopting a healthier lifestyle characterized by regular exercise, balanced nutrition, and active engagement in various activities can effectively reduce the risk of frailty and depressive symptoms in the older population. Ultimately, this study emphasizes the essential role of lifestyle choices in promoting the physical and mental well-being of older adults.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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노인의 라이프스타일 요인이 허약 및 우울 위험도에 미치는 영향: 노인실태조사 자료를 바탕으로

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목적 : 본 연구는 국내 노인 인구를 대상으로 라이프스타일의 요소가 허약 및 우울 위험도에 미치는 영향을 파악하고자 한다.

연구방법 : 본 연구는 2017년에 수집된 노인실태조사 자료를 활용하여 지역사회에 거주하는 65세 이상 노인 10,072명을 대상으로 수행하였다. 라이프스타일의 요소는 신체활동, 영양 관리, 여가 및 사회 활동 참여 변수를 활용하여 분석하였다. 허약은 허약 척도를 사용하여 측정되었고, 우울 증상은 노인 우울 선별 척도를 사용하여 측정되었다. 로지스틱 회귀분석을 수행하여 노인의 허약 및 우울 위험도에 대한 라이프스타일의 오즈비(odds ratio, OR)를 분석하였다.

결과 : 분석 결과 모든 라이프스타일의 요인은 허약 및 우울 위험도와 유의미한 연관이 있음을 확인하였다. 허약 및 우울의 OR은 주 3회 이상의 정기적인 운동(OR = 0.59, 95% confidence interval [95% CI] = 0.52~0.91; OR = 0.66, 95% CI = 0.59~0.75), 적극적인 영양 관리(OR = 0.86, 95% CI = 0.80~0.91; OR = 0.81, 95% CI = 0.76~0.86), 여가 참여(OR = 0.79, 95% CI = 0.74~0.84; OR = 0.71, 95% CI = 0.66~0.77), 사회 활동의 참여(OR = 0.92, 95% CI = 0.88~0.96; OR = 0.82, 95% CI = 0.78~0.87)를 통해 낮춰지는 것으로 확인되었다.

결론 : 본 연구 결과는 정기적인 운동, 균형 잡힌 영양 관리 및 다양한 활동에 대한 적극적인 참여를 특징으로 하는 건강한 라이프스타일이 노인의 허약 및 우울 위험도를 효과적으로 줄일 수 있음을 시사한다. 궁극적으로 본 연구는 노인의 신체 건강 및 정신 건강에 긍정적으로 작용하는 라이프스타일의 중요성을 강조한다.

주제어 : 노인, 라이프스타일, 우울, 허약