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Impact of the Cohabitation Status of Elderly on Nutrient Intake and the Prevalence of Anemia : The 2016-2019 Korea National Health and Nutrition Examination Survey

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Abstract

The purpose of this study was to compare the nutrient intake of elderly according to their cohabitation status and determine its effects on the prevalence of anemia. Data from the KNHANES were used for this study, including raw data on socioeconomic characteristics, nutrient intake, health status, and clinical laboratory findings. Study subjects aged 60 to 80 years were retrieved and analyzed. As a result, the prevalence of anemia was 12.0% (men, 11.6%; women, 12.3%). The prevalence rate increased with age, and odds ratio [OR] of anemia among those aged 75 to 80 years was 4.16 times higher in men (OR=4.16, 95% confidence interval [CI]=2.48-6.97) and 2.77 times higher in women (OR=2.77, 95% CI=1.86-4.14) compared to 60~64 years old. Socioeconomic factors (area of residence, education level, household income), including cohabitation Status (living alone VS living with other family members), and health behaviors (high-risk drinking, smoking, aerobic exercise) did not significantly effect on anemia. In addition, other than protein intake for men, nutrient intake did not have a significant effect on the prevalence rate of anemia. Hypertension, diabetes, and cancer significantly increased the risk of anemia. In Korea, the influencing factors of elderly anemia change over time, so periodic follow-up studies are needed.

Keywords: Anemia, Aged, Family, KNHANES

Major classifications: Health Science

1. Introduction

According to a 2021 survey by Statistics Korea, the elderly population in Korea is 16.5% of the total population. The number of elderly is expected to continue to grow, entering a super-aged society by 2025 (National Statistical Office, 2021). With the rapid aging of the population, concerns about the health problems for the elderly is also increasing (Kim et al., 2017). A nutritionally well-balanced diet is key to maintaining good health and preventing illness in elderly. However, complex problems such as decreased physical function, depression, dementia, and loss of appetite in the elderly lead to various health problems such as reduced nutrient intake or malnutrition (Bair et al., 2016; Bartali et al., 2003). Recently, the proportion of the elderly living alone is increasing, and this change has been reported to be one of the major contributors to nutrition deficiency among the elderly (Shin et al., 2012). In particular, the lack of nutrition intake in the elderly living alone leads to frailty and several health problems due to nutritional deficiency (Kim et al., 2005).

One of the most frequently experiencing health problems among elderly is elderly anemia. In 2018, the prevalence of anemia among the elderly aged 70 or older in Korea was 17.6%, and it is known that the prevalence increases with the age of the elderly (Korean Centers for Disease Control and Prevention [KCDCP], 2021; Lee et al., 2019). Prevention and treatment anemia is essential for decreasing the risk of accidents such as falls, slips and depression by encouraging elderly to remain physically active, and consequently extending the life expectancy. Although previous studies have confirmed the correlation between cohabitation status (whether live alone or with other members) and malnutrition among elderly (Shin et al., 2012; Kim et al., 2005), there have been few studies on the effects of malnutrition on the elderly anemia according to cohabitation status.

This study attempted to understand the relationship between nutrient intake and anemia prevalence according to cohabitation status using data from the 2016-2019 Korea National Health and Nutrition Examination Survey (KNHANES) which can be generalized to the elderly living in communities across whole the country. The research results can be used as useful evidence for geriatric nursing and health care plans in the community.

2. Literature review

Previous studies have reported in Korea, the elderly who live alone tend to have lower nutrient intake than elderly living with other family members (Shin et al., 2012; Kim et al., 2005). A gender discrepancy has also been found, with male elderly who live alone taking much less water, dietary fiber, phosphorus, iron, potassium, riboflavin, niacin, and vitamin C than elderly who live with others. For female elderly who live alone, protein, vitamin A, vitamin B1, vitamin B2, niacin, vitamin C, phosphorus, and iron intake was found to be lower than that of elderly who live with others (Oh &Jung, 2019).

