

## Original Research



# Malnutrition and its associated factors among community-dwelling older men living alone

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## ABSTRACT

**BACKGROUND/OBJECTIVES:** Older men who live alone are more vulnerable to poor nutrition. However, little attention has been paid to malnutrition among this population. This study aimed to examine malnutrition and its associated factors among community-dwelling older men living alone.

**SUBJECTS/METHODS:** This cross-sectional descriptive study used cohort data of community-dwelling older adults living alone in South Korea. A total of 230 older men aged 65 and over were included in this study. Nutritional status was assessed using the Mini Nutritional Assessment-Short Form. Multidimensional factors (sociodemographic, health-related, psychosocial, and lifestyle characteristics) were evaluated. Hierarchical logistic regression analyses were conducted to identify the malnutrition-related factors.

**RESULTS:** The prevalence of malnutrition was 32.2% in older men living alone. Low income (odds ratio [OR], 2.44; 95% confidence interval [CI], 1.01–5.90), polypharmacy (OR, 2.23; 95% CI, 1.16–4.28), suicidal ideation (OR, 2.13; 95% CI, 1.02–4.45), meal skipping (OR, 3.26; 95% CI, 1.60–6.64), and smoking (OR, 2.86; 95% CI, 1.43–5.73) were significantly associated with malnutrition.

**CONCLUSION:** Malnutrition is a severe health problem in older men living alone. This study highlights the importance of comprehensive and tailored interventions to mitigate malnutrition among older men living alone.

**Keywords:** Aged; Korea; nutritional status; men; prevalence

## INTRODUCTION

Increasing one-person households, particularly among older adults, is a significant public health concern. In some European countries such as Latvia, Finland, Norway, and Germany, approximately 40% of all households consist of one person. Meanwhile, in East Asian countries like Japan and South Korea, this figure exceeds 30% [1]. The proportion of older adults living alone is growing rapidly in South Korea and is projected to reach 41.1% by 2050, increasing from 34.9% by 2020 [2]. Although older men are a minority among Korean older adults living alone, their proportion has steadily increased from 29.0% in 2011 to 32.7% in 2021 [3]. Previous research has established that older men living alone are more likely to

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#### Conflict of Interest

The authors declare no potential conflicts of interests.

#### Author Contributions

Conceptualization: Kim G, Hwang M, Lee S, Park YH; Formal analysis: Kim G; Investigation: Kim G; Methodology: Kim G, Park YH; Supervision: Park YH; Validation: Park YH; Writing - original draft: Kim G; Writing - review & editing: Hwang M, Lee S, Park YH.

report poor self-rated health, depressive symptoms, suicidal ideation, and frailty than those living with others [4,5]. Furthermore, the adverse impact of living alone on lifestyle (e.g., diet and smoking), mental health, frailty, and mortality was significant in older men but not in women [4-6]. Despite their vulnerability, the healthcare needs of older men living alone have received limited attention.

Malnutrition, defined as an inadequate, excessive, or imbalanced intake of energy or nutrients [7], has primarily been addressed in older adults, focusing on undernutrition rather than overweight or obesity [8]. Malnutrition prevalence varies across healthcare settings, including hospitals (22%), residential care settings (17.5–28.7%), and community settings (3.1–8.7%) [9]. This variance correlates with the dependency level of older adults. Compared to older adults in other care settings, those living in the community had a lower prevalence of malnutrition. However, they are at risk of becoming malnourished, with rates ranging from 26.5% to 47.5% [9]. In community settings, early detection and timely intervention for malnutrition are vital for preserving older adults' independence at home, as untreated malnutrition is strongly associated with sarcopenia and frailty, resulting in hospitalization or institutionalization [10].

