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Research Article

Consumption of Vitamins and Associated Factors by Age Group

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Abstract

Background: The intake of vitamins is generalized, however, studies of their consumption have focused on limited associated factors and has not identified the influencing factors by age. This study was designed to contribute to an understanding of factors related to the use of vitamins by age group. **Methodology:** This study is a nationally representative cross-sectional, population-based and the sample consisted of 5,915 Korean adults aged 20 years older. Analyses were based on a multiple linear regression model including socioeconomic factors, health status and health behaviours. **Results:** Many factors are linked to the increased likelihood of using vitamins, including female, high income, living with a spouse, perception of health as bad, smoking, sufficient dietary intake, exercises and attempts to control one's weight. However, the presence of chronic diseases was not related to the use of vitamins in any age group. The associated factors differed according to age and the number of relevant factors decreased with age. **Conclusion:** Adults 20-44 years of age, especially who ate enough, require educations related to nutrient intake. Besides the nutrient education could be effective in adults 65 years who have regular exercises. But, people in this age group may need more vitamins than young and middle-aged adults do, they should receive relevant guidelines or information. Regarding the public health education of vitamins intake, among those aged 45-64 years, socioeconomic factors must be considered.

Key words: Vitamins, age, associated factors, socioeconomic factors, vitamin intake, health status, health behaviours, consumption

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The use of vitamins has become widespread and is continuing to increase. Historically, people obtained vitamins and minerals from diverse foods. Today, however, nutrients are also obtained from nutrient-fortified foods, vitamin or mineral supplements or other types of vitamins. Vitamins are widely used throughout the world and contribute to the amount of nutrients consumed¹. Multi-complex vitamins are widely used and the percentage of the Korean population consuming these products increased² from 25.8% in 2005 to 34.1% in 2008. This is comparable to the 35% of the US general population who report regular use of multivitamins as vitamins³.

Magazine or television advertisements for vitamins appear to promise that these supplements improve your health and well-being, prevent illness or increase your lifespan. However, not everyone needs vitamins; only people who do not obtain the necessary nutrients in their regular diet require supplements. Moreover, the amount of additional nutrients needed differs by age and symptomatology⁴⁻⁶.

Previous studies have reported inconsistent results^{7,8} or have focused on a limited number of factors associated with the use of vitamins³ have examined unrepresentative samples of adults or specific age/gender groups^{9,10} have not identified differences by age^{5,6,10} or have included few socioeconomic variables^{6,10}. Thus, this study investigated whether and to what extent socioeconomic factors, health status and health behaviours influenced the use of vitamins by different age groups. If such factors vary by age, different guidelines or nutrient-related education programs will be needed for different age groups. Therefore, this study was designed to contribute to an understanding of factors related to the use of vitamins by age group.

MATERIALS AND METHODS

Data sources and study population: Data were obtained from the 5th Korean National Health and Nutrition Examination Survey (KNHANES-V), which was conducted in 2010. KNHANES is a nationally representative cross-sectional, population-based study conducted by the Korea Center for Disease Control (KCDC) and approved by the KCDC Institutional Ethics Review Board No. 2010-02CON-21-C. All participants provided written informed consent before data collection¹¹. Survey participants were selected using a complex stratified, multistage probability sampling method and the response rate was 81.9%¹¹. Of the total

8958 individuals who participated, 5,915 Koreans aged 20 years or older were included in this study. Participants were interviewed by trained interviewers. Data about the presence of diseases were based on diagnostic evaluations performed by physicians. Height and weight for the assessment of obesity ($\geq 25 \text{ kg m}^{-2}$) were measured at a mobile medical centre.

Variables

Outcome variable: The outcome variable, the regular weekly consumption of vitamins was measured with the following question: "During the most recent year, did you regularly consume vitamins on a weekly basis?" Participants could respond with "yes" or "no."

Socioeconomic variables: This study examined a wide array of independent variables in three categories. The first included socioeconomic factors: Age group (20-44, 45-64 and 65 years older), sex (male, female), educational level (middle school or less, high school, college or higher), income (low, middle low, middle high and high), occupation (office work, farmer or fisher, physical labourer, student/housewife, unemployed), marriage (living with spouse, not living with spouse) and private health insurance (no, yes).

Health status: The second set of independent variables dealt with health status, including subjective (perceived health and body image) and objective health status (activity limitation, hypertension, diabetes, high levels of triglycerides and obesity). The following questions were used: "In general, how would you rate your health?" and "In general, how would you rate your body image?". In terms of health status, responses were divided into "good" (excellent/good), "moderate" (fair) and "bad" (poor/very poor). With regard to body image, responses were categorised into thin, moderate and obese. In terms of objective health, the presence of the following conditions was examined and coded as "present" or "absent": activity limitations, hypertension, diabetes, high levels of triglycerides and obesity.

Health-related behaviours and other factors: The third dimension involved the following health-related behaviours: Alcohol consumption (no, yes), smoking (no, yes), exercises (no, yes), daily activity level (low, average, intense), attempts at weight control during the past year (no, yes), eating patterns at regular meals (eating enough, eating a limited variety of foods, insufficient) and having knowledge about nutrients.