Although the causes of elderly anemia vary, 1/3 of them are attributed to inadequate nutritional intake (Lee et al., 2019). People with anemia not only experience problems such as dizziness, fatigue, general weakness, and decreased physical ability, but also increases the likelihood of falls and injuries (Thaler-Kall et al., 2014). In the elderly, anemia leads to dementia, reduced bone density and muscle mass, depression (Chaves et al., 2006; Chaves et al., 2005), and an increased risk of vertebral or femur fractures and ultimately increase mortality (Thaler-Kall et al., 2014, 2021). In particular, elderly with underlying diseases such as hypertension, osteoarthritis, diabetes, cancer, or chronic renal failure are more susceptible to anemia therefore require nursing services that will lead to timely check-up and management for anemia (Choi et al., 2005).

3. Methods

3.1. Study population and data source

Data from the KNHANES were used for this study, including raw data on socioeconomic characteristics, nutrient intake, health status, and clinical laboratory findings. From the 2016-2019 raw KNHANES data, which study subjects aged 60 to 80 years were retrieved and analyzed (8,150 in 2016, 8,127 in 2017, 7,992 in 2018, 8,110 in 2019) (KCDCP, 2021).

3.2. Analytical variables

Among the variables included in the raw KNHANES data, the following were used in the present study: demographic

characteristics (age, gender, area of residence, cohabitation status, education level, economic activity, household income), health behaviors (high-risk drinking, smoking, aerobic exercise), underlying diseases (hypertension, diabetes, stroke, osteoarthritis, chronic renal failure, liver cirrhosis, cancer), clinical laboratory test results (hemoglobin level), and daily nutrient intake (protein, iron, vitamin C). As specified by the KNHANES, anemia was defined as a hemoglobin level of less than 13 g/dL for men and less than 12 g/dL for women (KCDCP, 2021).

3.3. Statistical analysis

Since the KNHANES contains data that were selected using the complex sampling method, a weight of 0.25 was assigned to the 2016-2019 data for each year, and strata and clusters were also applied in the statistical analysis (KCDCP, 2021). The differences in prevalence relative to the subjects' characteristics and underlying diseases were analyzed using the Rao-Scott χ^2 (χh) test, and the difference in prevalence relative to subjects' nutrient intake was analyzed using the *t*-test. The effects of cohabitation on anemia were analyzed using multiple logistic regression after controlling for socioeconomic factors, health behaviors, and underlying diseases. For all analyses, SAS 9.4 was used (SAS Institute Inc., Cary, NC, USA).

4. Results

4.1. The prevalence of anemia according to socioeconomic characteristics and health behaviors

The 6,956 elderly people analyzed can be generalized to 8,166,093, and the prevalence of anemia in men was 11.6%, slightly lower than that of women 12.3%. In both men and women, the prevalence of anemia increased considerably with age, and in subjects aged 75 to 80 years, 21.7% in men and 20.0% in women. In men, there was a statistically significant difference in the prevalence of anemia according to the education level, economic activity, household income and high-risk drinking, smoking, and aerobic exercise. In the women, there was a statistically significant difference in the prevalence according to the area of residence, education level, economic activity, and household income. Both men and women showed no significant difference in the prevalence of anemia between the elderly living alone and living with other family members.

Table 1: Prevalence of anemia according to socioeconomic characteristics and health behaviors

Variables		Categories	Male (n=3,031, N=3,676,684)			Female (n=3,925, N=4,489,409)		
			None	Anemia	χh (*p*)	None	Anemia	χh (*p*)
			n (%)	n (%)		n (%)	n (%)	
Socioeconomic factors	Age (years)	60-64	786 (95.7)	35 (4.3)	109.86 (<.001)	990 (93.4)	70 (6.6)	78.88 (<.001)
		65-69	662 (91.6)	61 (8.4)		844 (90.5)	89 (9.5)	
		70-74	575 (88.6)	74 (11.4)		687 (88.0)	94 (12.0)	
		75-80	656 (78.3)	182 (21.7)		921 (80.0)	230 (20.0)	
	Area of residence	Urban	1,971 (88.7)	250 (11.3)	0.39 (.530)	2,602 (88.5)	338 (11.5)	10.39 (.001)
		Rural	708 (87.4)	102 (12.6)		840 (85.3)	145 (14.7)	
	Cohabitation status	Alone	351 (87.3)	51 (12.7)	0.78 (.378)	901 (85.6)	151 (14.4)	2.17 (.141)
		With others	2,328 (88.6)	301 (11.4)		2,541 (88.4)	332 (11.6)	
	Education level (years)	≥14	531 (91.4)	50 (8.6)	8.30 (.016)	257 (93.5)	18 (6.5)	8.48 (.014)
		12	737 (89.6)	86 (10.4)		538 (92.0)	47 (8.0)	
		≤9	1,411 (86.7)	216 (13.3)		2,647 (86.4)	418 (13.6)	
	Economic activity	No	1,301 (85.4)	223 (14.6)	21.87 (<.001)	2,243 (86.4)	352 (13.6)	6.48 (.011)
		Yes	1,378 (91.4)	129 (8.6)		1,199 (90.2)	131 (9.8)	
	Household income	Below average	1,036 (92.9)	79 (7.1)	21.45 (<.001)	1,050 (90.7)	108 (9.3)	12.27 (.001)
		Above average	1,643 (85.8)	273 (14.2)		2,392 (86.4)	375 (13.6)	