The vulnerability of older men living alone in maintaining adequate nutrition has been well recognized; however, this remains a controversial topic. Several Japanese studies have shown that older men living alone are more likely to be underweight and exhibit poor dietary behaviors, such as meal skipping and low dietary diversity, than those living with others [5,11]. Moreover, a qualitative study reported that older men living alone were less motivated to healthy eating because they lacked cooking skills and nutrition knowledge [12]. Conversely, a qualitative study in the United Kingdom reported that some older men living alone maintain their dietary requirements using community resources despite dietary barriers such as a lack of cooking skills [13]. These inconsistent findings suggest that not every older man living alone is nutritionally at risk and may vary depending on individual and socio-cultural factors. Identifying the factors related to malnutrition in older men living alone is important because these factors can explain the observed discrepancies.

Extensive studies have demonstrated that several factors influence malnutrition. These factors include normal age-related changes in taste, smell, appetite, and dental problems; living alone; a low level of education and income; chronic disease; polypharmacy; poor physical function; loneliness; depression; poor social network; and lifestyle factors such as smoking, alcohol consumption, physical activity, and meal skipping [8,14-17]. However, previous findings regarding malnutrition-related factors have been inconsistent, varying by country, healthcare setting, and participant. Moreover, earlier evidence primarily targeted all community-dwelling older adults or those living alone and did not specifically focus on older men living alone. Therefore, the existing research has limitations in providing a comprehensive understanding of malnutrition in older men living alone. The purpose of this study is to explore malnutrition and its influencing factors among community-dwelling older men living alone.

## SUBJECTS AND METHODS

### Study design and participants

This cross-sectional descriptive study analyzed secondary data from a cohort study [18]. The original study was conducted as a part of a project funded by the Ministry of Health and

Welfare, Republic of Korea, aimed at developing a community-integrated service model based on the healthcare needs of older adults living alone in Siheung City, Korea. We utilized data collected in August 2019, during the second year of the original 3-yr project. Detailed information has been published previously [18].

The original inclusion criteria were as follows: 1) older adults aged 65 yrs or older; 2) living alone in Siheung City, Korea; and 3) the ability to read or speak the language of the survey and provide written informed consent. Participants with severe visual or hearing problems were excluded from the study. The inclusion criterion for this study was older men without severe cognitive impairment (Mini-Mental State Examination [MMSE] > 17). Of the total cohort of participants (1,041 older men and women), there were 233 older men. Two participants with severe cognitive impairment and one whose cognitive function was not tested were excluded. In total, 230 older men living alone were included in this study.

### **Ethical considerations**

Written permission for the secondary use of the data was obtained from the principal investigators of the original study. Data were analyzed after approval from the Institutional Review Board (IRB) of the Seoul National University (IRB No. E2106/004-001).

### **Measurements and data collection**

#### *Survey and variable selection*

Surveys were conducted to collect data from public health centers and community centers in the original study. Data, excluding the body mass index (BMI) calculated from directly measured height and weight by trained research assistants, were collected through self-reported questionnaires and face-to-face interviews. This study selected independent variables associated with malnutrition based on the Determinants of Malnutrition in Aged Persons model [19] and previous studies [8,15,20,21] and then the variables available in the cohort data.

#### *Assessments of malnutrition*

Malnutrition was assessed using the Mini Nutritional Assessment-Short Form (MNA<sup>®</sup>-SF) [22]. This tool was designed to screen older adults for malnutrition. This instrument consists of 6 items concerning changes in appetite, weight loss, mobility, stress or acute illness, neuropsychological problems, and BMI. The total score ranged from 0 to 14 points. By summing the scores, subjects can be categorized into 3 groups: malnourished (0–7), at-risk of malnutrition (8–11), and normal nutritional status (12–14). In this study, nutritional status was classified as malnutrition ( $\leq 11$ ) or normal nutrition ( $\geq 12$ ). This tool showed good internal consistency (alpha coefficient, 0.84) [22].

#### *Assessments of sociodemographic characteristics*

We assessed participants' age, education, and income levels. Income level was categorized as "middle and above" or "low," based on 50% of the median income of Korean single-person households (853,504 KRW/mon) in 2019 [23].

#### *Assessments of health-related characteristics*

Comorbidity, polypharmacy, and instrumental activities of daily living (IADL) were assessed. The present study defined comorbidity as 2 or more chronic diseases. Polypharmacy refers to the daily use of 3 or more prescription drugs [24]. IADL was assessed using the Korean IADL scale. It considers activities such as grooming, housekeeping, and meal preparation, and provides a score ranging from 10 to 33 [25]. Higher scores indicate greater dependence.