Analysis: Descriptive statistics were calculated and multiple logistic regression analysis was performed to explore the factors associated with the use of vitamins, using the SPSS software (version 21.0). All analyses relied on the pooled weights of sampling clusters to yield statistics that were representative of the Korean adult population. The results are presented as weighted percentages and as Odds Ratios (ORs) with Confidence Intervals (CIs). The χ^2 -tests were performed to examine differences in the prevalence of using vitamins by participant characteristics according to age group.

RESULTS

Socioeconomic factors associated with using vitamins:

About half of the total sample were male and 20-44 years of age. A total of 41.2% of all respondents used vitamins, 38.1% for 20-44 years, 46.5% for 45-64 years and 38.8% for 65 years and older. The use of vitamins significantly differed by all other socioeconomic factors, health behaviours and several health-status variables independent of age (Table 1).

In terms of socioeconomic factors, users of vitamins who were 20-44 years of age were more likely to be female (46.0%), not live with a spouse (42.2%), earn a high income (45.3) have college education or higher (42.7%), be employed as office workers (41.5%) and have private health insurance (38.2%). Non-users in this age group were more likely to be male (69.5%), live with a spouse (67.8%) have a low income (66.4%), be a high school graduate (70.6%), work as a physical labourer (75.1%) and have non-private health insurance (63.4%). Other age groups showed similar patterns (Table 1).

Subjective and objective health status associated with use of vitamins:

With regard to health status, the users of vitamins who were 20-44 years of age were more likely to perceive their health as bad (43.9%), not be obese (33.5%) and not have high levels of triglycerides (39.6%). Users in the 45-64 year old group were more likely to view their body as obese (50.2%) have no limitations on their activities (47.5%) and not have high levels of triglycerides (49.4%). However, users who were at least 65 years of age differed significantly from non-users only with regard to body image (Table 1).

Health behaviours associated with use of vitamins:

Regarding health behaviours associated with use of vitamins by age, use was most prevalent among those who did not drink alcohol, smoke or perform exercises and those who had average activity levels had attempted to control their weight, ate appropriately and had knowledge about nutrition,

among those aged 20-44 and 45-64 years. Among those aged at least 65 years, users of vitamins did not differ from non-users in terms of alcohol consumption and smoking (Table 1).

Odds ratios and 95% confidence intervals of vitamin intake by age group:

After adjusting for all independent variables, multiple logistic regressions showed that the factors associated with the use of vitamins differed significantly by age. Among those 20-44 years of age, the use of vitamins differed according to many socioeconomic, health-status and behavioural factors. However, use of vitamins differed primarily according to socioeconomic factors among those 45-64 years of age. Among those at least 65 years of age, the use of vitamins differed only according to participation in exercises (Table 2).

Of those 20-44 years of age, women were 1.38 times (95% CI: 1.07-1.77) more likely than men and those with a high income were more than 1.38 times (95% CI: 1.03-1.74) more likely than those with a low income to use vitamins. Participants who assessed their health as "bad" were more likely to use vitamins than were those who assessed it as "good/moderate" and those who perceived themselves as "thin" were more likely to take vitamins than were those who perceived themselves as "moderate." Moreover, people who were not obese were 1.49 times (95% CI: 1.13-1.95) more likely to use vitamins compared with the obese group. Respondents who did not consume alcohol were 1.40 times (95% CI: 1.13-1.72) more likely to use vitamins than those who did and smokers were 1.34 times (95% CI: 1.04-1.74) more likely than were non-smokers to use vitamins. Additionally, most participants who regularly engaged in exercises and tried to control their weight were more likely to use vitamins compared with who did not engage in exercises or not try to control their weight. However, those who ate enough or who ate limited varieties of food were 3.49 times (95% CI: 1.34-9.10) more likely and 3.53 times (95% CI: 1.36-9.17), respectively to take vitamins compared with the insufficient eating group.

The socioeconomic factors associated with the use of vitamins among those 45-64 years old were similar to those associated with such use among those aged 20-44 years. However, among those with private health insurance were 1.37 times (95% CI: 1.10-1.85) more likely than those with non-private health insurance to take vitamins. Only one factor was related to using vitamins among those at least 65 years of age: respondents in this age group who participated in exercises on a weekly basis were 1.76 times (95% CI: 1.23-2.52) more likely to take vitamins than were those who did not.

