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Assessment of Dietary Intake and Plasma Lipid Profiles by Age Groups of Korean Men

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ABSTRACT

A cross-sectional study to determine dietary intake and plasma triglyceride, total cholesterol, LDL-cholesterol and HDL-cholesterol of 185 Korean men was conducted across three different age groups. The younger group(age 21 to 34) was significantly($p < 0.001$) taller but showed lower($p < 0.05$) percent body fat than the older group(age 45 to 65). Weight and body mass index was not different among age groups. Older men showed significantly($p < 0.01$) lower energy and total fat intake than younger men. Besides macronutrients, most participants consumed an adequate amount of micronutrients but calcium consumption of the middle age group(age 35 to 44) was less than 75% of RDA. In older men, plasma triglyceride(207.8 ± 155.5mg/dl), total cholesterol(201.4 ± 41.0mg/dl) and LDL-cholesterol(106.0 ± 32.7mg/dl) concentrations were significantly higher($p < 0.001$) than in younger men, whereas no significant difference was observed in HDL-cholesterol concentration. Subjects with a higher BMI(BMI ≥ 25.0) showed significantly higher($p < 0.001$) triglyceride(200.2 ± 107.6mg/dl), total cholesterol(211.0 ± 40.1mg/dl), LDL-cholesterol(118.16 ± 33.5mg/dl) concentrations and lower($p = 0.001$) HDL-cholesterol concentration(52.8 ± 15.9mg/dl) than subjects with lower BMI(BMI < 23.0). Dietary intake of fat and cholesterol did not show significant associations with any of the plasma lipid profiles. However, animal fat intake was significantly($p < 0.05$) correlated with plasma total cholesterol and triglyceride concentrations in the older age group. On the other hand, percent body fat was correlated($p < 0.05$) with all of the plasma lipid and lipoprotein concentrations examined for all age groups. Results indicate both dietary intake and percent body fat are important determinants of the plasma lipid concentrations in the elderly, but only percent body fat or body mass index could be valid predictors for the plasma lipid concentrations of the younger age group. (*J Community Nutrition* 3(1) : 14~20, 2001)

KEY WORDS : plasma lipids · dietary intakes · body fat content · body mass index.

Introduction

The risk factors for the development of coronary heart disease(CHD), as determined in numerous cross-sectional and longitudinal studies, are age, cigarette smoking, diabetes mellitus, hypertension, elevated plasma concentrations of low density lipoprotein cholesterol(LDL-C), and decreased plasma concentrations of high density lipoprotein cholesterol(HDL-C)(Kannel et al. 1986 ; Anderson et al. 1990). Kannel(1986) claims that nutrition continue to influence the incidence of CHD in advanced age because it is one of the chief risk factors for the disease. In Western countries, the incidence of CHD has declined over the last three decades probably through major advances in the diagnosis and treatment of CHD, public awareness of the CHD risk factors and the implementation of healthier diets, exercise programs, smoking cessation, and drug treatment of hypertension(Connor and Connor 1985 ; Powell et al 1987). On the other hand, the incidences and mortality rate of CHD in Korea has not decreased. Moreover, it has increased over the last few decades(National Statistical Office 2000).

A close relation between risk factors for CHD and eating habits has been investigated extensively in Western countries(Kannel 1986). Especially the prediction of blood lipid responses to multiple component dietary changes have been reported by many investigators (Garry et al. 1992 ; Lamon et al. 1994). However, it is difficult to apply these results directly to the case of Korea. Korea is among the most rapidly changing areas in Asia as well as in the world, and it is quite

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conceivable that the eating habits of the Korean people are also undergoing significant changes. Unfortunately, these changes are not toward the healthier diet but toward unhealthier diet such as more fat or energy consumption. This could be the reason why the morbidity and mortality of CHD in Korea is increasing. It is true in any population that adequate nutrition is one of the bases of public health. In Korea, the nation-wide nutritional status has been surveyed by the central government throughout the country, and the results have been published in detail(Ministry of Health and Welfare, Korea 2001). However the reports on local populations are still limited. There are some studies on adult subjects of various ages but many authors investigated on college students, presumably because of high availability of the study populations, even though the food habits of college students might not be representative of the habits of common people. It is of interest to determine whether dietary intake may be associated with plasma lipid concentrations in different age groups in a manner similar to that observed in younger subjects.

