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노화에 대한 취약성 비교에 따른 고령 농업인과 비농업인의 차별적 패턴

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Differential Patterns of Elderly Farmers and Non-farmers According to Vulnerability to Aging

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= Abstract =

목적: 본 연구는 65세 이상 농업인과 비농업인의 노화에 따른 취약성을 파악하고 차이를 비교 분석하고자 하였다.

방법: 본 연구는 단면 연구로서 강원도에 거주하는 고령의 농업인 29명과 비농업인 25명이 연구에 참여하였다. 노화에 대한 취약성 평가를 위해 노쇠, 신체 구성, 인지·신체 기능, 심리 상태를 검사하였다.

결과: 집단 간 유의한 차이가 있었던 배우자 유무를 보정하여 편 상관 분석한 결과, 농업인에서만 나이와 취약성 요소 간 유의한 상관관계가 있었으며, 편 상관 계수를 비교하였을 때 body mass index(BMI, $r = -0.625$ vs 0.026, $P < 0.01$), 우울도($r = 0.521$ vs -0.046, $P < 0.05$)에서 유의한 차이가 있었다.

결론: 고령의 농업인과 비농업인의 노화에 대한 취약성을 비교하였을 때 나이와 취약성 요소 간 유의한 상관관계는 농업인에서만 나타나 비농업인과는 차별적인 패턴을 보였다. 이러한 결과는 농촌의 고령 농업인에 대하여 건강한 노화를 위한 예방 및 관리 전략이 필요함을 시사한다.

주제어: 노화, 노인, 노인병학, 농업인, 농촌 건강

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INTRODUCTION

The problem of aging societies has extended beyond the individual and the family to the wider society. Particularly, rural areas are rapidly aging faster than urban areas, causing various problems in terms of social, economic, and regional aspects. Many studies have focused on the elderly in specific communities, including rural and urban areas. Previous studies have reported that people in rural areas, as opposed to urban, are vulnerable to self-rated health and are at higher risks of obesity, physical inactivity, food insecurity, heart disease, and diabetes [1, 2]. However, some studies report that the health behaviors and status of the elderly fare better in rural than urban areas [3]. Various research results have been reported according to country, region, and measured health characteristics.

Although studies of the elderly are being actively conducted, most consider persons 65 years or older to be the same population, and research lacks in details pertaining to the vulnerability of aging and variations in the characteristics of old age. Vulnerability to aging in the elderly is defined as sensitivity to the aging process and may be meaningful in predicting future health outcomes and for setting coping strategies for vulnerable communities [4].

Frailty is highly prevalent in the elderly and indicates that increased vulnerability to possible stressors and conferred high risk for disability and comorbidity [5]. For most elderly persons, weight loss is not due to losing fat but rather muscle and bone mass. Body mass index (BMI) is more highly correlated with body weight than with body height and, therefore, has been used as a general indication of healthy weight management [6]. As another representative age-related change, cognitive and physical functions are crucial factors in the prevention and treatment of health conditions in the elderly. The elderly present with decreased cognitive function, including reduced processing speed and poor executive function [7], and physical performance [8]. Recently, many studies highlighted psychological and social factors, especially depression, to be highly correlated with suicide, and major risk factors for the elderly [9, 10]. In identifying vulnerability to aging in the elderly, certain examinations may not be sufficient. Therefore, various factors were evaluated in this study to clarify this vulnerability.

Nevertheless, most previous studies did not identify age-related degeneration and the subjects' old age activity. Clarifying the vulnerability of aging based on specific communities may be meaningful in predicting future health effects and assist in setting coping strategies for overcoming these effects. Therefore, our study aimed to identify the vulnerabilities of aging and compare specific communities aged over 65 years as an initial step to resolving the issues in aging-vulnerable communities.

METHODS

1. Study design and participants

This study was a cross-sectional analysis of baseline data from a randomized case-control study of healthy Korean farmers (Healthy and Long life Program in Farm; HELPinFarm, CRIS number KCT0002366) [11]. According to the selection criteria for comparison between farmers and non-farmers, participants of the crop cooperative unit on the farms and with current farming were classified as farmers; participants registered in city welfare centers and without jobs were classified as

non-farmers. More than 30 people were recruited for statistical analysis, taking into account a 10% drop out in each group (input parameters specifying a Mann-Whitney test, an effect size of d = 0.93, α = 0.05, $1-\beta$ = 0.95, and an allocation ratio of n2/n1 = 1 would result in a total sample size of N = 54; 27 observation units in each group). In the analysis process, those under 65 years of age were excluded from the analysis of old age aging. Initially, healthy (defined as living independently, without functional limitations or active diseases) farmers in rural or non-farmers in urban areas, numbering 75 and 30, respectively, were recruited from Gangwon Province of South Korea (from November 2017 to December 2018). Those aged below 65 years (n = 46 farmers and 4 non-farmers) were excluded. Non-farmers with current jobs were excluded (n = 1 non-farmers). Finally, a total of 54 participants were included (29 farmers and 25 non-farmers) (see Fig. 1).