### *Assessments of psychosocial characteristics*

We assessed psychological (cognitive impairment, loneliness, and suicidal ideation) and social variables (social participation and social interaction with family members and neighbors). Cognitive impairment was measured using the MMSE, with a total score ranging from 0 to 30 [26]. A score of 24–30 on the MMSE indicated no impairment, 18–23 indicated mild cognitive impairment, and 0–17 indicated severe cognitive impairment. Since participants with severe cognitive impairment (MMSE  $\leq$  17) were excluded from our analysis, this study focused on those with no or mild cognitive impairment. Loneliness was evaluated using the Korean version [27] of the revised UCLA Loneliness Scale [28], a 20-item self-report questionnaire utilizing a 4-point Likert scale. Total scores range from 20 to 80, with higher scores indicating a greater feeling of loneliness. The scores were categorized into 4 groups: low (20–34), moderate (35–49), moderately high (50–64), high (65–80). Participants were divided into low (20–49) and high (50–80) groups for analysis. Suicidal ideation, which was measured on a 10-point visual analog scale in the original study, was dichotomized. A score of 0 indicated the absence of suicidal ideation, whereas all other scores indicated the presence of suicidal ideation.

Social participation was measured by the frequency of participation in social activities, such as those in community centers, religious institutions, cultural centers, clubs or fraternal organizations, and others ( $\geq$  3–4 times/wk, 1–2 times/wk, 1–2 times/mon, none). Responses were dichotomized into yes or no for analysis. Additionally, the frequency of social interactions with family members or neighbors (1–2 times/wk, 1–2 times/mon, 1–2 times/quarter, 1–2 times/yr, none) was assessed and categorized into 2 groups for analysis: low (less than quarterly) and high (more than monthly) contact [16].

### *Assessments of lifestyle characteristics*

Meal skipping, smoking, frequent alcohol consumption, and physical activity were assessed. Meal skipping was defined as eating 2 or fewer meals per day [11] due to habit rather than financial constraints, and was answered with a “yes” or “no” response.

Participants were categorized as non-smokers or current smokers. Frequent alcohol consumption was divided into 2 categories based on the frequency of drinking (20 days per mon) [29]. Physical activity was measured by the International Physical Activity Questionnaire-Short Form (IPAQ-SF) [30]. The IPAQ-SF evaluates the frequency and duration of the previous week's vigorous, moderate, and walking activities. The responses were converted into metabolic equivalents of the task per week. This study categorized data into 3 levels of physical activity based on the IPAQ-SF guidelines: low, moderate, and high [31].

### **Data analysis**

Differences in nutritional status according to sociodemographic, health-related, psychosocial, and lifestyle characteristics were analyzed using a univariate analysis (chi-squared or independent *t*-test). Potential factors with  $P < 0.15$  were entered into multivariate analysis. This cut-off point was selected based on the recommendation of variable selection in logistic regression to increase the chances of retaining meaningful confounders [32]. We conducted a hierarchical logistic regression analysis to investigate factors related to malnutrition. The relationship between malnutrition and participant characteristics was examined step by step. Sociodemographic characteristics are included in model 1. Health-related characteristics were added to model 2, followed by psychosocial characteristics in model 3. Finally, lifestyle characteristics were added to model 4. Variables with a *P*-value less than 0.05 were chosen

for the final logistic regression model. Missing values were replaced with the mean of the observed values for that variable. Data analysis was performed using Statistical Package for the Social Sciences version 23 (IBM Corp., Armonk, NY, USA).

## RESULTS

### General characteristics of the participants

The mean age of the participants was 74.23 (SD, 5.70) yrs. The majority of them reported a low economic status (79.1%). The average number of chronic diseases and medications was 3.05 (SD, 2.18) and 3.37 (SD, 3.10), respectively. Participants' average IADL was 10.29 (SD, 1.12), indicating high independence. Regarding psychosocial characteristics, most of them were cognitively intact (83.9%). Approximately 40% reported a high level of loneliness, and one-third reported suicidal ideation. Participants had more frequent contact with neighbors than family members, and half did not participate in social activities. Additionally, 30% of participants were meal skippers or current smokers. The proportion of frequent drinkers was very low (16.5%), and about 70% of participants belonged to moderate and high levels of physical activity (Table 1).

