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Relationship between Calcium or Vitamin C Supplement Use and Blood Pressure in Japanese Elderly People: Results from the National Health and Nutrition Survey, 2003-2010

Research Article

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Abstract

A higher intake of calcium or vitamin C has been associated with reductions in blood pressure (BP). However, the relationship between calcium or vitamin C supplement use and BP has not yet been confirmed. We herein investigated this relationship in elderly Japanese people. Data from the National Health and Nutrition Survey in Japan, 2003-2010 were used. Systolic/Diastolic BP (SBP/DBP) was compared by the usage of calcium or vitamin C supplements separately for antihypertensive medication use. Linear regression models were adjusted for sex, age, antiarrhythmic medication, drinking habits, smoking status, exercise habits, body mass index (BMI), sodium intake, and potassium intake. A total of 17067 people aged 60 years or older were included, among whom 40.4% took antihypertensive medication. Calcium or vitamin C supplement use did not correlate with SBP/DBP. On the other hand, non-drinkers and those with a lower BMI had a lower BP. These results indicated that the intake of calcium or vitamin C supplements was not involved in the regulation of BP. The results of the present study suggest that improving dietary habits is more effective as a public health measure than using dietary supplements.

Keywords: Blood pressure; Calcium/vitamin C supplements; Elderly people; National Health and Nutrition Survey in Japan

Introduction

Blood pressure (BP) control is an important public health issue because hypertension is one of the risk factors for cardiovascular disease [1-3]. Japan is the most rapidly aging country in the world, and the marked increase in medical expenses has become a significant problem. A report by the Estimates of National Medical Care Expenditure 2012 in Japan showed that hypertensive treatments accounted for approximately 5% of medical expenses, and most patients with hypertension were elderly [4].

The intake of food with health-promoting effects is increasingly being used as a countermeasure against hypertension, and concerted efforts have been made to reduce medical costs through the utilization of various forms of dietary supplements such as tablets, capsules, and powders. Dietary supplements contain not only vitamins and minerals, but also herbs, botanicals, enzymes, and animal extracts. Dietary supplement use is prevalent, with elderly people using supplements to prevent various diseases [5]. However, evidence in support of the efficacy and safety of non-vitamin/mineral supplements enriched with specific components such as natural

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substances is limited, and, as such, further studies are warranted. On the other hand, vitamins and minerals are essential nutrients that our body needs in small amounts to work properly, and evidence of their safety is well established. Therefore, if people take dietary supplements, vitamin/mineral supplements would be safer than natural products.

Calcium or vitamin C are known to play a role in the regulation of BP; an inverse relationship was previously reported between the dietary intake of or supplementation with calcium and/or vitamin C and BP in cross-sectional studies [6-8], randomized controlled trials [9,10] and meta-analyses[11-13]. Calcium and vitamin C supplements are popular with elderly Japanese people because of their bone health-promoting and antioxidant effects. If these supplements actually contribute to reductions in BP, they may help reduce medical care expenditure. Therefore, it is considered important to determine whether calcium and vitamin C supplements are effective tools for the prevention of hypertension. Previous studies on calcium or vitamin C dietary and supplemental intake by the Japanese population have been limited in their comprehensiveness because they were only regional [7,10]. Furthermore, to the best of our knowledge, a national survey report has not yet been conducted on the association with calcium or vitamin C supplement use and BP.

In the present study, we examined the relationship between the use of calcium or vitamin C supplements and BP among elderly people based on data from the National Health and Nutrition Survey (NHNS) in Japan 2003-2010.

Methods

Study population

The present study used NHNS data between 2003 and 2010 with permission from the Ministry of Health, Labour and Welfare, Japan. The NHNS is conducted every November as a cross-sectional survey of a nationally representative sample of the non-institutionalized Japanese population; it includes a physical examination, dietary survey, and questionnaires on health-related behaviors [14]. Details of the NHNS study protocol, data collection design, and other documentation are available online (in Japanese) [14-21]. The quality assurance of data processing has been described elsewhere [22]. The sample included 26670 elderly people aged 60 years or older. We excluded participants whose data on dietary supplement use, BP, and antihypertensive medication were unreported. The final sample size for analyses was 17067 elderly people.