Table 1: Characteristics of the study population by vitamin use and age groups n (Percentage among age groups)

Characteristics	Vitamin use (n = 2,437, 41.2%)					No vitamin use (n = 3,478, 59.8%)					Total (n = 5,915)	
	20-44	45-64	Over 65	20-44	45-64	Over 65	20-44	45-64	Over 65			
Socioeconomic factors												
Sex (n = 5,915)	1,130 (38.1)	978 (46.5)	329 (38.8)	1,837 (61.9)	1,122 (53.5)	519 (61.2)	2,967 (50.2)	2,101 (35.5)	847 (14.3)			
Male	466 (30.5)	392 (37.4)	135 (38.5)	1,057 (69.5)	656 (62.6)	215 (61.5)	1,523 (51.3)	1,048 (49.9)	350 (41.3)			
Female	665 (46.0)	586 (55.7)	194 (39.0)	780 (54.0)	466 (43.3)	303 (61.0)	1,445 (48.7)	1,052 (50.1)	497 (58.7)			p = 0.475
Marriage (n = 5,916)												
Living with spouse	391 (32.2)	110 (46.2)	115 (38.7)	824 (67.8)	128 (53.8)	182 (61.3)	1,215 (41.0)	238 (11.3)	297 (35.0)			
Not living with spouse	739 (42.2)	868 (46.6)	214 (38.8)	1,103 (57.8)	995 (53.4)	337 (61.2)	1,752 (59.0)	1,863 (88.7)	551 (65.0)			p = 0.517
Income level (n = 5,869)												
Low	242 (33.6)	191 (35.6)	70 (30.8)	479 (66.4)	345 (64.4)	157 (69.2)	721 (24.5)	536 (25.7)	227 (27.1)			
Middle low	290 (37.4)	253 (46.3)	78 (34.3)	486 (62.6)	294 (53.7)	149 (65.7)	776 (26.3)	547 (26.3)	227 (27.1)			
Middle high	285 (37.2)	244 (46.2)	89 (42.6)	481 (62.8)	284 (53.8)	120 (57.4)	766 (26.0)	528 (25.3)	209 (24.9)			
High	310 (45.3)	277 (58.7)	87 (49.4)	374 (54.7)	195 (41.3)	89 (50.6)	684 (23.2)	472 (22.7)	176 (21.0)			
Education (n = 5,918)												
Middle school or less	23 (30.7)	344 (39.3)	260 (42.1)	52 (69.3)	531 (60.7)	429 (57.9)	75 (2.5)	875 (41.7)	689 (81.4)			
High school	285 (29.4)	358 (49.2)	42 (40.4)	684 (70.6)	369 (50.8)	62 (59.6)	969 (32.7)	727 (34.5)	104 (12.3)			
College or more	821 (42.7)	276 (55.4)	26 (49.0)	1,101 (57.3)	222 (54.6)	27 (51.0)	1,922 (64.8)	498 (23.7)	53 (6.3)			p = 0.248
Occupation (n = 5,912)												
Office work	588 (41.5)	374 (54.8)	17 (40.5)	830 (58.5)	308 (45.2)	25 (59.5)	1,418 (47.8)	682 (32.5)	42 (5.0)			
Farmer or fisher	100 (25.7)	185 (18.9)	50 (30.7)	289 (74.3)	384 (67.5)	113 (69.3)	389 (13.1)	569 (27.1)	163 (19.2)			
Physical labor	45 (24.9)	111 (42.0)	40 (35.4)	136 (75.1)	153 (58.0)	73 (64.6)	181 (6.1)	264 (12.6)	113 (13.3)			
Students/ housewife/unemployed	396 (40.6)	309 (52.7)	221 (41.8)	580 (59.4)	277 (47.3)	308 (58.2)	976 (32.9)	586 (27.9)	529 (62.5)			
Private health insurance (n = 5,850)												
No	157 (36.6)	130 (30.3)	231 (36.0)	272 (63.4)	263 (69.7)	410 (64.0)	429 (14.6)	393 (18.9)	641 (77.0)			
Yes	959 (38.2)	836 (49.6)	91 (47.6)	1,550 (61.8)	851 (50.4)	100 (52.4)	2,509 (85.4)	1,687 (81.1)	191 (23.0)			
Subjective and objective health status												
Perceived health (n = 5,916)												
Good	411 (35.7)	356 (48.4)	84 (38.2)	742 (64.3)	380 (51.6)	136 (61.8)	1,153 (38.9)	736 (35.0)	220 (25.9)			
Moderate	578 (38.7)	454 (46.0)	139 (40.5)	915 (61.3)	533 (54.0)	204 (59.5)	1,493 (50.3)	987 (47.0)	343 (40.4)			
Bad	141 (43.9)	168 (44.4)	179 (62.8)	180 (66.1)	210 (55.6)	179 (37.2)	321 (10.8)	378 (18.0)	285 (33.6)			
Body image (n = 5,915)												
Thin	211 (39.7)	130 (41.0)	74 (31.5)	321 (60.3)	187 (59.0)	161 (68.5)	532 (17.9)	317 (15.1)	235 (27.7)			
Moderate	383 (36.9)	377 (44.7)	157 (40.2)	655 (63.1)	466 (55.3)	233 (59.8)	1,038 (35.0)	843 (40.1)	390 (46.0)			
Obese	536 (38.4)	472 (50.2)	98 (44.1)	861 (61.6)	469 (49.8)	124 (55.9)	1,397 (47.1)	941 (44.8)	222 (26.2)			
Activity limitation (n = 5,916)												
Absent	1,098 (38.4)	888 (47.5)	253 (39.5)	1,761 (61.6)	981 (52.5)	387 (60.5)	2,859 (96.4)	1,869 (89.0)	640 (75.5)			
Present	32 (29.6)	90 (38.8)	76 (36.5)	76 (70.4)	142 (61.2)	132 (63.5)	108 (3.6)	232 (11.0)	208 (24.5)			
Hypertension (n = 5,916)												
Absent	1,098 (38.1)	756 (46.6)	138 (38.7)	1,781 (61.9)	867 (53.4)	219 (61.3)	2,879 (97.0)	1,623 (77.2)	357 (42.1)			
Present	32 (40.0)	222 (46.4)	191 (39.0)	57 (60.0)	256 (53.6)	299 (61.0)	89 (3.0)	478 (22.8)	490 (57.9)			
Diabetes (n = 5,914)												
Absent	1,119 (38.2)	893 (47.1)	272 (40.0)	1,811 (61.8)	1,003 (52.9)	408 (60.0)	2,930 (98.8)	1,896 (90.2)	680 (80.4)			
Present	11 (29.7)	86 (42.0)	56 (33.7)	26 (70.3)	119 (58.0)	110 (66.3)	37 (1.2)	205 (9.8)	166 (19.6)			
												p = 0.155

