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Dietary Factors Associated with Hyperlipidemia in Korean Postmenopausal Women*

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ABSTRACT

This study was performed to investigate the related dietary factors associated with hypercholesterolemia in postmenopausal Korean women. The study sample comprised 455 postmenopausal women aged 40 ≤ < 65. The hypercholesterolemic (serum cholesterol ≥ 240mg/dl) group (N = 82) showed significantly higher BMI and waist circumference compared to the normal group (N = 373). However, both group did not show any significant difference in energy intake but hypercholesterolemic group demonstrated significantly lower intakes of fat and vitamin A with higher intake of vitamin C. Significant dietary factors associated with the higher risk of hypercholesterolemia included consumption frequencies of light color vegetable more than 3.79times/day (OR = 4.62 ; 95% CI : 2.96 − 7.22), dried squid more than 0.08time/day (OR = 1.63 ; 95% CI : 1.13 − 2.35), and beer more than 0.03time/day (OR = 1.57 ; 95% CI : 1.01 − 2.43). Whereas consumption frequency of yellow and green leafy vegetables more than 1time per day was associated with the significantly lower risk of hypercholesterolemia (OR = 0.06 ; 95 CI : 0.038 − 0.101). (*J Community Nutrition* 7(4) : 193~200, 2005)

KEY WORDS : dietary factors · hypercholesterolemia · postmenopausal women.

Introduction

The prevalence of cardiovascular disease was rapidly increased and became the second leading cause of death in Korea (The Korea National Statistical Office 2004). The mean serum cholesterol level has been increasing (The Ministry of Health and Welfare 1999, 2002) probably as a result of the westernization of Korean life style, such as an increase in the daily consumption of animal fat and protein (The Ministry of Health and Welfare 2002). Elevated serum cholesterol concentration is an independent, but modifiable risk factor for cardiovascular disease (Assmann et al. 1998).

Menopause is the permanent cessation of menstruation and fertility (Teoman et al. 2004). A woman who has not menstruated within at least 12 months retrospectively is regarded to have entered the phase of menopause (Vandenakker, Glass 2002). Natural menopause leads to an adverse lipid profile with loss of estrogen, which in turn results in an enhanced risk of coronary artery disease (Torng et al. 2002) in postmenopausal women.

Genetic factors, age, sex, obesity, dietary behavior, blood pressure, fasting blood sugar, stress and smoking were reported to be related to hyperlipidemia (The Expert Panel 1988 ; The Expert Panel 1993). In contrast with the relatively apparent relationship between dietary factors such as fiber, fatty acids, cholesterol or antioxidant intakes and serum cholesterol (Gey et al. 1987 ; Harris 1984 ; Hopkins 1992 ; Miettinen 1987) in western countries, the hypercholesterolemic group in Korea were observed with non significant difference of dietary intakes compared to the normocholesterolemic group except lower consumption frequencies in vegetable origin foods such as cereals, vegetable, mushroom and seaweeds, dietary cholesterol or vitamin E intake (Lee et al. 2001).

Despite the postmenopausal women are at higher risk of hypercholesterolemia, there were few studies suggesting dietary factors associated with hypercholesterolemia. Kim et al. (2000) demonstrated that dietary cholesterol intake of post-

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menopausal hypercholesterolemic women was significant higher than that of normocholesterolemic women. However, mean cholesterol intake of the hypercholesterolemic group was 240mg/day, which can be regarded as much less than that of Americans whose cholesterol intake is estimated as 400 − 500mg/day.

Therefore we determined the anthropometric and dietary factors associated with hypercholesterolemia in postmenopausal women in Korea.

Subjects and Methods

1. Data collection and processing

The data was derived from the 2001 Korean National Health and Nutrition Survey (KNHANS) conducted by the Ministry of Korean Health and Welfare (2001). The survey sample comprised of 37,769 persons (12,183 households) representing the Korean population. The 2001 KNHANS consisted of a four part survey including 1) health interview survey on disease prevalence and health care service utilization 2) health examination survey on 6 major degenerative diseases 3) health behavior survey on smoking, drinking, exercise and sleeping and 4) nutrition and dietary survey. Specially trained interviewers had conducted the health behavior survey on smoking, drinking and food consumption frequencies. For the dietary survey, 24 hour recall method was used. Trained dietitian interviewed subjects at their home. Food portions were converted into weight according to the standard estimators. Nutrient intake was estimated using the food composition table published by the National Rural Living Science Institute.