Sociodemographic and Health Status

In the NHNS, sociodemographic and health status data were obtained by questionnaires. Sociodemographic items included sex (men/women) and age. Health status included current medication (antihypertensive and antiarrhythmic drugs; yes/no), BP, drinking status (current/past, never), smoking habit (current/past, never), and exercise habit (yes/no).

Nutrient and Supplement Intakes

A semi-weighed, 1-day household dietary record with approximate proportions by which family members shared each dish was used [22]. Nutrient intake for each family member was estimated based on the Standard Tables of Food Composition in Japan, Fifth Revised (NHNS 2003-2004), and Fifth Revised and Enlarged Edition (NHNS 2005-2010) [23]. We used calcium (mg/day), vitamin C (mg/day), sodium (mg/day) , and potassium (mg/day) intake data. Calcium and vitamin C intakes from food were calculated as all intake (mg) - intake from dietary supplements (mg).

The intake of dietary supplements containing calcium or vitamin C was also collected using the 1-day dietary record in the NHNS. There is no clear definition of dietary supplements in Japan. Therefore, in the present study, dietary supplements were defined as "supplements, including drugs or quasi-drugs, intended for ingestion in pill, capsule, tablet, powder, or liquid form", as per the NHNS definition [14-21].

Blood pressure

In the NHNS, Systolic/Diastolic BP (SBP/DBP) were measured by health care providers using the Riva-Rocci mercurial sphygmomanometer and Japanese Industrial Standards manchette (BP cuff) instrument. Two measurements were taken and the second measurement was used.

Statistical analysis

All analyses were performed separately for antihypertensive medication use. The sociodemographic status, health status, and nutrition intake (calcium, vitamin C, sodium, and potassium) were compared between supplement users and non-users of calcium or vitamin C supplements. The $\chi 2$ and one-way ANOVA tests were performed for categorical and continuous variables, respectively.

The adjusted mean values of BP by dietary supplement use were calculated by ANCOVA. Mean BP values were unadjusted (Unadjusted) and adjusted for sex and age (Adjusted 1); for sex, age, antiarrhythmic drugs, drinking status, smoking habit, exercise habits, BMI, sodium intake, and potassium intake (Adjusted 2).

Multivariable regression models were used to assess the relationship between calcium or vitamin C supplement use and BP. The confounding variables included were the same as Adjusted 2.

All statistical analyses were performed using PASW statistics for Windows (version 18.0J, 2009; SPSS Inc., Chicago, IL, USA), and the level of significance was set at $p < 0.05$.

Results

Characteristics associated with calcium supplement use

Antihypertensive medication users accounted for 40.4% (n=6898) of the elderly population examined. Among antihypertensive medication non-users, the utilization ratio of calcium supplements was 3.4% (n=350), and their mean calcium intake from foods was 671.5 (SD=283.5) mg/day. Among antihypertensive medication users, 2.9% (n=198) elder people used calcium supplements, and their mean calcium intake from foods was 684.9 (SD=291.1) mg/day. Regardless of the antihypertensive medication use, calcium supplement users were more likely to be female, not taking antiarrhythmic medication, not smoking, than non-users. Calcium supplement users were also more likely to have a higher potassium intake and calcium intake from food, than non-users (Table 1).

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BP and calcium

No significant differences were observed in SBP between calcium supplement users and non-users in Adjusted 2, whereas calcium supplement users had a lower SBP than that of non-users in Unadjusted and Adjusted 1, among antihypertensive medication non-users (Table 2). A multivariate analysis showed that calcium supplement use was not associated with SBP (Table 3).

DBP was not significant associated with calcium supplement use in all analyses (Table 2,3).