Table 1: Continue

Characteristics	Vitamin use (n = 2,437, 41.2%)					No vitamin use (n = 3,478, 59.8%)					Total (n = 5,915)		
	20-44	45-64	Over 65	20-44	45-64	Over 65	20-44	45-64	Over 65	20-44	45-64	Over 65	
Obesity (n = 5,914)	Absent	1,130 (38.1)	978 (46.5)	329 (38.8)	1,837 (61.9)	1,122 (53.5)	519 (61.2)	2,967 (50.2)	2,038 (69.3)	1,336 (63.8)	847 (14.3)		
	Present	683 (33.5)	590 (44.2)	200 (34.7)	1,375 (66.5)	746 (55.8)	376 (65.3)	2,068 (69.8)	903 (30.7)	757 (36.2)	576 (68.1)		
High triglyceride (n = 5,914)	Absent	781 (39.6)	651 (49.4)	220 (38.0)	1,187 (60.4)	666 (50.6)	359 (62.0)	1,968 (88.6)	p = 0.012	p = 0.142	p = 0.250		
	Present	82 (32.5)	125 (38.6)	46 (39.0)	170 (67.5)	199 (61.4)	72 (61.0)	252 (11.4)	1,317 (80.3)	324 (19.7)	579 (83.1)		
Alcohol drinking (n = 5,894)	No	410 (43.0)	502 (52.9)	209 (37.1)	544 (56.0)	447 (47.1)	354 (62.9)	2,002 (67.7)	p = 0.016	p = 0.000	p = 0.459		
	Yes	716 (35.8)	470 (41.2)	120 (42.1)	1,286 (64.2)	672 (68.8)	165 (57.9)	954 (32.3)	949 (45.4)	1,141 (54.6)	563 (66.4)		
Smoking (n = 5,914)	No	853 (41.2)	820 (51.2)	293 (39.7)	1,215 (58.8)	783 (48.8)	445 (60.3)	2,068 (69.8)	p = 0.000	p = 0.000	p = 0.179		
	Yes	275 (30.7)	159 (31.9)	36 (32.7)	621 (59.3)	340 (68.1)	74 (67.3)	896 (30.2)	2,002 (67.7)	499 (23.7)	738 (87.0)		
Flexibility exercises (n = 5,916)	No	682 (49.4)	350 (40.7)	167 (33.2)	931 (50.6)	510 (59.3)	336 (66.8)	1,379 (46.5)	p = 0.000	p = 0.000	p = 0.174		
	Yes	448 (28.2)	628 (50.6)	162 (47.1)	906 (71.8)	612 (49.4)	182 (52.9)	1,588 (53.5)	860 (41.0)	1,240 (59.0)	503 (59.4)		
Daily activity level (n = 5,912)	Low	511 (31.5)	447 (46.8)	170 (37.2)	1,109 (68.5)	509 (53.2)	287 (62.8)	1,620 (54.6)	p = 0.000	p = 0.000	p = 0.000		
	Average	373 (32.9)	381 (43.3)	109 (33.5)	760 (67.1)	498 (56.7)	216 (62.5)	1,133 (38.2)	956 (45.5)	879 (41.9)	457 (54.1)		
	Intense	48 (22.4)	77 (29.1)	24 (38.1)	166 (77.6)	188 (70.9)	39 (61.9)	214 (7.2)	1,240 (59.0)	265 (12.6)	325 (38.5)		
Weight control (n = 5,915)	No	295 (31.2)	304 (38.9)	169 (32.8)	651 (68.8)	478 (61.1)	347 (67.2)	946 (31.9)	p = 0.010	p = 0.000	p = 0.534		
	Yes	835 (41.3)	674 (51.1)	160 (48.3)	1,186 (58.7)	644 (48.9)	171 (51.7)	2,021 (68.1)	782 (37.2)	1,318 (62.8)	516 (60.9)		
Eating patterns (n = 5,916)	Enough eating	569 (40.2)	455 (50.5)	123 (44.6)	845 (59.8)	446 (49.5)	153 (55.4)	1,414 (47.7)	p = 0.000	p = 0.000	p = 0.000		
	Limited on sorts	550 (36.8)	500 (44.1)	189 (36.8)	946 (63.2)	633 (55.9)	325 (63.2)	1,496 (50.4)	901 (42.9)	1,133 (53.9)	276 (32.5)		
	Insufficient eating	11 (19.3)	24 (35.8)	17 (29.3)	46 (80.7)	43 (64.2)	41 (70.7)	57 (2.0)	1,133 (53.9)	67 (3.2)	514 (60.6)		
Having knowledge of nutrient (n = 5,914)	No	92 (29.0)	331 (39.3)	255 (36.7)	225 (71.0)	511 (60.7)	440 (63.3)	317 (10.7)	p = 0.001	p = 0.009	p = 0.071		
	Yes	1,039 (39.2)	644 (51.3)	74 (48.7)	1,613 (60.8)	612 (48.7)	78 (51.3)	2,652 (89.3)	842 (40.1)	1,256 (59.9)	695 (82.1)		
									p = 0.000	p = 0.000	p = 0.008		