Health behaviors	High risk drinking	No	2,325 (87.7)	327 (12.3)	3.69 (.055)	3,383 (87.6)	478 (12.4)	3.67 (.055)
		Yes	354 (93.4)	25 (6.6)		59 (92.2)	5 (7.8)	
	Smoking	No	2,084 (87.4)	300 (12.6)	11.33 (<.001)	3,348 (87.7)	471 (12.3)	0.01 (.917)
		Yes	595 (92.0)	52 (8.0)		94 (88.7)	12 (11.3)	
	Aerobic exercise	No	1,649 (87.1)	245 (12.9)	7.36 (.007)	2,349 (86.9)	355 (13.1)	3.42 (.065)
		Yes	1,030 (90.6)	107 (9.4)		1,093 (89.5)	128 (10.5)	

4.2. Prevalence of anemia according to underlying diseases

The subjects with hypertension, stroke, myocardial infarction, diabetes, osteoarthritis, chronic renal failure, and cancer had a significantly higher prevalence of anemia than those who did not. Unlike for men, there was no significant difference in the prevalence of anemia depending on stroke, myocardial infarction, and osteoarthritis, and the prevalence was high in women with hypertension, diabetes, chronic renal failure, and cancer. Chronic renal failure was the comorbidity associated with the highest rate of anemia, with 56.3% of men and 61.1% of women with chronic renal failure suffering from anemia.

Table 2: Prevalence of anemia according to the underlying diseases

Variables	Categories	Male (n=3,031, N=3,676,684)			Female (n=3,925, N=4,489,409)		
		None	Anemia	χh (p)	None	Anemia	χh (p)
		n(%)	n(%)		n(%)	n(%)	
Hypertension	No	1,425 (91.0)	141 (9.0)	18.53 (<.001)	1,759 (90.3)	190 (9.7)	16.39 (<.001)
	Yes	1,254 (85.6)	211 (14.4)		1,683 (85.2)	293 (14.8)	
Stroke	No	2,547 (88.7)	326 (11.3)	5.34 (.021)	3,326 (87.8)	461 (12.2)	0.20 (.652)
	Yes	132 (83.5)	26 (16.5)		116 (84.1)	22 (15.9)	
Myocardial infarction	No	2,457 (88.9)	308 (11.1)	9.33 (.002)	3,286 (87.9)	453 (12.1)	0.70 (.404)
	Yes	222 (83.5)	44 (16.5)		156 (83.9)	30 (16.1)	
Diabetes mellitus	No	2,155 (90.2)	233 (9.8)	34.60 (<.001)	2,852 (89.4)	337 (10.6)	30.22 (<.001)
	Yes	524 (81.5)	119 (18.5)		590 (80.2)	146 (19.8)	
Osteoarthritis	No	2,390 (89.2)	289 (10.8)	6.24 (.013)	2,121 (88.6)	273 (11.4)	2.24 (.135)
	Yes	289 (82.1)	63 (17.9)		1,321 (86.3)	210 (13.7)	
Chronic renal failure	No	2,670 (88.6)	345 (11.4)	14.56 (<.001)	3,435 (87.9)	472 (12.1)	35.95 (<.001)
	Yes	9 (56.3)	7 (43.8)		7 (38.9)	11 (61.1)	
Liver cirrhosis	No	2,657 (88.4)	348 (11.6)	0.19 (.661)	3,431 (87.7)	480 (12.3)	0.83 (.362)
	Yes	22 (84.6)	4 (15.4)		11 (78.6)	3 (21.4)	
Cancer	No	2,595 (89.2)	315 (10.8)	43.59 (<.001)	3,350 (88.0)	456 (12.0)	8.79 (.003)
	Yes	84 (69.4)	37 (30.6)		92 (77.3)	27 (22.7)	

4.3. Comparison of nutrient intake based on anemia

A comparison of the daily intake of protein, iron, and vitamin C between subjects with and without anemia (Table 3) showed that protein and iron intake were lower in both men and women with anemia. However, the difference in vitamin C intake was significant only in men.