Characteristics associated with vitamin C supplement use

The utilization ratio of vitamin C supplements was 4.8% (n=493), and their mean vitamin C intake from foods was 171.6 (SD=129.4) mg/day among antihypertensive medication non-users. Their characteristics were more likely to be female, not smoking, and have more exercise habits, a lower BMI, intake of sodium, and a higher intake of potassium and vitamin C from food, than non-users. Among antihypertensive medication users, 4.0% (n=275) elder people used vitamin C supplements, and their mean vitamin C intake from foods was 153.9 (SD=179.1) mg/day. Their characteristics were more likely to have more exercise habits, and a higher potassium intake than non-users (Table 4).

BP and vitamin C

No significant differences were observed in adjusted mean SBP between vitamin C supplement users and non-users; however, vitamin C supplement users had a lower SBP than non-users in Unadjusted only, among antihypertensive medication non-users (Table 5). Among antihypertensive medication users, there were no significant differences in SBP between vitamin C supplement users and non-users in Adjusted 2, whereas vitamin C supplement users had a lower SBP than that of non-users in Unadjusted and Adjusted 1 (Table 5). A multivariate analysis showed that vitamin C supplement use was not associated with SBP (Table 6).

DBP was not significant associated with vitamin C supplement use in all analyses (Table 5,6).

Discussion

This cross-sectional study of a representative sample of the Japanese population revealed that the use of calcium or vitamin C supplements was not associated with BP reductions among elderly people.

Japan is an aging society, and the marked increase in medical expenses has become a big problem [4]. Concerted efforts have been made to reduce medical costs through the utilization of food with physiological functions. The prevention of hypertension represents a particularly important measure because many elderly people are treated for hypertension [24]. Accumulated evidence has indicated that vitamins and minerals are safer than natural products for use as dietary supplements. Therefore, we herein determined whether calcium and vitamin C supplements, which were previously reported to have an inverse relationship with high BP [6-13] were an effective tool for the prevention of hypertension.

In the elderly people who take antihypertensive medication, the blood pressure is controlled with those medicines and hard to be affected by the food. Therefore, we analyzed the data separately for antihypertensive medication use. Regardless of the antihypertensive medication use, our results showed that calcium or vitamin C supplement use was not associated with BP. Although, some previous

Table 1: Characteristics of the elderly people according to the Ca supplement use.

	Antihypertensive medication non users					Antihypertensive medication users				
	Ca Supplement Non Users (n=9819)		Ca Supplement Users (n=350)		P-values*	Ca Supplement Non Users (n=6700)		Ca Supplement Users (n=198)		P-values*
	n	%	n	%		n	%	n	%	
Sex, Female	5486	55.9	247	70.6	< 0.001	3792	56.6	128	64.6	0.014
Antiarrhythmic medication, Yes	364	3.7	4	1.1	0.004	803	12.0	14	7.1	0.018
Drinking habits, Yes	4072	41.6	130	37.1	0.054	2672	40.1	68	34.3	0.058
Smoking status, Yes	3595	36.8	89	25.4	< 0.001	2349	35.3	55	27.8	0.016
Exercise habits, Yes	3808	38.9	175	50.3	< 0.001	2464	36.9	83	42.1	0.078
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Age	69.4	7.0	69.5	6.5	0.832	72.6	7.4	73.2	6.9	0.244
BMI	22.9	3.1	22.0	3.0	< 0.001	24.2	3.4	23.9	3.4	0.250
Sodium intake (mg/day)	4652.5	1894.8	4505.9	1747.7	0.154	4480.2	1817.2	4533.9	1511.5	0.625
Potassium intake (mg/day)	2717.0	1023.6	2915.0	935.4	< 0.001	2571.8	957.4	2881.5	838.1	< 0.001
All Ca intake (mg/day)	591.1	288.5	851.1	409.3	< 0.001	560.0	277.2	882.6	382.8	< 0.001
Ca intake from foods (mg/day)	591.1	288.5	671.5	283.5	< 0.001	560.0	277.2	684.9	291.1	< 0.001
Abbreviations: BMI, body mass index; Ca, calcium										
*P value from $\chi 2$ test or ANOVA.										