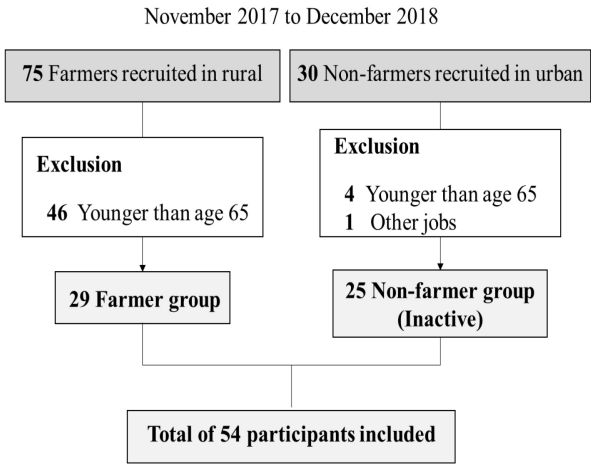

Figure 1. Participants flow chart

This study was approved by the institutional review board of the Kangwon National University Hospital (IRB No. 2017-04-017-006, approved on May 23, 2017), and a trial registration number was obtained from the Clinical Research Information Service (HELPinFarm, KCT0002366, registered on June 30, 2017).

2. Outcome Measurements

The following baseline characteristics were assessed: age (in years), sex (male/female), presence of a spouse (yes/no; including single, divorce, and bereavement), education duration (in years), morbidity, and smoking and drinking status (Never/Past/Current). Morbidity was defined as the number of medically diagnosed diseases, including: hypertension, cardiovascular disease, stroke, diabetes, hyperlipidemia, cancer, respiratory disease, urinary disease, and muscular-skeletal disease [12]. Vulnerability factors were assessed as follows. Frailty was measured using the Cardiovascular Health Study (CHS) scale [5]. The CHS scale assigns one point to each of the following five components: exhaustion (Moderate or most to either of the following: "I felt that everything I did was an effort" or "I could not get going."), low activity (Lowest quintile in physical activity level measured using the international physical activity questionnaire short form), slowness (gait speed < 0.8 m/s from the 4-m walk test), weakness (Dominant hand grip strength < 26 kg for men and < 17 kg for women), and weight loss (Unintentional weight loss > 3 kg during the previous 6 months). For body composition, BMI, percent of body fat (PBF), and skeletal muscle mass (SMM) were measured using a bioelectrical impedance analysis (InBody S10, InBody Corp., Seoul, South Korea). Cognitive function was assessed using the Mini-Mental State Examination in the Korean version of the CERAD assessment battery (MMSE-KC) [13] and correct response time in the go/no-go test (GNG) [14]. To assess physical function, the short physical performance battery (SPPB) protocol [15], and

timed up-and-go (TUG) test [16] were used. Regarding psychological status, mental and physical health scores in the 36-item Short-Form Health Survey (SF-36) [17] and the Korean Version of the Beck Depression Inventory (K-BDI) [18] were assessed. Variables were analyzed by independent variables are age and groups and dependent variables are other characteristics and vulnerability factors.

3. Statistical analyses

The characteristics of each group were summarized by mean ± standard deviation (SD) for continuous variables and number and proportions for categorical variables. Comparisons of continuous variables between the farmer and non-farmer groups were analyzed using the Mann-Whitney U test. The chi-square test was used to identify the differences between categorical variables. Spearman's correlation coefficient was analyzed to evaluate the correlation of age with vulnerability factors in each farmer and non-farmer group. The partial Pearson's correlation coefficients between age and vulnerability factors were analyzed by group to show their associations, adjusted by the presence of a spouse aspect. The partial correlation coefficients were compared between the study groups by using an online calculation (http://www.quantpsy.org/corrtest/corrtest.htm) [19]. Each correlation coefficient was converted into a z-score using Fisher's r-to-z transformation. The z-scores were compared using formula 2.8.5 of Cohen et al [20]. By convention, z-scores of $> |1.96|$ were considered significant for two-tailed tests. P values of < 0.05 were considered statistically significant. Statistical analyses were performed using the Statistical Package for the Social Sciences, version 20.0 (SPSS, Chicago, IL, USA).