### Malnutrition of the participants

The average score of MNA<sup>®</sup>-SF was 11.94 (SD, 2.13). Of the 230 older men living alone, 74 (32.2%) were classified into the malnutrition group, and 156 (67.8%) belonged to the normal nutrition group (Table 2).

### Factors associated with malnutrition

Univariate analysis showed that, at a significance level of 0.15, participants in the malnutrition group were younger ( $P = 0.062$ ), had lower levels of education ( $P = 0.095$ ) and income ( $P = 0.059$ ), took more polypharmacy ( $P = 0.008$ ), experienced greater loneliness ( $P = 0.004$ ) and suicidal ideation ( $P < 0.001$ ), had less social interaction with family ( $P = 0.059$ ), and had higher rates of skipping meals ( $P < 0.001$ ) and current smoking ( $P < 0.001$ ) compared to those in the normal nutrition group (Table 1).

The results of the hierarchical logistic regression are presented in Table 3. The omnibus test of model coefficients using the chi-square test showed significant differences ( $P < 0.05$ ) between the previous and new models, indicating that the effect of the newly added variables at each step was significant. In the final regression model, low income (odds ratio [OR], 2.44; 95% confidence interval [CI], 1.01–5.90), polypharmacy (OR, 2.23; 95% CI, 1.16–4.28), suicidal ideation (OR, 2.13; 95% CI, 1.02–4.45), meal skipping (OR, 3.26; 95% CI, 1.60–6.64), and smoking (OR, 2.86; 95% CI, 1.43–5.73) were associated with malnutrition in older men living alone. The final model explained 29.4% of the variance in malnutrition and showed a good fit in the Hosmer–Lemeshow test ( $P = 0.595$ ).

## DISCUSSION

Our research highlights malnutrition as a significant health issue for older men living alone who require proactive prevention at the community level. In our study, one-third of the older men living alone were found to have malnutrition. This prevalence is lower than the 53.1% found in a study of older men living in a Taiwanese veteran's community using MNA<sup>®</sup>-SF [33].

**Table 1.** Differences in nutritional status according to the characteristics of the participants

Variables	Category	Total (n = 230)	Normal nutrition (n = 156)	Malnutrition (n = 74)	P-value
<b>Sociodemographic characteristics</b>					
Age (yrs)	65–74	132 (57.4)	83 (53.2)	49 (66.2)	0.062
	≥ 75	98 (42.6)	73 (46.8)	25 (33.8)	
Education	≤ Middle school	131 (57.0)	83 (53.2)	48 (64.9)	0.095
	≥ High school	99 (43.0)	73 (46.8)	26 (35.1)	
Income	Low	182 (79.1)	118 (75.6)	64 (86.5)	0.059
	≥ Middle	48 (20.9)	38 (24.4)	10 (13.5)	
<b>Health-related characteristics</b>					
Comorbidity	No	65 (28.3)	48 (30.8)	17 (23.0)	0.220
	Yes	165 (71.7)	108 (69.2)	57 (77.0)	
Polypharmacy	No	110 (47.8)	84 (53.8)	26 (35.1)	0.008
	Yes	120 (52.2)	72 (46.2)	48 (64.9)	
IADL <sup>1)</sup>	-	10.29 ± 1.12	10.32 ± 1.27	10.22 ± 0.71	0.510
<b>Psychosocial characteristics</b>					
Cognitive impairment	No	193 (83.9)	133 (85.3)	60 (81.1)	0.421
	Yes	37 (16.1)	23 (14.7)	14 (18.9)	
Loneliness	Low	143 (62.2)	107 (68.6)	36 (48.6)	0.004
	High	87 (37.8)	49 (31.4)	38 (51.4)	
Suicidal ideation	No	154 (67.0)	118 (75.6)	36 (48.6)	< 0.001
	Yes	76 (33.0)	38 (24.4)	38 (51.4)	
Social participation	No	111 (48.3)	71 (45.5)	40 (54.1)	0.226
	Yes	119 (51.7)	85 (54.5)	34 (45.9)	
Social interaction with family members	Low	116 (50.4)	72 (46.2)	44 (59.5)	0.059
	High	114 (49.6)	84 (53.8)	30 (40.5)	
Social interaction with neighbors	Low	70 (30.4)	43 (27.6)	27 (36.5)	0.170
	High	160 (69.6)	113 (72.4)	47 (63.5)	
<b>Lifestyle characteristics</b>					
Meal skipping	No	160 (69.6)	124 (79.5)	36 (48.6)	< 0.001
	Yes	70 (30.4)	32 (20.5)	38 (51.4)	
Smoking	No	160 (69.6)	120 (76.9)	40 (54.1)	< 0.001
	Yes	70 (30.4)	36 (23.1)	34 (45.9)	
Frequent alcohol consumption	No	192 (83.5)	129 (82.7)	63 (85.1)	0.641
	Yes	38 (16.5)	27 (17.3)	11 (14.9)	
Physical activity	Low	74 (32.2)	47 (30.1)	27 (36.5)	0.353
	Moderate	110 (47.8)	74 (47.4)	36 (48.6)	
	High	46 (20.0)	35 (22.4)	11 (14.9)	