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Table 2: Unadjusted and adjusted mean blood pressure by the calcium supplement use.

	Antihypertensive medication non users					Antihypertensive medication users				
	Ca Supplement Non Users (n=9819)		Ca Supplement Users (n=350)		P-values‡	Ca Supplement Non Users (n=6700)		Ca Supplement Users (n=198)		P-values‡
	Mean	95%CI	Mean	95%CI		Mean	95%CI	Mean	95%CI	
SBP										
Unadjusted	136.3	135.9, 136.7	133.6	131.7, 135.6	0.010	144.0	143.6, 144.4	141.7	139.6, 143.7	0.060
Adjusted 1*	136.3	135.9, 136.7	134.2	132.2, 136.2	0.043	144.0	143.6, 144.4	141.7	139.3, 144.1	0.070
Adjusted 2†	136.3	135.9, 136.6	134.9	133.0, 136.9	0.192	144.0	143.6, 144.5	141.9	139.5, 144.3	0.087
DBP										
Unadjusted	79.9	79.6, 80.1	78.8	77.7, 80.0	0.094	80.2	79.9, 80.5	80.2	78.9, 81.6	0.966
Adjusted 1*	79.8	79.6, 80.1	79.2	78.1, 80.4	0.294	80.2	79.9, 80.5	80.5	79.0, 82.0	0.655
Adjusted 2†	79.8	79.6, 80.0	79.5	78.3, 80.6	0.538	80.2	80.0, 80.5	80.4	78.9, 81.9	0.792
Abbreviations: Ca, calucium; DBP, diastolic blood pressure; SBP, Systolic blood pressure										
*Adjusted 1; sex, age										
†Adjusted 2; sex, age, antiarrhythmic medication, drinking habits, smoking status, BMI, exercise habits, sodium intake, potassium intake										
‡P value from ANCOVA.										

Table 3: Association between blood pressure and calcium supplement use, adjusted the other variables.

	Antihypertensive medication non users			Antihypertensive medication users		
	Mean change	95%CI	P-values*	Mean change	95%CI	P-values*
SBP						
Ca supplement use (Yes)	-1.1	-3.1, 0.9	0.294	-2.0	-4.5, 0.4	0.107
Sex (Female)	-2.5	-3.1, 0.9	< 0.001	-0.7	-1.9, 0.5	0.239
Age (per 10 years)	3.3	2.8, 3.9	< 0.001	0.3	-0.3, 0.8	0.380
Antiarrhythmic medication (Yes)	-5.6	-7.5, -3.6	< 0.001	-2.3	-3.6, -1.0	< 0.001
Drinking habits (Yes)	2.5	1.6, 3.3	< 0.001	0.3	-0.6, 1.3	0.503
Smoking status (Yes)	-0.4	-1.4, 0.6	0.393	0.5	-0.7, 1.6	0.426
Exercise habits (Yes)	-0.9	-1.6, -0.1	0.024	-0.1	-0.9, 0.8	0.887
Sodium intake (per g)	0.0	0.0, 0.1	0.014	0.2	-0.1, 0.5	0.113
Potassium intake (per g)	-1.0	-2.0, -1.0	< 0.001	-0.9	-1.4, -0.4	< 0.001
BMI	1.1	0.9, 1.2	< 0.001	0.2	0.1, 0.3	< 0.001
DBP						
Ca supplement use (Yes)	-0.1	-1.2, 1.1	0.907	0.5	-1.0, 2.0	0.542
Sex (Female)	-2.4	-3.0, -1.9	< 0.001	-1.6	-2.3, -0.9	< 0.001
Age (per 10 years)	-1.8	-2.8, -1.4	< 0.001	-4.4	-4.5, -3.8	< 0.001
Antiarrhythmic medication (Yes)	-4.0	-5.3, -2.9	< 0.001	-2.0	-2.8, -1.2	< 0.001
Drinking habits (Yes)	1.9	1.4, 2.4	< 0.001	1.3	0.7, 1.9	< 0.001
Smoking status (Yes)	-0.5	-1.1, 0.1	0.081	-0.3	-1.0, 0.4	0.438
Exercise habits (Yes)	-0.1	-0.5, -0.4	< 0.001	-0.2	-0.8, 0.3	0.372
Sodium intake (per g)	0.0	0.0, 0.0	0.806	-0.1	-0.2, 0.1	0.370
Potassium intake (per g)	0.0	0.0, 0.0	0.324	0.1	-0.2,0.5	0.361
BMI	0.7	0.6, 0.7	< 0.001	0.3	0.2, 0.4	< 0.001
Abbreviations: BMI, body mass index; Ca, calucium; DBP, diastolic blood pressure; SBP, systolic blood pressure						
*P value from multiple regression analysis.						