RESULTS

1. Comparison of baseline characteristics and vulnerability factors between the study groups

A total of 54 participants were enrolled in the farmer group (n = 29; age, 71.2 ± 6.1 years) and non-farmer group (n = 25; age, 73.5 ± 4.3 years). Significant differences in age, elderly group, sex, education duration, morbidity, smoking, and drinking were not found between the study groups (Table 1). There was a significant difference in the current presence of a spouse: the proportion of respondents with spouses was 86.2% for farmers and 44% for the non-farmers (P = 0.001). The vulnerability factors are compared in Table 2. Farmers showed a significantly shorter TUG test time than the non-farmer group (10.6 ± 1.9 sec vs. 13.4 ± 3.5 sec, P = 0.001) regarding physical function. Regarding psychological status, the mental (77.7 ± 16.4 vs. 44.7 ± 18, P < 0.001) and physical (65.1 ± 21.9 vs. 43.6 ± 22.9, P = 0.001) health scores in SF-36 were significantly higher for the farmer group, reflecting a better quality of life (QOL). The K-BDI score (7.7 ± 6.1 vs. 17.1 ± 11.5, P = 0.002) was significantly lower in the farmer group, indicating a higher depressive mood.

2. Comparison of vulnerability factors regarding the presence of a spouse

Table 3 presents the differences in vulnerability according to the presence of a spouse. Farmers with spouses exhibited significantly lower PBF (23.6 ± 8.5 vs. 33.5 ± 3.1, P = 0.03) than those without spouses. Likewise, non-farmers with spouses showed significantly lower PBF (18.2 ± 7.9 vs. 25.2 ± 7.4, P = 0.05) than those without spouses.

Table 1. Comparison of baseline characteristics between the farmer and non-farmer groups

Baseline characteristics		Farmers (n=29)	Non-farmers (n=25)	Total (n=54)	P-value‡
		Mean ± SD or n (%)†			
Age (yr)		71.2 ± 6.1	73.5 ± 4.3	72.3 ± 5.4	0.06
Elderly Group	Y-O (65-74)	21 (72.4)	16 (64)	37 (68.5)	0.51
	O-O (75 ≤)	8 (27.6)	9 (36)	17 (31.5)	
Sex	Male	14 (48.3)	13 (52)	27 (50)	0.78
	Female	15 (51.7)	12 (48)	27 (50)	
Presence of spouse	Yes	25 (86.2)	11 (44)	36 (66.7)	0.001**
	No	4 (13.8)	14 (56)	18 (33.3)	
Education Duration (yr)		7.7 ± 4.4	9 ± 3.9	8.3 ± 4.2	0.16
Morbidity (n)		2.3 ± 1.3	2.2 ± 1.2	2.2 ± 1.3	0.71
Smoking	Never	17 (58.6)	14 (56)	31 (57.4)	0.91
	Past	10 (34.5)	10 (40)	20 (37)	
	Current	2 (6.9)	1 (4)	3 (5.6)	
Drinking	Never	9 (31)	11 (44)	20 (37)	0.06
	Past	4 (13.8)	8 (32)	12 (22.2)	
	Current	16 (55.2)	6 (24)	22 (40.7)	

Abbreviations: Y-O = Young-old (65 to 74 years old), O-O = Old-Old (over 75 years old)
† Values are presented as mean ± standard deviation or number of participants (%).
‡ P value from Mann-Whitney test for continuous outcomes and χ2 test for categorical outcomes.
** $P < 0.01$

Table 2. Comparison of vulnerability factors between the farmer and non-farmer groups