Adult women aged 40 ≤ < 65 and experienced menopause were of interest in the current research. To minimize potential bias due to special dietary intakes, women in pregnancy, lactation or on a special diet were excluded. The resulting sample included 455 menopausal women. Subjects who showed higher serum cholesterol (≥ 240mg/dl) were categorized into the hypercholesterolemic group (N = 82) and the rest into the normal group (N = 373).

The consumption frequency of each food was calculated based on the frequency per day : 1 point for once a day, 2 points for twice a day, 3 points for three times a day, 0.71 point for 4 − 6 times per week, 0.36 point for 2 − 3 times per week, 0.14 point for one time per week, 0.08 point for 1 time per month and 0 point for 6 − 11 times per year or rarely eaten.

2. Statistical analysis

All values were expressed as group mean ± SD or frequency distribution N(%). Differences between the means of two groups were examined using ANOVA or ANCOVA. Logistic regression analysis were used to estimate the risk of hypercholesterolemia by nutrient intake or food consumption frequencies. All the analyses were done using SAS statistic software. Less than 5% error was considered as statistically significant.

Results and Discussion

1. General characteristics

Higher proportion of the hypercholesterolemic women was observed as widowed or divorced. Educational status, perceived health status, smoking or drinking status were not significantly different between two groups (Table 1). Death of spouse or divorce can cause emotional stress in postmenopausal women, which can evoke depression, or psychological

Table 1. General characteristics of the subjects N (%)

Variable	Normal (N = 373)	Hyper-cholesterolemia (N = 82)	Total	χ^2-value
Marriage status				
Never married	1(0.3)	2(2.4)	3(0.7)	
Married	288(77.2)	58(70.7)	346(76.0)	5.71*
Divorced or widowed	84(22.5)	22(26.8)	106(23.3)	
Total	373	82	455(100.0)	
Education				
≤ Elementary school	230(61.7)	50(61.0)	280(61.5)	
≤ Hight school	122(32.7)	29(35.4)	151(33.2)	0.64
≥ University	21(5.6)	3(3.7)	24(5.3)	
Total	373	82	455(100.0)	
Perceived health status				
Good	99(26.5)	23(28.1)	122(26.8)	
Fair	132(35.4)	23(25.1)	155(34.1)	2.0
Bad	141(37.8)	36(43.9)	177(38.9)	
Total	373	82	455(100.0)	
Smoking status				
No	353(94.6)	75(91.5)	428(94.1)	
Yes	20(5.4)	7(8.5)	27(5.9)	1.21
Total	373	82	455(100.0)	
Alcohol drinking				
No	225(60.3)	45(54.9)	373(82.0)	
Yes	148(39.7)	37(45.1)	82(18.0)	0.83
Total	373	82	455(100.0)	

*: $p<0.05$

disturbances. Hormones secreted more in stressful condition were reported as catabolic hormones and affect on hypertension, cardiovascular disease or diabetes (Kawachi et al. 1994 ; Van Doomen, Orlebeke 1982). Son et al. (2003) also reported stress factor such as depression was a risk factor to increase the proportion of hyperlipidemia in female elderly.

2. Anthropometric measurements and serum lipid profile

Hypercholesterolemic postmenopausal women showed significantly higher weight and BMI (60.3 ± 7.6kg, 25.6 ± 3.1) compared to the normal group (58.2 ± 8.6kg, 24.3 ± 3.3) (Table 2). The significant differences of weight and BMI were maintained after those variables were adjusted with age. Hypercholesterolemic subjects were also observed as having significantly elevated waist and hip circumferences. Many studies reported that obesity is associated with hypercholesterolemia (Eckel 1997 ; Kannel, Gordon 1979 ; Lai, Ng 2004 ; Liu et al. 2004). However, the relationship between BMI and hypercholesterolemia for postmenopausal women were not consistent in the previous studies. Harris et al. (1994) demonstrated that postmenopausal hypercholesterolemic patients showed higher proportion of obesity compared to normocholesterolemic group. Ten percent of increase of weight above the ideal body weight was associated with 12mg increase of serum cholesterol (Kannel 1991).