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Table 4: Characteristics of the elderly people according to the usage of vitamin C supplement.

	Antihypertensive medication non users					Antihypertensive medication users				
	Vitamin C Supplement Non Users (n=9676)		Vitamin C Supplement Users (n=493)		P-values*	Vitamin C Supplement Non Users (n=6623)		Vitamin C Supplement Users (n=275)		P-values*
	n	%	n	%		n	%	n	%	
Sex, Female	5389	55.7	344	69.8	< 0.001	3750	56.6	170	61.8	0.050
Antiarrhythmic medication, Yes	353	3.6	15	3.0	0.612	790	11.9	27	9.8	0.166
Drinking habits, Yes	4017	41.6	185	37.7	0.083	2640	40.1	100	36.5	0.128
Smoking status, Yes	3548	36.8	136	27.7	< 0.001	2320	35.3	84	30.7	0.066
Exercise habits, Yes	3757	39.0	226	46.2	< 0.001	2432	36.8	115	42	0.049
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Age	69.4	7.0	69.3	6.5	0.816	72.6	7.4	72.9	7.5	0.500
BMI	22.9	3.1	22.5	3.1	0.003	24.2	3.4	24.1	3.3	0.559
Sodium intake (mg/day)	4650.4	1896.4	4589.4	1760.7	0.005	4477.9	1811.3	4574.1	1755.4	0.388
Potassium intake (mg/day)	2712.6	1018.8	2944.0	1046.6	< 0.001	2570.6	955.0	2824.2	936.6	< 0.001
All vitamin C intake (mg/day)	141.0	104.8	588.7	559.0	< 0.001	132.8	100.6	574.7	627.4	< 0.001
vitamin C intake from foods (mg/day)	141.0	104.8	171.6	129.4	< 0.001	132.8	100.6	153.9	179.1	0.053
Abbreviations: BMI, body mass index										
*P value from $\chi 2$ test or ANOVA.										

Table 5: Unadjusted and adjusted mean blood pressure by the vitamin C supplement use.

	Antihypertensive medication non users					Antihypertensive medication users				
	Vitamin C Supplement Non Users (n=9676)		Vitamin C Supplement Users (n=493)		P-values‡	Vitamin C Supplement Non Users (n=6623)		Vitamin C Supplement Users (n=275)		P-values‡
	Mean	95%CI	Mean	95%CI		Mean	95%CI	Mean	95%CI	
SBP										
Unadjusted	136.3	136.0, 136.7	134.1	132.6, 135.7	0.006	144.0	143.6, 144.4	141.7	140.0, 143.5	0.032
Adjusted 1*	136.3	135.9, 136.7	134.7	133.0, 136.4	0.064	144.0	143.6, 144.4	141.8	139.7, 143.8	0.036
Adjusted 2†	136.3	135.9, 136.6	135.1	133.4, 136.8	0.181	144.1	143.7, 144.5	142.2	140.1, 144.3	0.081
DBP										
Unadjusted	79.9	79.6, 80.1	79.0	78.0, 79.9	0.077	80.2	79.9, 80.5	80.3	79.1, 81.5	0.934
Adjusted 1*	79.8	79.6, 80.1	79.3	78.3, 80.3	0.291	80.2	79.9, 80.5	80.4	79.2, 81.7	0.727
Adjusted 2†	79.8	79.6, 80.0	79.3	78.4, 80.3	0.326	80.2	90.0, 80.5	80.7	79.4, 81.9	0.505
Abbreviations: Ca, calucium; DBP, diastolic blood pressure; SBP, systolic blood pressure										
*Adjusted 1; sex, age										
†Adjusted 2; sex, age, antiarrhythmic medication, drinking habits, smoking status, BMI, exercise habits, sodium intake, potassium intake										
‡P value from ANCOVA.										