Table 2: Vitamin use by age groups in multiple logistic regression analysis: odds ratios and 95% CIs

Characteristics			20-44 years	45-64 years	Over 65 years
Socioeconomic factor	Sex (male = 1)	Female	1.38 (1.07-1.77)*	1.61 (1.202.16)*	1.51 (0.95-2.40)
	Education (middle school = 1)	High school	0.51 (0.23-1.12)	1.15 (0.88-1.51)	0.76 (0.43-1.34)
		College or higher	0.92 (0.41-2.03)	1.57 (1.122.21)*	1.21 (0.57-2.54)
		Income level (low = 1)	Middle low	1.01 (0.77-1.34)	1.41 (1.03-1.93)*
		Middle high	0.93 (0.69-1.23)	1.24 (0.89-1.71)	1.52(0.93-2.47)
		High	1.38 (1.03-1.74)*	1.82 (1.29-2.56)*	1.33 (0.79-2.26)
		Occupation (no, students, etc. = 1)	Office	0.92 (0.74-1.15)	1.27 (0.95-1.70)
	Farmer or fisher		0.93 (0.63-1.37)	0.73 (0.52-1.03)	0.79 (0.48-1.31)
	Simple labor		1.23 (0.78-1.96)	0.94 (0.64-1.36)	0.84 (0.50-1.43)
	Marriage (not living with = 1)	Living with spouse	1.82 (1.45-2.28)*	0.82 (0.58-1.16)	0.84 (0.55-1.27)
Private health Insurance (no = 1)		Yes	0.89 (0.67-1.20)	1.37 (1.01-1.85)*	0.99 (0.67-1.49)
Subjective and objective health status	Perceived health (bad = 1)	Good	0.66 (0.47-0.93)*	1.06 (0.75-1.50)	1.01 (0.62-1.67)
		Moderate	0.56 (0.41-0.78)*	0.99 (0.72-1.37)	1.10 (0.71-1.72)
	Body image (thin = 1)	Moderate	0.75 (0.56-0.99)*	1.22 (0.86-1.72)	1.28 (0.83-1.98)
		Obese	1.12 (0.82-1.54)	1.47 (0.99-2.17)	1.20 (0.67-2.13)
	Hypertension (present = 1)	Absent	1.12 (0.63-2.00)	0.98 (0.75-1.28)	1.10 (0.77-1.58)
	Diabetes (present = 1)	Absent	0.97 (0.46-2.04)	0.81 (0.55-1.18)	1.04 (0.67-1.62)
	High triglyceride (present = 1)	Absent	0.92 (0.67-1.26)	1.13 (0.85-1.51)	0.89 (0.57-1.40)
	Activity limitation (absent = 1)	Present	0.59 (0.33-1.07)	0.86 (0.59-1.24)	1.20 (0.77-1.87)
	Obesity (present = 1)	Absent	1.49 (1.13-1.95)*	1.24 (0.94-1.64)	0.97 (0.61-1.53)
	Health behaviors	Alcohol drinking (yes = 1)	No	1.40 (1.13-1.72)*	1.34 (1.06-1.70)*
Smoking (no = 1)		Yes	1.34 (1.04-1.74)*	0.74 (0.54-1.00)	0.86 (0.49-1.51)
Exercises (no = 1)		Yes	1.33 (1.09-1.62)*	1.23 (0.97-1.54)	1.76 (1.23-2.52)*
Daily activity level (low = 1)		Average	1.03 (0.84-1.26)	0.94 (0.74-1.19)	0.95 (0.66-1.38)
		Intense	0.62 (0.36-1.06)	0.80 (0.54-1.19)	1.53 (0.78-3.02)
Weight control experience (no = 1)		Yes	1.65 (1.32-2.07)*	1.09 (0.86-1.38)	1.34 (0.94-2.01)
Eating patterns (insufficient = 1)		Enough	3.49 (1.34-9.10)*	1.94 (0.89-4.21)	1.19 (0.57-2.51)
		Limited on sorts	3.53 (1.36-9.17)*	1.75 (0.82-3.78)	0.95 (0.47-1.91)
Having knowledge of nutrient (no = 1)		Yes	1.24 (0.86-1.79)	1.05 (0.83-1.34)	1.33 (0.85-2.09)