Vulnerability factors		Farmers (n=29)	Non-farmers (n=25)	Total (n=54)	P-value‡
		Mean ± SD or n (%)†			
Frailty	Robust (0)	8 (27.6)	5 (20)	13 (24.1)	0.76
	Prefrail (1-2)	17 (58.6)	17 (68)	34 (63)	
	Frail (3-5)	4 (13.8)	3 (12)	7 (13)	
Body Composition	BMI (kg/m^2)	25.7 ± 3.3	24.8 ± 3	25.3 ± 3.1	0.21
	SMM (kg)	26.5 ± 6.2	27.4 ± 5.3	26.9 ± 5.8	0.45
	PBF (%)	25 ± 8.6	22.1 ± 8.3	23.6 ± 8.5	0.26
Cognitive function	MMSE-KC (0-30)	26 ± 3.6	25.1 ± 2.8	25.6 ± 3.2	0.11
	CRT of GNG (ms)	570.4 ± 197.5	662 ± 243.9	613.6 ± 223.3	0.06
Physical function	SPPB (0-12)	9 ± 1.6	9.4 ± 1.5	9.1 ± 1.6	0.33
	TUG (s)	10.6 ± 1.9	13.4 ± 3.5	11.9 ± 3.1	0.001**
Psychological status	SF-36 MH (0-100)	77.7 ± 16.4	44.7 ± 18	62.5 ± 23.8	P < 0.001**
	SF-36 PH (0-100)	65.1 ± 21.9	43.6 ± 22.9	55.1 ± 24.6	0.001**
	K-BDI (0-63)	7.7 ± 6.1	17.1 ± 11.5	12 ± 10.1	0.002**

Abbreviations: BMI = Body Mass Index, PBF = Percent Body Fat, SMM = Skeletal Muscle Mass, MMSE-KC = Mini-Mental State Examination in the Korean version of the CERAD assessment battery score, CRT of GNG = Correct reaction time of Go/No-go task, SPPB = Short Physical Performance Battery score, TUG = Performance time of Timed Up & Go test, SF-36 MH/ PH = Short-Form health survey 36 questions Mental health/ Physical health score, K-BDI = Korean version of Beck Depression Inventory score
† Values are presented as mean ± standard deviation or number of participants (%).
‡ P value from Mann-Whitney test for continuous outcomes and χ2 test for categorical outcome.
* $P < 0.05$ or ** $P < 0.01$

Table 3. Comparison of vulnerability factors regarding the presence of a spouse.

Vulnerability factors		Farmers (n=29)			Non-farmers (n=25)			Total (n=54)		
		Spouse (n=25)†	Spouseless (n=4)	P-value‡	Spouse (n=11)	Spouseless (n=14)	P-value	Spouse (n=36)	Spouseless (n=18)	P-value
Frailty (0-5)		1.9 ± 0.7	1.8 ± 0.5	0.75	2.1 ± 0.5	1.8 ± 0.6	0.18	1.9 ± 0.6	1.8 ± 0.5	0.36
Body Composition	BMI (kg/m^2)	25.5 ± 3.3	27 ± 2.6	0.32	23.7 ± 1.5	25.7 ± 3.6	0.12	24.9 ± 3	26 ± 3.4	0.23
	SMM (kg)	27 ± 6.5	23.5 ± 3.8	0.31	28.4 ± 4.8	26.6 ± 5.8	0.39	27.4 ± 6	25.9 ± 5.5	0.41
	PBF (%)	23.6 ± 8.5	33.5 ± 3.1	0.03*	18.2 ± 7.9	25.2 ± 7.4	0.05*	21.9 ± 8.6	27.1 ± 7.5	0.03*
Cognitive function	MMSE-KC (0-30)	26.4 ± 3.3	23.8 ± 4.7	0.19	24.8 ± 2.4	25.3 ± 3.2	0.74	25.9 ± 3.1	24.9 ± 3.5	0.31
	CRT of GNG (ms)	575.2 ± 206.7	530.9 ± 107.3	0.91	695.9 ± 273	635.4 ± 225.4	0.41	612.1 ± 231.9	617 ± 210.7	0.66
Physical function	SPPB (0-12)	9 ± 1.7	8.8 ± 1	0.95	9.5 ± 1.4	9.3 ± 1.7	0.84	9.1 ± 1.6	9.2 ± 1.5	0.96
	TUG (s)	10.7 ± 1.9	10 ± 2.6	0.61	13.3 ± 3.1	13.6 ± 3.8	0.96	11.5 ± 2.6	12.8 ± 3.8	0.20
Psychological status	SF-36 MH (0-100)	78.6 ± 14.5	72.5 ± 28.3	1.00	49 ± 18.2	41.4 ± 17.7	0.48	69.5 ± 20.7	48.3 ± 23.6	0.003**
	SF-36 PH (0-100)	65.4 ± 21.3	63.1 ± 29	0.85	49.6 ± 27.1	38.9 ± 18.7	0.34	60.6 ± 24	44.3 ± 22.8	0.02*
	K-BDI (0-63)	7.3 ± 5.9	10.3 ± 7.7	0.39	15.6 ± 12.4	18.2 ± 11.1	0.37	9.8 ± 9.1	16.4 ± 10.8	0.02*