Table 2. Anthropometric indices and serum lipid profiles

Variable	Normal (N = 373)	Hyper-cholesterolemia (N = 82)	F-value
Age (yr)	56.0 ± 5.6	57.2 ± 5.5	1.74
Weight (kg)	58.2 ± 8.6	60.3 ± 7.6	2.18*
Height (cm)	154.7 ± 5.3	153.6 ± 5.9	1.71*
BMI (kg/m^2)	24.3 ± 3.3	25.6 ± 3.1	3.34**
Waist circumference (cm)	82.6 ± 8.8	85.4 ± 7.7	2.89**
Hip circumference (cm)	94.1 ± 6.4	95.9 ± 5.7	2.51*
WHR	0.90 ± 0.1	0.90 ± 0.1	1.73
Serum cholesterol (mg/dl)	194.2 ± 26.6	256.1 ± 14.4	29.49**
Triglyceride (mg/dl)	145.8 ± 73.7	159.1 ± 75.0	1.46
HDL-cholesterol (mg/dl)	45.8 ± 9.6	53.0 ± 9.4	6.22**
Adjusted with age			
Weight (kg)	58.2 ± 0.4	60.2 ± 1.0	3.76*
Height (cm)	154.7 ± 0.3	154.0 ± 0.6	1.03
BMI (kg/m^2)	24.3 ± 0.2	25.4 ± 0.4	7.39**
Waist circumference (cm)	82.5 ± 0.5	84.6 ± 1.0	3.95*
Hip circumference (cm)	94.1 ± 0.3	95.7 ± 0.7	3.99*
WHR	0.876 ± 0.003	0.883 ± 0.007	1.09
Serum cholesterol (mg/dl)	194.4 ± 1.3	254.1 ± 2.8	364.54**
Triglyceride (mg/dl)	145.3 ± 3.9	155.5 ± 8.3	1.24
HDL-cholesterol (mg/dl)	45.7 ± 0.5	52.8 ± 1.1	

1) Mean ± SD
2) *: $p<0.05$, **: $p<0.01$, ***: $p<0.001$

In Korea it was reported that hypercholesterolemic subjects showed significantly higher BMI (Seo et al. 1999 ; Lee et al. 2001), waist or hip circumference (Seo et al. 1999). However the anthropometric measurements were not adjusted with age even though the hypercholesterolemic subjects showed significantly higher age. According to Cena (2004), serum cholesterol level of hypercholesterolemic subjects showed significant and positive correlation with age, but not with BMI. Kim et al. (1998) also presented that the postmenopausal hypercholesterolemic group did not show any significant difference of BMI compared to the normocholesterolemic group.

It was recently found that waist circumference rather than BMI is more practical and had higher discriminant ability in identifying the presence of hypertension, dyslipidemia and type 2 diabetes (Foucan et al. 2002). Significantly higher serum LDL-cholesterol was also observed with the increased waist circumference, but not with BMI (Seidell 2001). In the present study the hypercholesterolemic group showed elevated BMI and waist circumference concomitantly, health risk seems to be more serious in this group.

3. Nutrient intakes and food consumption frequencies

The hypercholesterolemic group did not show any significant difference in energy intake even with higher BMI and waist circumference (Table 3). The energy intake of hypercholesterolemic group was 1676.6 ± 700.2kcal and 1740.4 ± 678.6kcal for normal group. Both group did not show any significant differences in other nutrient intakes except the hypercholesterolemic group showed significantly lower intakes of fat ($p<0.05$) and vitamin A ($p<0.05$) and higher intake in vitamin C ($p<0.05$). There were no significant differences of carbohydrate, protein and fat energy percent between the two groups. The lower intake of fat in the hypercholesterolemic group found in this study is not consistent with the previous finding that serum cholesterol was positively corre-

lated with total fat intake (Kay et al. 1980).

Many studies performed in Korea were observed with no significant correlation between fat intake and serum cholesterol level (Kim et al. 2000 ; Oh et al. 1995 ; Park et al. 1993) It is uncertain that why the positive association between the fat intake and hypercholesterolemia observed in the western countries is hardly found in Korea, especially for postmenopausal women. It seems it is related to the low dietary fat energy percent of the group, estimated as 13% both in the National Health and Nutrition Examination Survey and in the present study. Kim et al. (1998) presented that the fat energy percent of Korean hyperlipidemic patients was about 20%, but they still showed hypercholesterolemia. The lower intake of fat in hypercholesterolemic group found in this study seems to be partly related to the constriction of fat with the consideration of their higher BMI.