Table 3: Mean comparison of daily nutrient intake based on anemia

Variables	Men (n=3,031, N=3,676,684)				Women (n=3,925, N=4,489,409)			
	None	Anemia	t	*p*	None	Anemia	t	*p*
	M±SD	M±SD			M±SD	M±SD		
Protein (g)	70.3±0.9	58.9±1.7	38.92	<.001	50.1±0.5	45.7±1.3	9.71	.002
Iron (mg)	14.8±0.3	12.7±0.4	18.37	<.001	11.1±0.2	9.7±0.3	16.82	<.001
Vitamin C (mg)	76.3 (2.3)	61.6±4.	8.84	.003	73.2±2.1	64.3±5.0	2.89	.090

M, mean; SD, standard deviation

4.4. Impact of cohabitation status on anemia

After adjusting the factors affecting anemia in the elderly as covariates, the effect of cohabitation status on anemia was analyzed (Table 5). As a result of the analysis, there was no statistically significant difference in the odds ratio of anemia between elderly who lived alone and elderly who lived with others in men and women. Looking at the covariates affecting anemia, the odds ratios for men aged 70-74 and 75-80 were 1.82 and 4.16, and for women, odds ratios were 1.56 and 2.77, respectively. Health behaviors such as high-risk drinking, smoking, and aerobic exercise did not significantly affect anemia, whereas hypertension, diabetes, and cancer increased the prevalence of anemia in the elderly. Acute myocardial infarction in men and chronic renal failure in women were risk factors for anemia. Regarding nutrient intake, intake of iron and vitamin C showed no significant impacts, whereas an increase in daily protein intake by 1g led to a corresponding 1% decrease in the risk of geriatric anemia.

Table 4: Multivariate logistic regression analysis results for factors affecting anemia

Area	Variables	Categories	Male (n=3,031, N=3,676,684)		Female (n=3,925, N=4,489,409)	
			OR (95% CI)	*p*	OR (95% CI)	*p*
Socioeconomic factors	Age (ref=60-64)	65-69	1.58 (0.90~2.77)	.113	1.26 (0.83~1.93)	.276
		70-74	1.82 (1.04~3.19)	.037	1.56 (1.02~2.38)	.040
		75-80	4.16 (2.48~6.97)	<.001	2.77 (1.86~4.14)	<.001
	Area of residence (ref=Urban)	Rural	0.96 (0.66~1.40)	.845	1.36 (0.98~1.88)	.068
	Cohabitation area (ref=Alone)	With others	0.84 (0.53~1.32)	.444	1.06 (0.78~1.46)	.700
	Education level (ref=≤9)	≥14	0.97 (0.60~1.56)	.884	0.93 (0.52~1.69)	.818
		12	1.09 (0.71~1.68)	.688	0.89 (0.56~1.40)	.601
	Economic activity (ref=No)	Yes	1.01 (0.71~1.43)	.952	0.93 (0.67~1.28)	.648
	Household income (ref=Below average)	Above average	1.17 (0.76~1.80)	.467	1.09 (0.79~1.51)	.586
Health behaviors	High risk drinking (ref=No)	Yes	1.21 (0.68~2.14)	.517	0.63 (0.20~2.00)	.428
	Smoking status (ref=No)	Yes	0.71 (0.47~1.09)	.120	0.85 (0.36~2.04)	.718
	Aerobic exercise (ref=No)	Yes	0.91 (0.63~1.31)	.608	1.01 (0.75~1.36)	.971
Underlying diseases	Hypertension	Yes	1.44 (1.05~1.98)	.023	1.38 (1.04~1.82)	.024
	Stroke	Yes	1.51 (0.85~2.67)	.160	0.73 (0.42~1.25)	.252
	Myocardial infarction	Yes	1.81 (1.08~3.03)	.025	1.05 (0.59~1.86)	.873
	Diabetes mellitus	Yes	1.87 (1.33~2.62)	<.001	1.66 (1.20~2.28)	.002