study suggested that calcium or vitamin C supplements reduced BP [9-13]. The reasons for this difference currently remain unclear. Calcium or vitamin C supplement users had a lower systolic BP than that of the non-users in the unadjusted analysis. Therefore, we considered the apparent effects of dietary supplements to disappear by adjustments for various factors influencing BP or that the BP-reducing effects of calcium/vitamin C supplements were very few [11,12]. Excessive amounts of vitamin C are immediately flushed out of our body through urination [25-27], suggesting that the influence of supplements was not significant because participants had a sufficient nutrient intake from food. Hence, reductions in BP may not occur with the intake of calcium or vitamin C supplements, especially in those with an adequate nutritional status. Another reason is that this difference may be due to small group size for analysis of calcium

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or vitamin C supplement users.

In antihypertensive medication non-users, non-drinkers, those with a lower BMI, with exercise habits, with lower sodium intake, and higher potassium intake had a lower SBP. Even in antihypertensive medication users, a lower BMI and a higher potassium intake were associated with a lower SBP. Furthermore, non-drinkers and those with a lower BMI had a lower DBP among all groups. These results suggested that improving dietary habits is more effective for controlling BP than the use of dietary supplements.

Previous studies have suggested that calcium supplement use with high dietary calcium intake increases the risk of cardiovascular disease [28-31]. The present study did not show that calcium supplement users had a higher BP than that of non-users. However, the intake of calcium from food was higher by calcium supplement users than by non-users, with a mean amount of 851 or 883 mg/day. These results suggested that elderly people use supplements without needed them, and also that supplement usage may lead to excessive mineral consumption, resulting in adverse effects. Many elderly people make efforts to increase their intake of calcium from their diets in an attempt to prevent osteoporosis; therefore, supplemental calcium may have detrimental effects in these individuals [28-32]. In the case of vitamin C, supplement users took about 420 mg/day of vitamin C from supplements, whereas the recommended dietary allowance is 100 mg/day in Japan [23]. Guidance regarding appropriate intake and decisions for dietary supplement use is necessary.

Elderly people are more likely to use dietary supplements [5,33]. A previous study reported that 46% of elderly Japanese people used dietary supplements [34]. However, calcium or vitamin C supplement users accounted for less than 5% of our study population. The reason for this may have been that many elderly people used supplements with natural substances rather than vitamins and minerals [34]. Since dietary supplements are not drugs, manufacturers cannot claim that the supplements treat or cure diseases in Japan; however, some people use them to treat their disease due to the flood of advertisements implying that supplements are effective for various diseases such as hypertension, diabetes, arthritis, and cancer [35]. Most elderly people visit a hospital to be treated, therefore they are likely to be taken in by such advertisements. Calcium and vitamin C are essential nutrients, and their beneficial effects are well-known. However, their effectiveness for other diseases is controversial as are effects of natural

Table 6: Association between blood pressure and vitamin C supplement use, adjusted the other variables.