The hypercholesterolemic group showed significantly lower intake of vitamin A compared to the normal group in the present study (Table 3). The significantly lower vitamin A intake found in the hypercholesterolemic group in this study was supported by the other finding of Kim et al. (2000), with lower vitamin A intake or Lecerf, Hottin (2004), with lower β carotene intake of hypercholesterolemic group.

Hypercholesterolemia is associated with endothelial dysfunction, an early manifestation of subclinical atherosclerosis (Heitzer et al. 2001) Oxidative stress causes abnormal contraction and relaxation of blood vessels by increasing the oxidized LDL (Furukawa et al. 2004). Kim, Kim (2005) reproted that supplementation of antioxidant nutrients improved the lipid metabolism, suggesting that hypercholesterolemia is associated with lower intakes or function of antioxidant nutrients. Intake of vitamin A or β carotene was also positively correlated with the serum HDL-cholesterol (Bolton-Smith 1992 ; Lamon-Fava 1994).

In the present study, the hypercholesterolemic group showed significantly lower vitamin A but higher vitamin C intakes. Vitamin C is also known as an antioxidant, but the roles of vitamin C as an antioxidant were contradictable in the previous studies. It was reported that long term vitamin C supplementation had no markedly favorable effects on the serum lipid (Hercbergs et al. 2005 ; Kim et al. 2004) On the other hand, Antoniades et al (2003) demonstrated that supplementation of vitamin C or E improved endothelial function of blood vessels in hypercholesterolemic patients.

In the present study, hypercholesterolemic women showed

Table 3. Daily energy and nutrient intakes of normal and hypercholesterolemia subjects

Variable	Normal (N = 373)	Hyper-cholesterolemia (N = 82)	F-value
Energy (kcal)	1740.0 ± 678.6	1676.6 ± 700.2	0.79
Protein (g)	60.1 ± 30.0	58.3 ± 28.7	0.51
Lipid (g)	25.7 ± 2.4	20.8 ± 13.8	2.55*
Carbohydrate (g)	311.1 ± 121.3	302.0 ± 119.0	0.63
Carbohydrate energy %	79.9 ± 10.2	73.8 ± 8.7	0.80
Protein energy %	13.9 ± 4.3	14.4 ± 3.8	0.94
Fat energy %	13.8 ± 9.1	13.2 ± 7.1	0.52
Calcium (mg)	485.4 ± 360.1	472.8 ± 331.5	0.30
Phosphorus (mg)	1055.6 ± 459.3	1041.6 ± 451.5	0.31
Iron (mg)	12.7 ± 10.0	12.2 ± 9.7	0.44
Sodium (mg)	5039.5 ± 4271.5	4793.2 ± 2574.0	0.52
Potassium (mg)	2792.0 ± 1364.4	2699.4 ± 1255.2	0.58
Vitamin A (μgRE)	604.4 ± 668.5	496.2 ± 105.0	1.94*
Retinol (μg)	38.4 ± 64.1	30.3 ± 57.6	1.08
β-carotene (μg)	3289.6 ± 3922.5	2723.8 ± 2263.7	1.31
Vitamin B_1 (mg)	1.10 ± 0.70	1.0 ± 0.48	1.15
Vitamin B_2 (mg)	0.90 ± 0.50	0.80 ± 0.47	1.27
Niacin (mg)	14.7 ± 8.0	14.6 ± 8.6	0.11
Vitamin C (mg)	151.8 ± 129.6	163.3 ± 183.0	1.93*
RDA (%)			
Energy	91.0 ± 35.5	87.6 ± 36.7	0.44
Calcium	69.3 ± 51.4	67.6 ± 47.4	1.11
Phosphorus	151.0 ± 65.6	158.8 ± 64.5	0.13
Iron	102.5 ± 82.0	98.3 ± 80.7	0.64
Vitamin A	86.3 ± 95.5	70.9 ± 57.4	0.88
Vitamin B_1	109.01 ± 66.45	97.03 ± 47.88	0.32
Vitamin B_2	75.85 ± 45.34	69.22 ± 38.84	1.41
Niacin	112.9 ± 61.6	112.1 ± 65.9	0.46
Vitamin C	216.9 ± 185.1	233.3 ± 261.4	1.93*