The present study was carried out on local populations in three study regions of a moderate degree of urbanization, to examine the dietary intake and plasma triglyceride, total cholesterol, LDL-C and HDL-C of Korean adult male subjects. Attention was paid towards age-dependent changes, and the associations between dietary intakes and plasma lipid and lipoprotein concentrations in this population.

Methods and Materials

1. Study population

The survey was conducted from the middle of September to October 2000 in three regions(Bupyong, Koomi and Chonan). Participation in the study was voluntary and all participants provided written, informed consent. Fifty subjects from Bupyung(21 – 65 years) and sixty seven subjects from Koomi(21 – 59 years), who have received mandatory medical surveillance programs by Institute of Industrial Medicine at Soonchunhyang University, were recruited and participated. Sixty eight subjects(24 – 65 years), recruited from among those visited Soonchunhyang University Hospital at Chonan for a mandatory annual medical examination. The participants in Bupyong and Koomi were battery industry workers and those in Chonan were manufacturing industry workers, small shop owners or farmers. Elderly subjects over 60 were mostly farmers or retired.

2. Nutrient intake assessment

A food consumption survey was conducted using 24 hour recall by one to one interviews with trained interviewers. Detailed descriptions of all foods and beverages consumed and estimated food portion sizes were recorded by interviewers with the use of food models, standard household measures and natural-sized colored photographs as memory aids.

Food records were converted to nutrient intake by using the computerized nutrient analysis program(CAN-pro, Korean Society of Nutrition, 1998, Seoul, Korea). Nutrient intakes from nutritional supplements were not considered because brand labels, doses, and durations of intake were not recorded with sufficient accuracy. Nutrient intakes were calculated as percent of recommended daily allowance(RDA) according to RDA values of age(Korean Society of Nutrition, 2000). For fat intake, the value of 20% as the percent energy intake of fat was used for RDA.

3. Anthropometric and clinical measurements

Body weights and heights of the subjects were measured and body mass index, a traditional anthropometric parameter of body composition(Simopolous and Van Italie 1990), was calculated by dividing the weight in kilogram by the square of height in meters(kg/m^2). Percent body fat was assessed using a portable bioelectric impedance analyzer(Tanita Co., Japan).

Fasting blood samples were collected by trained phlebotomists from an antecubital vein of each subject into 7-ml vacutainers. Plasma was separated from the whole blood within 2 hours of being drawn. Plasma triglyceride, total cholesterol and HDL-C concentrations were determined by using an automated enzymatic procedure(Hitachi Model 7150 Automatic

Analyzer, Japan). Values for LDL-C were calculated by Friedwald's equation(1972).

4. Statistical analysis

All statistical analyses were conducted using SPSS statistical software(Version 10.0). ANOVA and multiple comparison(Tukey) were employed to detect possible significant differences among means. Pearson's correlation coefficients was also conducted to test for a trend in the association between fat consumption and plasma lipids or lipoproteins

Results

1. Subject characteristics and nutrient intake by age groups

General characteristics of subjects by different age groups were summarized in Table 1. In the older group(age 45 to 65), height was significantly smaller compared to the younger(age 21 to 34) and the mid-

Table 1. General characteristics of subject[1,2]