Values are presented as mean ± SD or number (%).

IADL, instrumental activities of daily living.

<sup>1)</sup>Two missing data.

This discrepancy could be attributed to older age, lower cognitive level, and poorer ADL function than our participants. Meanwhile, our findings align with a meta-analysis of studies using the MNA<sup>®</sup>-SF for assessing malnutrition in European countries, including France, Germany, Italy, Spain, Sweden, Türkiye, and the UK, revealing a pooled prevalence of malnutrition at 32.4% [34]. However, a direct comparison with our study is difficult because that research encompassed all older adults rather than specifically focusing on men living alone. Further epidemiological research is needed to gain a better understanding of the nutritional status of older men living alone.

Regarding sociodemographic characteristics, low-income status was identified as a significant factor related to malnutrition. Several studies have reported that financial constraints hinder accessing balanced meals [35]. A qualitative study highlighted the challenges faced by older men, including cost and lack of transportation for grocery shopping, leading to reduced portion sizes and limited access to fresh fruit [12]. In 2022, South Korea had the highest relative poverty rate among Organization for Economic Cooperation and Development members for older adults, at 40.4% [36]. In particular, older





adults living alone earn approximately half the income of those living with their spouse [37]. Healthcare providers should consider the financial challenges and develop sustainable meal plans for this vulnerable subgroup of older adults.

This study highlighted the influence of polypharmacy on malnutrition. A systematic review also reported a strong correlation between polypharmacy and malnutrition in older adults, regardless of the nutrition screening methods [38]. Commonly prescribed medications for older adults, such as glucose-lowering drugs, lipid-lowering drugs, and antidepressants, can increase the risk of malnutrition by inducing appetite loss, altering taste and salivary secretion, and impairing gastrointestinal function [39]. Hence, it is crucial to clinically assess the appropriateness of polypharmacy and provide nutrition education to older men living alone and clinicians to prevent medication-related malnutrition.

Although loneliness was not a significant variable in the logistic regression analysis, the malnutrition group exhibited a higher trend of loneliness than the normal nutrition group. A Finnish study demonstrated that frequent feelings of loneliness were associated with poor nutritional status in older adults [40]. Loneliness can reduce the desire to eat and nutrient intake in older adults because of its impact on mood, cognition, and physical function [40]. However, the effect of loneliness on malnutrition remains controversial [8]. Further investigations with larger sample sizes are necessary to understand the relationship between loneliness and malnutrition better.