Odds ratios adjusted for all other variables in the model and their 95% CIs, *Significance at p<0.05

DISCUSSION

This study focused on the factors related to the use of vitamins and examined whether and to what extent the influence of such factors differed by age. The results suggested that socioeconomic factors are related to the use among those 20-64 years of age. Besides, the associated factors differed across age groups. However, the presence of chronic diseases was not related to the use of vitamins in any age group. Those aged 20-44 years who usually ate enough were more likely to take vitamins compared with the insufficient eating group. Higher educational level was associated with taking vitamins only among those 44-64 years of age and having a high income had a stronger influence on the use of vitamins among this age group than it did on that of those 20-44 years of age. Among those 65 years of age and older, the only associated factor was regular participation in exercises. Because people in this age group may need more vitamins than young and middle-aged adults do, they should receive relevant guidelines or information.

Paradoxically, those aged 20-44 year who usually ate enough were more likely to use vitamins compared with the

insufficient eating group. This result is consistent with the previous study, who found that those who took vitamins had higher recorded nutrient intake from food sources alone than did those who did not take vitamins¹². Besides, a study in Japan also identified that vitamin use tends to be associated with interest in aspects of Western lifestyle as an intake of energy⁵. This is usually known as the "Inverse supplement hypothesis"⁹. However, this paradox was not observed among other age groups, even among those whose dietary intake was similar to or higher. This result suggests those who most needed to use vitamins were those who were least likely take to them. Thus, relevant guidelines should be emphasised and public health educational efforts should be intensified¹⁰.

Almost all the participants aged 65 or older had low levels of education, which may have affected their use of vitamins. Higher educational level was strong related to the use of vitamins, but this relationship was observed only among those 45-64 years of age in the present study³. Moreover, education was not among the many factors that influenced the use of vitamins among those 20-44 years of age. The use of multivitamin supplements was associated with the characteristics of a healthy lifestyle¹³ and dietary

supplement intake was also associated with physical activity¹⁴. The current emphasis on well-being among young adults may influence their consumption of vitamins regardless of their educational level. The popularity of this trend among this cohort and their greater receptivity may render the influence of education weaker than it is among those 45-64 years of age. Additionally, having private health insurance may reflect the health-related concerns of those aged 45-64 years. Indeed, the mean age of applicants for private health insurance was about 50 years and that these applicants usually expressed considerable concern about their health¹⁵. Specifically, the use of vitamins is associated with healthy lifestyles and concern about one's health and these factors may be an indicator of engagement in healthy behaviours¹⁵.

Only one factor was significantly associated with the use among elderly individuals. However, it is important to note that the rate at which elderly individuals used vitamins was similar that for those aged 20-44 years despite the fact that the need for such products should be higher among the former group. Elderly individuals tended to obtain vitamins for reasons related to aging (consuming lower levels of nutrients, difficulties with eating). Moreover, vitamins are a very popular gift in Korea and children frequently give vitamins to their parents as a sign of respect or as a means of celebrating their parents' birthdays, parents' day, national holidays and visits to their parents' home. Thus, the use of vitamins among elderly individuals is related to several factors. Widespread and comprehensive education should be directed at this age group because older adults may benefit more from specific supplements. Additionally, elderly individuals who engaged in regular exercises on a weekly basis were 1.76 times more likely to take supplements than were those who did not regardless of socioeconomic and health status. Thus, participation in exercises reflected concern about health among elderly individuals in all subgroups.

The relationships of smoking with vitamins use was opposite that between alcohol consumption and supplement use. Smokers were likely to use multivitamins to compensate for the loss of nutrients through smoking because smoking increases oxidants and vitamins provide antioxidants, which are known for their anti-aging properties¹⁶. Thus, smokers should take more vitamins¹⁶. A study about the use of vitamins among women found that those who did not consume alcohol and those who smoked were more likely to take vitamins⁹. These relationships should be explored further in future prospective studies. In contrast, some studies indicated that former smokers tended to use vitamins more than current

smokers¹⁷ and dietary supplement users were less likely to smoke^{18,19}. Patterns of dietary supplement use differed by type of drinks consumed¹⁷ and dietary supplement use has been reported to be linked to higher alcohol consumption¹⁹, obesity and young age^{7,20}.