	Osteoarthritis	Yes	1.40 (0.89~2.21)	.145	1.02 (0.80~1.31)	.880
	Chronic renal failure	Yes	4.33 (0.83~22.56)	.082	8.61 (2.40~30.90)	.001
	Liver cirrhosis	Yes	1.89 (0.37~9.76)	.445	1.81 (0.38~8.68)	.456
	Cancer	Yes	3.62 (1.95~6.73)	<.001	2.72 (1.36~5.46)	.005
Nutrient intake	Protein (g)		0.99 (0.98~1.00)	.027	1.00 (0.99~1.01)	.495
	Iron (mg)		1.01 (0.99~1.03)	.453	0.97 (0.93~1.01)	.181
	Vitamin C (mg)		1.00 (0.99~1.00)	.068	1.00 (1.00~1.01)	.128

CI, confidence interval; OR, odds ratio

5. Discussion

This study analyzed the effects of cohabitation status, socioeconomic factors, health behaviors, and underlying diseases on anemia of the 60~80 years elderly using data from the 2016-2019 KNHANES. In result, the prevalence rate of anemia among elderly was 12.0% (11.6% in men, 12.3% in women), which was higher than the 7.2% rate suggested in a study by Choi et al. (Choi et al., 2005) and the 10% rate reported in a study from the United States of elderly aged more than 65 years (Chaves et al., 2006). However, it was similar to the 17.6% rate reported in a 2018 study from South Korea of elderly aged more than 70 years (KCDCP, 2021; Lee et al., 2019). However, it should be noted that a simple comparison of the prevalence rate is not adequate because different subjects vary from study to study (Chueh al., 2020). Nonetheless, the subjects of this study are elderly people who live relatively healthy daily lives in the community, and elderly anemia increases the risk of dementia, depression, bone fractures, cancer, and ultimately lower life expectancy (Chaves et al., 2006; Chaves et al., 2005; Choi et al., 2005).

There are various causes of elderly anemia, of which one-third of cases can be attributed to insufficient nutrient intake (Lee et al., 2019). Therefore, it was reported that the prevalence of anemia was higher when the household income was lower or triggered sufficient food intake obstacles such as the elderly living alone (Lee et al., 2019; Kim et al., 2005), but this study found that socioeconomic factors such as area of residence, cohabitation status, education level, and household income did not significantly affect anemia. This finding is identical to that of a study by Choeh et al. (Choeh et al., 2020) that was based on data from the 2007-2016 KNHANES. One possible explanation for this difference from the findings of previous studies that confirmed a correlation between elderly anemia, nutrient intake, and cohabitation status (Shin et al., 2012; Kim et al., 2005) is the Basic Senior Pension that has been provided to more than 60% of South Korean senior citizens beginning in July 2014. The elderly poverty rate continues to decline to 46.3% in 2013, 42.3% in 2017, and 38.9% in 2020 (Korean Statistical Information Service, 2022). In other words, financial support is assumed to have played a crucial role in improving the nutrient intake of the elderly.

Hypertension, diabetes, and cancer were the comorbidities that had the most significant affection with elderly anemia in both men and women. Acute myocardial infarction in men and chronic renal failure in women were confirmed to be risk factors for anemia. Therefore, when caring for elderly with these diseases, nursing activities are required to assess and take care of anemia from time to time.

6. Conclusion

As a result of extracting and analyzing 6,956 elderly people aged 60-80 years old from the 2016-2019 KNHANES data, the prevalence of anemia was 12.0% (11.6% in men and 12.3% in women). The prevalence rate of anemia increased with age. Socioeconomic factors (area of residence, education level, household income) including cohabitation status (living alone VS living with other family members) and health behaviors (high-risk drinking, smoking, aerobic exercise) did not significantly affect. Other than protein intake in men, nutrient intake showed no significant effects on anemia. But underlying diseases such as hypertension, diabetes, and cancer were found to significantly increase the risk of anemia. Since the factors associated with elderly anemia tend to change over time, periodic follow-up studies are needed.

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