Abbreviations: BMI = Body Mass Index, PBF = Percent Body Fat, SMM = Skeletal Muscle Mass, MMSE-KC = Mini-Mental State Examination in the Korean version of the CERAD assessment battery score, CRT of GNG = Correct reaction time of Go/No-go task, SPPB = Short Physical Performance Battery score, TUG = Performance time of Timed Up & Go test, SF-36 MH/ PH = Short-Form health survey 36 questions Mental health/ Physical health score, K-BDI = Korean version of Beck Depression Inventory score

† Values are presented as mean ± standard deviation. ‡ P value from Mann-Whitney test. *$P < 0.05$ or **$P < 0.01$

In all participants, significant differences were observed in PBF (21.9 ± 8.6 vs. 27.1 ± 7.5, P = 0.03), the mental (69.5 ± 20.7 vs. 48.3 ± 23.6, P = 0.003) and physical (60.6 ± 24.0 vs. 44.3 ± 22.8, P = 0.02) health scores in SF-36, and the K-BDI score (9.8 ± 9.1 vs. 16.4 ± 10.8, P = 0.02). These reflected a better QOL and less depressed temperament in the presence of a spouse. Each group of farmers and non-farmers with spouses also exhibited better QOL scores and lower depressed scores, but they were not statistically significant.

3. Partial correlation analysis between age and vulnerability factors and comparison of partial correlation coefficients in the study groups

Table 4 reports the Spearman and partial correlation coefficients between age and vulnerability factors in the farmer and non-farmer groups. Partial correlation was adjusted by the presence of a spouse. In the non-farmer group, the correlation between age and all vulnerability factors was not statistically significant, in both the unadjusted and adjusted results. In a partial correlation analysis adjusted by the presence of a spouse, the farmer group had significant correlations between age and vulnerability factors by $P < 0.05$ or $P < 0.01$ in the vulnerability factors of frailty ($r = 0.444$), BMI ($r = -0.625$), MMSE-KC ($r = -0.587$), SPPB ($r = -0.422$), mental health in SF-36 ($r = -0.477$), and K-BDI ($r = 0.521$). The absolute values of the Z scores greater than 1.96 in BMI ($Z = -2.621$, P = 0.009) and the K-BDI ($Z = 2.153$, P = 0.03), reflect more significant correlations for the farmer group.

Table 4. Partial correlation analysis between age and vulnerability factors adjusted by the presence of a spouse and comparison of two independent partial correlation coefficients†

Vulnerability factors		Farmers (n=29)		Non-farmers (n=25)		Farmers vs. Non-farmers
		Unadjusted	Adjusted	Unadjusted	Adjusted	z-score‡
Frailty (0-5)		0.564**	0.444*	0.155	0.162	1.083
Body Composition	BMI (kg/m^2)	−0.547**	−0.625**	0.034	0.026	-2.621**
	SMM (kg)	−0.436*	−0.345	−0.047	−0.017	-1.183
	PBF (%)	−0.032	−0.232	0.029	−0.019	-0.75
Cognitive function	MMSE−KC (0−30)	−0.517**	−0.587**	−0.385	−0.334	-1.125
	CRT of GNG (ms)	0.261	0.284	0.28	0.188	0.351
Physical function	SPPB (0−12)	−0.502**	−0.422*	−0.222	−0.163	-0.986
	TUG (s)	0.387*	0.305	0.01	−0.141	1.577
Psychological status	SF−36 MH (0−100)	−0.529**	−0.477*	0.117	0.036	-1.916
	SF−36 PH (0−100)	−0.427*	−0.279	−0.013	−0.071	-0.744
	K−BDI (0−63)	0.522**	0.521**	−0.031	−0.046	2.153*

Abbreviations: BMI = Body Mass Index, PBF = Percent Body Fat, SMM = Skeletal Muscle Mass, MMSE-KC = Mini-Mental State Examination in the Korean version of the CERAD assessment battery score, CRT of GNG = Correct reaction time of Go/No-go task, SPPB = Short Physical Performance Battery score, TUG = Performance time of Timed Up & Go test, SF-36 MH/ PH = Short-Form health survey 36 questions Mental health/ Physical health score, K-BDI = Korean version of Beck Depression Inventory score

† Values are presented as a Spearman (Unadjusted) and partial (Adjusted) correlation coefficient or z-score using Fisher's r-to-z transformation.