1) Mean ± SD
2) *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

significantly lower consumption frequencies in soft boiled rice, bread, snack, ham, fish and Chinese cabbage ($p < 0.01$ – $p < 0.05$), but higher in chicken ($p < 0.01$) and rice wine ($p < 0.05$) (Table 4). When the food items were categorized into food groups, there were no significant differences in food group consumption frequency according to the presence of hypercholesterolemia (Table 5). It is well known that bread is abundant with saturated fatty acid from butter or with trans fatty acid from margarine. Snack has also plenty of saturated fatty acid because they are fried in coconut or palm oil (Choi et al. 1998). It seems that the lower intake of fat in the hypercholesterolemic group found in the present study are related to the decreased food consumption frequencies in such as fat

Table 4. Food consumption frequencies in normal and hypercholesterolemic subjects (time/day)

Variable	Normal (N = 373)	Hypercholesterolemia (N = 82)	F-value
Boiled rice	2.78 ± 0.45	2.70 ± 0.52	1.25
Boiled barley	0.92 ± 1.22	0.75 ± 1.19	1.08
Boiled soft rice	0.48 ± 0.98	0.25 ± 0.74	2.20*
Fried noodles	0.06 ± 0.12	0.08 ± 0.14	1.03
Noodle soup	0.08 ± 0.13	0.09 ± 0.11	0.65
Breads	0.09 ± 0.17	0.06 ± 0.11	2.15*
Cakes	0.01 ± 0.02	0.01 ± 0.01	0.75
Rice cakes	0.07 ± 0.12	0.07 ± 0.14	0.46
Snacks	0.10 ± 0.27	0.05 ± 0.13	2.06*
Tofu	0.25 ± 0.28	0.25 ± 0.24	0.24
Beans boiled with soy	0.68 ± 0.11	0.64 ± 1.03	0.25
Potatoes and its products	0.16 ± 0.21	0.12 ± 0.15	1.67
Sweet potatoes and its product	0.09 ± 0.18	0.08 ± 0.14	0.24
Beef (beef soup, broiled beef, beef seasoned with soy)	0.12 ± 0.20	0.11 ± 0.17	0.23
Chicken (chicken soup, boiled chicken, fried chicken)	0.05 ± 0.07	0.09 ± 0.17	2.76**
Pork (fried pork, pork soup with kimchi, panbroiled pork)	0.13 ± 0.15	0.14 ± 0.17	0.65
Ham, hotdog, sausage	0.02 ± 0.09	0.01 ± 0.01	2.93**
Eggs (egg soup, boiled egg, fried egg)	0.27 ± 0.36	0.22 ± 0.29	1.06
Mackerel (fish)	0.10 ± 0.14	0.07 ± 0.01	2.08*
Tuna	0.05 ± 0.11	0.04 ± 0.07	0.73
Hairtail	0.08 ± 0.14	0.08 ± 0.10	0.39
Yellow corvine	0.10 ± 0.15	0.09 ± 0.14	0.53
Alaska Pollack	0.09 ± 0.14	0.08 ± 0.11	1.07
Anchovy	0.41 ± 0.50	0.46 ± 0.63	0.81
Fish pastes	0.07 ± 0.18	0.07 ± 0.13	0.01
Squid (including dried squid)	0.07 ± 0.16	0.08 ± 0.12	0.26
Clam	0.08 ± 0.17	0.08 ± 0.15	0.76
Fermented fishes with salts	0.23 ± 0.50	0.20 ± 0.48	0.35
Chinese cabbage (kimchi, soup)	2.57 ± 0.73	2.33 ± 0.91	2.40*
Radish (soup, radish salad)	1.60 ± 1.11	1.59 ± 1.12	0.09
Coffee	0.69 ± 0.84	0.73 ± 0.83	0.37
Green tea	0.21 ± 0.43	0.20 ± 0.46	0.04
Beer	0.03 ± 0.11	0.05 ± 0.24	0.97
Soju	0.04 ± 0.16	0.04 ± 0.10	0.12
Rice wine	0.01 ± 0.06	0.03 ± 0.14	2.40*
Hamburger	0.01 ± 0.06	0.01 ± 0.02	0.40
Pizza	0.01 ± 0.02	0.00 ± 0.01	1.17