In females, a lower BMI, participation in physical activity and non-manual social class were associated with the use of vitamins²¹. A study of the use of vitamins in the US found that being female and a having higher level of education were associated with the use³. Those in the high socioeconomic class used vitamins more and certain socioeconomic factors and lifestyle factors were necessary for preventive nutrition²². Additionally, some studies have found that multivitamins may reduce the risk for chronic diseases, especially cancers²³, but a study reported that vitamins did not have a beneficial effect on almost any chronic disease²⁴. Recent studies have described inconsistencies in the benefits of vitamins for chronic diseases^{8,24}. Besides, there was no difference in morbidity between the supplement groups in either older males or females²⁵. Our study found no relationship between using vitamins and chronic diseases. If the main purpose of the use of multivitamin supplements by the general adult population involves the primary prevention of diseases, it should be known that these supplements may not be helpful with regard to chronic conditions. However, this study used a cross-sectional design, examined only several chronic diseases and did not analyse the data according to type of vitamin. Thus, further studies in this domain are warranted.

Before discussing the factors related to taking vitamins, we will address the effectiveness of and possibility of a harmful effect on the body resulting from the use vitamins²⁶. The study about dietary supplement use for weight loss in obese adults, showed that both the dietary supplement group and the placebo group increased their self-efficacy, even though the mechanisms of the placebo effects were fully identified²⁷. Indeed, dietary supplement use in lower-income adults had barriers of knowledge, income, accessibility, health and preferences²⁸. If people used vitamins despite their having appropriate eating habits, vitamins may be useless or lead to the inefficient absorption and use of nutrients from foods. Additionally, when people consume large amounts of vitamins from two or more sources simultaneously, micronutrients may be overused and vitamins may build up. Nutrient-related education and effective guidelines targeted at specific groups of users should be provided to ameliorate these problems. When used according to such guidelines by social marketing, vitamins can be very helpful²⁹.

This study has several limitations. First, we did not identify the kinds of nutrients used by participants. Data was not gathered regarding the kinds of vitamins used by subjects, because more than 70% of Koreans usually take vitamins and mineral supplements and they refer to these in a generic manner⁶. Thus, respondents generally answered with a simple “yes” or “no” to the question about the use of these products. Nevertheless, information about the characteristics of those who use vitamins should be helpful, especially our data regarding the factors related to vitamin use among different age groups in a nationally representative sample. Second, we could not discuss the effectiveness of vitamins for specific symptoms or dietary insufficiencies. Additional studies should examine the effect of vitamins on health, including the frequency of use and the prevalence of different effects.

CONCLUSION

Adults 20-44 years of age require additional and more specific interventions related to nutrient intake, because those in this age group tended to consume vitamins even though they usually ate enough, which could lead to intoxication or harmful somatic effects. Additionally, older people also require guidelines for making rational choices regarding increased needs of dietary supplements use. We must strengthen nutrition-related education and guidelines about eating appropriately directed at the public. It should be also needed to design and publicize an effective nutrition-related educational program for those who are interested in learning more about this important topic.

SIGNIFICANT STATEMENTS

- This study focused on the factors related to the use of vitamins and examined whether and to what extent the influence of socioeconomic status, health status and/or health behaviours differed by age
- Socioeconomic factors are related to the use among those 20-64 years of age and the associated factors differed across age groups. Higher educational level was associated with taking vitamins only among those 44-64 years of age and having a high income had a stronger influence on the use of vitamins among this age group
- The presence of chronic diseases was not related to the use of vitamins in any age group
- Those aged 20-44 years who usually ate enough were more likely to take vitamins compared with the insufficient eating group

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REFERENCES

1. Murphy, S.P., K.K. White, S.Y. Park and S. Sharma, 2007. Multivitamin-multimineral supplements' effect on total nutrient intake. *Am. J. Clin. Nutr.*, 85: 280S-284S.
2. KMHW., 2012. The 2nd wave plan for the development of Korean oriental medicine. Korean Ministry of Health and Welfare (KMHW), February 3, 2012.
3. Rock, C.L., 2007. Multivitamin-multimineral supplements: Who uses them? *Am. J. Clin. Nutr.*, 85: 277S-279S.
4. Bailey, R.L., J.J. Gahche, C.V. Lentino, J.T. Dwyer and J.S. Engel *et al.*, 2010. Dietary supplement use in the United States, 2003-2006. *J. Nutr.* 10.3945/jn.110.133025
5. Ishihara, J., T. Sobue, S. Yamamoto, S. Sasaki and S. Tsugane, 2003. Demographics, lifestyles, health characteristics and dietary intake among dietary supplement users in Japan. *Int. J. Epidemiol.*, 32: 546-553.
6. Ock, S.M., S.S. Hwang, J.S. Lee, C.H. Song and C.M. Ock, 2010. Dietary supplement use by South Korean adults: Data from the national complementary and alternative medicine use survey (NCAMUS) in 2006. *Nutr. Res. Practice*, 4: 69-74.
7. Radimer, K.L., A.F. Subar and F.E. Thompson, 2000. Nonvitamin, nonmineral dietary supplements: Issues and findings from NHANES III. *J. Am. Dietetic Assoc.*, 100: 447-454.
8. Hoggatt, K.J., 2003. Commentary: Vitamin supplement use and confounding by lifestyle. *Int. J. Epidemiol.*, 32: 553-555.
9. Kirk, S.F., J.E. Cade, J.H. Barrett and M. Conner, 1999. Diet and lifestyle characteristics associated with dietary supplement use in women. *Public Health Nutr.*, 2: 69-73.
10. Sien, Y.P., N. Sahril, M.H.A. Mutalip, N.A.M. Zaki and S.A. Ghaffar, 2014. Determinants of dietary supplements use among adolescents in Malaysia. *Asia-Pacific J. Public Health*, 26: 36S-43S.
11. KMHW and KCDCP, 2012. Guidelines for using raw data of the Korean National Health and Nutrition Examination Survey, the first and second survey of the fifth phase. Korean Ministry of Health and Welfare (KMHW), Korea Center for Disease Control and Prevention (KCDCP).
12. Gregory, J., K. Foster, H. Tyler and M. Wiseman, 1990. *The Dietary and Nutritional Survey of British Adults*. HMSO Publications Centre, USA.
13. Mullie, P., P. Clarys, M. Hulens and G. Vansant, 2011. Socioeconomic, health and dietary determinants of multivitamin supplements use in Belgium. *Int. J. Public Health*, 56: 289-294.