‡ The z-score greater than |1.96| are considered significant if a 2-tailed test is performed.

$^*P < 0.05$ or $^{**}P < 0.01$

DISCUSSION

Our study aimed to identify the differences of vulnerability in aging over 65 years between elderly farmers and non-farmers in the community. The study results showed that different patterns in terms of vulnerability to aging in elderly farmers and non-farmers. For health-related vulnerability factors, no significant correlation was found in elderly non-farmers, whereas a significant correlation was found in elderly farmers. Moreover, compared to the non-farmer group, the correlation coefficients significantly differed in BMI and depression degree in the K-BDI. This may be due to differences in the environments of farmers and non-farmers in the community and persistent physical labor in old age. These results could re-affirm that elderly farmers in rural areas are vulnerable communities. Previous comparative studies of the elderly in the rural and urban areas showed that people in rural areas were more vulnerable to health promotion lifestyles and health status and behaviors [21]. Nevertheless, most of these studies did not account for age-related degeneration and the individuals' current activity.

In the elderly non-farmers, the insignificant correlation between age and health-related vulnerability factors may have been affected by the presence of current spouses in addition to retirement and urban environment. Urban elderly with a high spouseless rate and social activity less had an ill-health psychological state. Our results show significant differences in psychological status and negative regarding the presence of a spouse. These differences may be affected by whether they were living with their spouses or not. Previous studies report that the elderly without spouses were more depressed [22], had a worse health status, and poorer QOL than the elderly with spouses [23]. Therefore, in the farmer group, which had a higher proportion of married persons, depression and QOL may be improved. Additionally, such could be due to the difference between an active elderly farmer and an inactive unemployed elderly person. Farming is physically active and unemployment can reduce the physical and social activities of older people, indicating better physical performance for farmers.

BMI is an indicator of obesity with a risk factor for heart disease, diabetes, high blood pressure, and other diseases. However, for the elderly, a decrease in BMI may be considered to indicate frailty and a sign of health problems. Recent studies have shown that the risk of death decreases [24] along with frailty [25] in the elderly of high BMI. Regarding indicators of healthy weight management, decreasing BMI in the elderly can be seen as a risk factor for deteriorating health. Therefore, these results indicate that to improve age-related degeneration in elderly farmers, normal body weight maintenance, and nutritional factors along with BMI management are important and should be emphasized along with BMI management.

Psychological factors stood out as being vulnerable to aging. "Exhaustion" (as a component of frailty), involving psychological weakness and mental health and pertaining to QOL was more important an outcome than physical health. These results, relevant to most psychological factors, indicate that vulnerability in the mental and emotional states should be noted for elderly farmers. Depressive symptoms of the elderly were higher for older adults [26], or in rural areas, than in the city [27].

Psychological vulnerability in rural areas is a consequence of reduced social interactions due to isolation along with social frailty [28]. Physical and cognitive changes experienced by elderly farmers can reduce their interactions with others, increasing isolation, dependence, and depression [29]. Thus, elderly farmers in rural areas can easily be exposed to both health and social problems of aging.

This study could not rule out a few limitations, which require further understanding. First, this was a cross-sectional study with a small sample size instead of a follow-up or nationwide study. Thus, further study may be needed to fill this gap. Nevertheless, this study is valuable, as it examined the welfare of elderly farmers in rural areas as the initial step. Second, besides rural farmers, various confounding variables such as motor ability, nutritional status, and the economic level may have affected the deterioration of health from aging. A further detailed study is needed considering various confounding variables to prove the causality of aging vulnerability. However, our study confirms the effects of current occupational activities and presence of a spouse on the psychological states of the elderly.

Our study demonstrated that elderly farmers had a more vulnerable pattern of aging pertaining to body composition, cognitive function, physical function, and psychological status than elderly non-farmers. These results suggest that persistent agricultural work of old age in rural communities can make a difference in the aging process and reflect the necessity of intensive preventive care strategies against aging, primarily targeting farmers in rural areas. Instead of discussing old age in one category, welfare policies for the elderly require a specifically segmented approach that reflects their diverse characteristics and differences. This approach will greatly aid public health policy in promoting the healthy aging of this vulnerable population through future research.

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