	Age group(yr)			
	Total	21 – 34	35 – 44	45 – 65
N(%)	185(100.0)	63(34.1)	69(37.3)	53(28.6)
Age(yr)	39.42 ± 9.59	29.13 ± 3.63^{a}	39.57 ± 2.77^{b}	51.45 ± 4.87^{c}
Height(cm)	169.61 ± 5.68	171.84 ± 5.31^{a}	170.00 ± 5.02^{a}	166.45 ± 5.58^{b}
Weight(kg)	66.28 ± 9.53	67.35 ± 8.20	65.99 ± 10.00	65.37 ± 10.41
Bodymass index(BMI)	23.04 ± 3.13	22.86 ± 3.00	22.82 ± 3.22	23.54 ± 3.18
Body fat(%)	22.60 ± 5.72	21.15 ± 5.33^{a}	22.93 ± 6.11^{ab}	23.90 ± 5.36^{b}

1) Mean ± S.D.
2) Means in each row not sharing a common superscript letter are significantly($p < 0.05$) different by Tukey's multiple comparisons

Table 2. Mean daily intakes of energy and nutrients of subjects[1,2]

Variables	Total	21 – 34yr	35 – 44yr	45 – 65yr
N(%)	185(100)	63(34.1)	69(37.3)	53(28.6)
Energy(kcal)	2188.2 ± 751.5(88.6)[3]	2446.4 ± 912.4(97.6)^{a}	2039.5 ± 697.5(81.5)^{b}	2074.7 ± 496.1(87.2)^{b}
Protein(g)	83.6 ± 39.9(119.4)	94.7 ± 53.2(135.2)^{a}	76.5 ± 29.0(109.3)^{b}	79.8 ± 30.2(113.9)^{ab}
Total fat(g)	54.7 ± 37.8	66.5 ± 45.2^{a}	49.8 ± 35.9^{b}	47.1 ± 26.0^{b}
Animal source	30.8 ± 30.3	35.5 ± 32.0	29.1 ± 33.7	27.6 ± 22.6
A/TF(%)[4]	56.3	53.4	58.4	58.6
Plant source	23.8 ± 15.3	31.0 ± 20.2^{a}	20.6 ± 11.1^{b}	19.5 ± 8.9^{b}
P/TF(%)[5]	43.5	46.6	41.6	41.4
Carbohydrate(g)	318.3 ± 85.0	345.1 ± 93.1^{a}	297.9 ± 84.8^{b}	313.1 ± 66.1^{ab}
Ca(mg)	543.0 ± 225.7(77.6)	546.8 ± 211.3(78.1)	517.3 ± 216.0(73.9)	571.8 ± 253.7(81.7)
P(mg)	228.8 ± 442.1(175.5)	1346.3 ± 546.0(192.3)^{a}	1144.5 ± 365.6(163.5)^{b}	1198.7 ± 366.3(171.2)^{ab}
Fe(mg)	13.3 ± 10.3(110.5)	13.7 ± 8.8(113.8)	11.8 ± 4.4(98.5)	14.7 ± 16.0(122.2)
Na(mg)	5176.8 ± 2212.5	5270.9 ± 2215.1	5092.2 ± 2095.1	5175.2 ± 2389.8
K(mg)	2776.6 ± 836.0	2698.0 ± 835.3	2780.0 ± 832.0	2865.7 ± 848.9
Vit. A(R.E.)	718.2 ± 686.6(102.6)	850.2 ± 975.1(121.5)	618.5 ± 446.1(88.4)	691.0 ± 489.1(98.7)
Vit. B_1(mg)	1.4 ± 0.7(110.4)	1.5 ± 0.6(115.4)	1.4 ± 0.9(105.2)	1.4 ± 0.5(111.2)
Vit. B_2(mg)	1.2 ± 0.6(79.8)	1.2 ± 0.7(82.0)	1.1 ± 0.6(76.1)	1.2 ± 0.4(82.0)
Niacin(mg)	17.4 ± 11.2(104.2)	19.6 ± 16.5(115.1)	16.3 ± 7.8(96.1)	16.0 ± 5.8(101.6)
Vit. C(mg)	87.7 ± 55.8(125.2)	78.5 ± 54.6(112.2)	92.6 ± 50.3(132.3)	92.0 ± 63.2(131.5)
Crude fiber(g)	7.1 ± 2.7	6.8 ± 2.6	7.3 ± 2.7	7.2 ± 2.8
Cholesterol(mg)	318.8 ± 216.1	365.1 ± 233.9	305.3 ± 205.9	281.5 ± 200.9