14. George, G.C., D.M. Hoelscher, T.A. Nicklas and S.H. Kelder, 2009. Diet-and body size-related attitudes and behaviors associated with vitamin supplement use in a representative sample of fourth-grade students in Texas. *J. Nutr. Educ. Behav.*, 41: 95-102.
15. Lee, H.B. and K.R. Hyun, 2011. A study of the characteristics and factors of private health insurers. *Korean Soc. Secur. Stud.*, 27: 217-240.
16. Rautiainen, S., L. Wang, J.M. Gaziano and H.D. Sesso, 2014. Who uses multivitamins? A cross-sectional study in the physicians' health study. *Eur. J. Nutr.*, 53: 1065-1072.
17. Radimer, K., B. Bindewald, J. Hughes, B. Ervin, C. Swanson and M.F. Picciano, 2004. Dietary supplement use by US adults: Data from the national health and nutrition examination survey, 1999-2000. *Am. J. Epidemiol.*, 160: 339-349.
18. Brownie, S., 2005. Characteristics of older dietary supplement users: Review of the literature. *Aust. J. Ageing*, 24: 77-87.
19. Smith, C., N.C. Wilson and W.R. Parnell, 2005. Dietary supplements: Characteristics of supplement users in New Zealand. *Nutr. Dietetics*, 62: 123-129.
20. Dorant, E., P.A. Van den Brandt, A.M. Hamstra, M.H. Feenstra, R.A. Goldbohm, R.J. Hermus and F. Sturmans, 1993. The use of vitamins, minerals and other dietary supplements in The Netherlands. *Int. J. Vitamin Nutr. Res.*, 63: 4-10.
21. McNaughton, S.A., G.D. Mishra, A.A. Paul, C.J. Prynne and M.E. Wadsworth, 2005. Supplement use is associated with health status and health-related behaviors in the 1946 British birth cohort. *J. Nutr.*, 135: 1782-1789.
22. Hulshof, K.F., M.R. Lowik, F.J. Kok, M. Wedel, H.A. Brants, R.J. Hermus and F. Ten Hoor, 1991. Diet and other life-style factors in high and low socio-economic groups (Dutch nutrition surveillance system). *Eur. J. Clin. Nutr.*, 45: 441-450.
23. Earnest, C., K.H. Cooper, A. Marks and T.L. Mitchell, 2002. Efficacy of a complex multivitamin supplement. *Nutrition*, 18: 738-742.
24. Huang, H.Y., B. Caballero, S. Chang, A.J. Alberg and R.D. Semba *et al.*, 2006. The efficacy and safety of multivitamin and mineral supplement use to prevent cancer and chronic disease in adults: A systematic review for a National Institutes of Health state-of-the-science conference. *Ann. Internal Med.*, 145: 372-385.
25. Denison, H.J., K.A. Jameson, H.E. Syddall, E.M. Dennison, C. Cooper, A.A. Sayer and S.M. Robinson, 2012. Patterns of dietary supplement use among older men and women in the UK: Findings from the hertfordshire cohort study. *J. Nutr. Health Aging*, 16: 307-311.
26. Van der Horst, K. and M. Siegrist, 2011. Vitamin and mineral supplement users. Do they have healthy or unhealthy dietary behaviours? *Appetite*, 57: 758-764.
27. Tippens, K.M., J.Q. Purnell, W.L. Gregory, E. Connelly, D. Hanes, B. Oken and C. Calabrese, 2014. Expectancy, self-efficacy and placebo effect of a sham supplement for weight loss in obese adults. *J. Evidence-Based Complementary Alternat. Med.*, 19: 181-188.
28. Whiting, S.J., H. Vatanparast, J.G. Taylor and J.L. Adolphe, 2010. Barriers to healthful eating and supplement use in lower-income adults. *Can. J. Dietetic Practice Res.*, 71: 70-76.
29. Warnick, E., K.A. Dearden, S. Slater, B. Butron, C.F. Lanata and S.L. Huffman, 2004. Social marketing improved the use of multivitamin and mineral supplements among resource-poor women in Bolivia. *J. Nutr. Educ. Behav.*, 36: 290-297.