In this study, older men with suicidal ideation had higher malnutrition levels. One study reported that the odds of suicidal ideation were 1.43 times higher in breakfast skippers and 1.29 times higher in dinner skippers [41], supporting our findings. Another study emphasized the close relationship between suicidal ideation and low food intake, particularly of fruits and vegetables [42]. The authors suggested that specific nutrients found in fruits and vegetables, such as Vitamin B, folate, and polyphenols, may positively reduce suicide risk [42]. Although explaining the causality between suicidal ideation and malnutrition is challenging, our findings underscore the necessity for proactive nutritional interventions for older men at suicide risk.

In previous research, older adults with restricted social networks, characterized by few network members, infrequent contact, and low participation in community activities, were identified as having a high nutritional risk [20]. Contrary to expectations, our study found no significant association between malnutrition and social factors. Nevertheless, we found that older men living alone with limited social participation or interactions had a higher prevalence of malnutrition than those with active social engagement. In future research, it might be essential to assess malnutrition by comprehensively considering the frequency of social interactions, the quality of social networks, and the presence of someone during mealtime [11,43].

Meal skipping was a significant malnutrition factor, consistent with prior research [17,21]. Skipping meals is associated with a decrease in the daily recommended energy intake and diet quality [44], potentially leading to malnutrition. A possible reason for the poor eating behavior observed in older men may be a lack of cooking skills or nutritional knowledge [12]. Men's vulnerability may be more pronounced in Asian countries with patriarchal cultures, where meal preparation is traditionally perceived as a woman's task [45]. In South Korea, older men living alone reported that maintaining a balanced diet is more challenging than dealing with loneliness or financial strain [46]. Meal frequency is influenced by personal beliefs about health and sociocultural norms. Moreover, the health benefits of meal skipping may vary



depending on the individual's health status [47]. Therefore, assessing the primary reasons for meal skipping among older men living alone is crucial, considering their health status and sociocultural context and promoting healthy eating behaviors to reduce malnutrition.

We identified smoking increased the risk of malnutrition. This finding aligns with previous research among geriatric patients, revealing that current smokers had a 5.5 times higher risk of malnutrition than non-smokers [48]. A study on Chinese men reported that smoking was related to binge drinking and an unhealthy diet, even after controlling for socioeconomic status [49]. Similarly, in a study of community-dwelling older adults in Australia, smokers were twice as likely to skip meals as non-smokers [50]. This association may be linked to nicotine-induced changes in taste and loss of appetite, leading to food choices, inadequate nutrient intake, and weight loss [51]. Given that lifestyle factors such as smoking and meal skipping are modifiable, healthcare providers should prioritize lifestyle modifications to improve nutrition in older men living alone.

In our study, variables such as cognitive function, IADL, and physical activity, identified as factors affecting malnutrition in previous studies [10,14], were not associated with malnutrition. The reason for this is unclear. However, the recruitment methods used in the original study may have affected the results. Our survey targeted older adults who could independently visit public health centers or community centers, indicating that participants generally had higher physical and cognitive functions than homebound older adults. Future studies should explore how malnutrition varies across diverse functions in older adults.

To the best of our knowledge, this study is one of the few that specifically examines malnutrition and its related factors in older men living alone in South Korea. However, this study has some limitations. First, there is still a chance that participants had errors in recall, producing a bias that tends to overestimate their nutritional status. However, a previous study has demonstrated the high test-retest reliability of the self-reported MNA<sup>®</sup>-SF among older adults [52]. Second, as this study used data from a survey conducted among older men residing in a specific city in South Korea, the findings cannot be generalized to all community-dwelling older men who live alone. Finally, we used a cross-sectional design; therefore, we could not establish a causal relationship between malnutrition and its associated factors. Further longitudinal studies with larger sample sizes are needed to explore the factors contributing to malnutrition in older men living alone.

In conclusion, malnutrition was found in approximately one-third of community-dwelling older men living alone. The identified factors—low income, polypharmacy, suicidal ideation, meal skipping, and smoking—underscore the need for early detection and a comprehensive approach to address malnutrition. These interventions should include tailored nutrition education for those taking multiple medications, as well as lifestyle modifications such as regular, healthy eating and smoking cessation, while considering economic status and mental health.

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