	Antihypertensive medication non users			Antihypertensive medication users		
	Mean change	95%CI	P-values*	Mean change	95%CI	P-values*
SBP						
Vitamin C supplement use (Yes)	-1.0	-2.7, 0.7	0.259	-1.9	-4.0, 0.2	0.081
Sex (Female)	-2.5	-3.6, -1.5	< 0.001	-7.0	-1.9, 0.5	0.239
Age (per 10 years)	3.3	2.8, 3.9	< 0.001	0.3	-0.3, 0.8	0.385
Antiarrhythmic medication (Yes)	-5.6	-7.5, -3.6	< 0.001	-2.3	-3.6, -1.0	< 0.001
Drinking habits (Yes)	2.5	1.6, 3.3	< 0.001	0.3	-0.6, 1.3	0.502
Smoking status (Yes)	-0.4	-1.4, 0.6	0.399	0.5	-0.7, 1.6	0.425
Exercise habits (Yes)	-0.9	-1.6, -0.1	0.023	-0.1	-0.9, 0.8	0.895
Sodium intake (per g)	0.3	0.1, 0.5	0.014	0.2	-0.1, 0.5	0.110
Potassium intake (per g)	-1.3	-1.8, -0.9	< 0.001	-0.9	-1.4, -0.4	< 0.001
BMI	1.1	1.0, 1.2	< 0.001	0.2	0.1, 0.3	< 0.001
DBP						
Vitamin C supplement use (Yes)	-0.3	-1.3, 0.7	0.511	0.5	-0.8, 1.8	0.422
Sex (Female)	-2.4	-3.0, -1.9	< 0.001	-1.6	-2.3, -0.9	< 0.001
Age (per 10 years)	-1.8	-2.1, -1.5	< 0.001	-4.1	-4.5, -3.8	< 0.001
Antiarrhythmic medication (Yes)	-4.0	-5.1, -2.9	< 0.001	-2.0	-2.8, -1.2	< 0.001
Drinking habits (Yes)	1.9	1.4, 2.4	< 0.001	1.3	0.7, 1.9	< 0.001
Smoking status (Yes)	-0.5	-1.1, 0.1	0.082	-0.3	-1.0, 0.4	0.438
Exercise habits (Yes)	-0.1	-0.5, 0.4	0.735	-0.2	-0.8, 0.3	0.368
Sodium intake (per g)	0.0	-0.1, 0.1	0.818	-0.1	-0.2, 0.1	0.369
Potassium intake (per g)	-0.1	-0.4, 0.1	0.341	0.1	-0.2, 0.5	0.364
BMI	0.7	0.6, 0.7	< 0.001	0.3	0.2, 0.4	< 0.001
Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure						
*P value from multiple regression analysis.						

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products. Since this is not quoted by the mass media, sufficient information may not be available to elderly people. Therefore, the information system for elderly people who do not use social network services needs to be improved.

The present study had several limitations. First, the NHNS was a cross-sectional survey and did not allow for the determination of causal effects. Second, as the NHNS was a 1-day survey, the intake results of dietary supplements and food may not reflect habitual intake by the individual. There is a doubt that intra-individual variation of dietary supplement users may be larger than that of nonusers, because dietary supplements contain large amounts of specific nutrients. Although, it was reported that almost Japanese dietary supplement users were daily users [36]. Therefore, we thought the methodological limitation of a 1-day survey is unlikely to have largely skewed the results. Furthermore, seasonal variations may also have influenced the results obtained. Nutrient intakes were not exact, but estimated by calculations. Additionally, the brand names of specific dietary supplements were not reported. Thus, the results of the present study need to be interpreted with these limitations in mind.

In conclusion, the present study showed that calcium or vitamin C supplement use did not correlate with SBP/DBP in elderly Japanese people. Additionally, calcium or vitamin C supplement users had a higher intake of calcium or vitamin C from food than that of non-users. The use of calcium or vitamin C supplements is not recommended for the prevention and treatment of hypertension in Japan. Continuous recommendation to improve dietary habits is considered more effective as a public health measure than using dietary supplements.

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