1) Mean ± SD
2) *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

Table 5. Consumption frequencies for each food groups (time/day)

Variable	Normal (N = 373)	Hypercholesterolemia (N = 82)	F-value
Cereals foods	4.30 ± 1.91	3.81 ± 1.77	1.78
Meat foods	0.55 ± 0.47	0.62 ± 0.64	0.80
Fish and shellfishes	0.95 ± 0.64	1.00 ± 0.75	0.46
Light color vegetables	3.28 ± 2.10	3.40 ± 2.09	0.42
Yellow and green leafy vegetables	0.71 ± 0.55	0.74 ± 0.56	0.43
Sea foods	0.79 ± 0.54	0.71 ± 0.54	1.21
Fruits	1.05 ± 0.71	1.06 ± 0.78	0.10
Dairy products	0.62 ± 0.72	0.62 ± 0.72	0.05
Beverages	0.97 ± 1.03	0.93 ± 0.91	0.24
Instant foods	0.10 ± 0.19	0.10 ± 0.16	0.17
Alcohols	0.09 ± 0.24	0.11 ± 0.34	0.55

1) Mean ± SD
2) Cereals foods = Boiled rice + Boiled barley + Boiled soft rice + Rice cakes
Meat foods = Beef + Chicken + Pork
Fish and shellfishes = Mackerel (fish) + Tuna + Hairtail + Yellow corvine + Anchovy + Clam
Light yellow vegetables = Chinese cabbage (kimchi, soup, kimchistew, mulkimchi) + Radish (soup, radish salad, kimchi with Radish) + Beans sprouts (soup, seasoned) + Cabbage (kimchi, soup, fried)
Yellow and green vegetables = Spinach (soup, seasoned) + Carrot (fried, juicy) + Pumpkin (soup, seasoned) + Tomato (salad, juicy)
Sea foods = Brown seaweed (soup, seasoned) + Broiled laver
Fruits = Orange (canned, juicy) + Apples + Pear + Watermelon + Melon + Strawberry + Grape (canned, juicy) + Peach (canned, juicy) + Banana
Dairy products = Milk (low fat milk, milk products) + Yogurts + Ice cream
Beverages = Cooling Beverages (coke) + Coffee + Green tea
Instant foods = Ham, Hotdog, Sausage + Fried noodles + Hamburger + Pizza
Alcohols = Beer + Soju + Rice wine

rich foods. Multiple logistic regression revealed that the consumption frequency of light color vegetables more than 3.79 times (75percentile) per day was associated with the significantly increased risk of hypercholesterolemia (OR = 4.62 ; 95% CI : 2.96 − 7.22) (Table 6). The odds ratio was still significant when adjusted with age (OR = 4.55 ; 95% CI : 2.91 − 7.11). The risk of hypercholesterolemia was significantly higher in groups consuming dried squid more than 0.08 time/day compared to the women who consuming less than that (OR = 1.63 ; 95% CI : 1.13 − 2.35). Beer consuming ($\geq$ 0.03 time/day) was also associated with hypercholesterolemia after adjusted with age (OR = 1.57 ; 95% CI : 1.01 − 2.43). The odds ratio for hypercholesterolemia was significantly lower among subjects who consumed yellow and green leafy vegetables more than 1 time per day (OR = 0.06 ; 95% CI : 0.038 − 0.101).

Table 6. Odds ratio for hypercholesterolemia according to the food consumption frequency

Variables	Criteria	Odd's ratio(CI)	Age-adjusted Odd's ratio(CI)
Dried squids(Time/day)	≥ 0.08	1.63(1.13 – 2.35)	1.87(1.29 – 2.72)
	<0.08	1	1
Beer(Time/day)	≥ 0.03	1.42(0.92 – 2.19)	1.57(1.01 – 2.43)
	<0.03	1	1
Light color vegetables(Time/day)	≥ 3.79	4.62(2.96 – 7.22)	4.55(2.91 – 7.11)
	<3.79	1	1
Yellow and green leafy vegetables(Time/day)	≥ 1.00	0.06(0.04 – 0.10)	0.06(0.04 – 0.11)
	<1.00	1	1

It is not clear why postmenopausal women consuming more light color vegetable were associated with higher risk of hypercholesterolemia. In the present study, light color vegetable included Chinese cabbage, radish, cabbage and bean sprouts, which are mostly used as Kimchi, Kimchi stew, Kimchi soup. In a previous study (Jeon 2005), high consumption of light color vegetable was associated with high consumption of rice for Korean women. As a result women consuming more light color vegetable showed high carbohydrate intake. It was reported that high carbohydrate diet group presented higher proportion of dyslipidemia (Son, Jeon 2004) in Korea.

Dried squid is usually eaten as snack or side dish with alcohol drinking in Korean women. It is known as cholesterol rich food (National Rural Living Science Institute 2001). It seems cholesterol intake with dried squid is related to hypercholesterolemia in the present study. It was reported that heavy alcohol consumption was related to obesity (Son et al. 2004), hypertriglyceridemia and large waist (Yoon et al. 2004), therefore heavy alcohol consumption was significantly but positively associated with the risk of metabolic syndrome. On the contrary light to moderate alcohol consumption showed beneficial effect such as increasing HDL-cholesterol (Langer et al. 1992). In the present study beer consumption (≥ 0.03 time per day) was associated with the increased risk of hypercholesterolemia in postmenopausal women.

The beneficial effect of yellow and green leafy vegetables consumption frequency (≥ 1 time per day) decreasing the risk of hypercholesterolemia is supported by the finding that fruit and vegetable consumption was negatively correlated with serum triglyceride (Bains, Kaur 2004). In other studies performed in Korea hyperlipidemic patients showed more frequent consumption of milk and milk product and less consumption of vegetables, mushrooms and seaweeds (Lee et al. 2001) Kim et al. (1998) also presented that serum cholesterol was positively correlated with the consumption of eggs or squid but negative correlation with the carrot.

Summary and Conclusion

This study was performed to examine the dietary factors associated with hypercholesterolemia in post menopausal women in Korea. The data was derived from the 2001 Korean National Health and Nutrition Survey. Adult women age 40 ≤ < 65 and experienced menopause were of interest in the current research. To minimize the potential bias due to special dietary intakes, women in pregnancy, lactation or on a special diet were excluded. The resulting sample included 455 post menopausal women. Subjects who showed higher serum cholesterol (≥ 240mg/dl) were categorized into hypercholesterolemic group (N = 82) and the rest into the normal group (N = 373).

1) Hypercholesterolemic postmenopausal women showed significantly higher weight and BMI compared to the normal group. Hypercholesterolemic subjects were also observed as having significantly elevated waist and hip circumference.

2) The hypercholesterolemic group did not show any difference in energy intake even with higher BMI and waist circumference. Both group did not show any significant differences in other nutrient intakes except hypercholesterolemic group showed significantly lower intakes of fat and vitamin A but higher intake of vitamin C.

3) Multiple logistic regression revealed that the consumption frequency of light color vegetables more than 3.79 times per day (75 percentile) was associated with the significantly increased risk of hypercholesterolemia (OR = 4.62 ; 95% CI : 2.96 – 7.22).

The risk of hypercholesterolemia was significantly higher in group consuming dried squid more than 0.08 time per day (OR = 1.63 ; 95% CI : 1.13 – 2.35). Beer consuming (≥ 0.03 time/day) was also associated with hypercholesterolemia

after adjusted with age (OR = 1.57 ; 95% CI : 1.01 − 2.43). The odds ratio for hypercholesterolemia was significantly lower among subjects who consumed yellow and green leafy vegetables more than 1 time per day (OR = 0.06 ; 95 CI : 0.038 − 0.101).

In conclusion, hypercholesterolemia in Korean postmenopausal women was associated with higher BMI and waist circumference. However the mean energy intake of hypercholesterolemic group was not significantly different and their fat and vitamin A intakes were significantly lower compared to the normal group. It appears that hypercholesterolemia in Korean postmenopausal women is not related to the fat or energy intake, but with low antioxidant intake such as vitamin A. It is supported by the finding that the odds ratio for hypercholesterolemia was significantly lower among subjects consuming yellow and green leafy vegetable more than 1 time per day. Because dried squid or beer consumption are shown to increase the risk of hypercholesterolemia, careful selection of food for snacking or limitation of alcohol drinking is needed.

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