1) Mean ± S.D.
2) Means in each row not sharing a common superscript letter are significantly($p < 0.05$) different by Tukey's multiple comparisons
3) Values in parentheses are % of RDA
4) Percent of animal fat intake over total fat intake
5) Percent of plant fat intake over total fat intake

dle age group(age 35 to 44), whereas weights of three different age groups did not show any significant differences. The older group showed significantly higher percent body fat than the younger group and there was a trend toward higher BMI in the older subjects although it is not statistically significant.

Table 2 shows the average daily nutrient intake of subjects by age group. Total energy and fat intakes were significantly($p < 0.01$) higher in the younger group compared with the other two age groups, whereas protein and carbohydrate intakes were significantly($p < 0.05$) lower in the middle age group while the other two age groups did not show a statistically significant difference. Besides energy sources, only the phosphorous intake was significantly($p < 0.05$) higher in the younger group compared to the other age groups. Intakes of most micronutrients analyzed from all three different age groups were more than 75% of RDA.

2. Comparison of plasma lipid profiles

The means and standard deviations of plasma lipid profiles according to age group, body mass index and fat and cholesterol intake levels are shown in Table 3 and 4. The means of total cholesterol, LDL-C and triglyceride were significantly($p < 0.01$) lower in the younger group while HDL-C level was not significantly different. When subjects were grouped by BMI, the highest BMI group(BMI $\geq$ 25.0) showed significantly($p < 0.01$) higher total cholesterol, LDL-C and triglyceride concentrations and lower($p = 0.01$) HDL-C concentration, as expected. The ratio of LDL-C to HDL-C, which has been known to be a more effective predictor of CHD risk than each single parameter (Stampfer et al 1991), was higher($p < 0.05$) in the older group than in the younger group and higher($p < 0.01$) in the highest BMI group than in the lowest BMI group(BMI $<$ 23.0). However, when subjects were grouped by dietary fat and cholesterol intake, no significant differences were observed in plasma lipid profiles between the high fat or cholesterol intake group and the low fat or cholesterol intake group (Table 4). Percent body fat was significantly($p < 0.05$) correlated with all plasma lipids in all age groups (Table 5). In the older group, dietary total fat intake is also correlated($p < 0.05$) with plasma total cholesterol level. Dietary animal fat intake was significantly ($p < 0.05$) correlated with total cholesterol and triglyceride only in the older age group. In the other age groups, dietary intake of fat and cholesterol did not show significant correlation with any of plasma lipids or percent body fat.

Discussion

Many cross-sectional studies have shown a progressive increase in total and LDL-cholesterol concentrations from early to late adulthood(The Expert Panel 1988, The Lipid Research Clinics 1980, Gordon and Shurtleff 1974). Consistently, the present study also showed higher plasma total and LDL cholesterol concentrations in older age groups(Table 3). Oddly, consumption of dietary fat was higher in the younger group. In all age groups, dietary fat from animal sources was higher than from plant sources. However,

Table 3. Plasma lipid profiles according to age and body mass index[1)]

Variables	Subclass	N	Total cholesterol(mg/dl)	LDL-cholesterol (mg/dl)	HDL-cholesterol (mg/dl)	Triacyl glycerol(mg/dl)	LPH[3)]
Age group(yrs)	21 34	63	175.0 ± 31.3[a]	89.0 ± 23.0[a]	60.9 ± 18.2	125.6 ± 121.5[a]	1.6 ± 1.1[a]
	35 44	69	200.4 ± 39.4[b]	110.3 ± 32.9[b]	57.6 ± 16.1	162.4 ± 96.7[ab]	2.1 ± 0.8[ab]
	45 65	53	201.4 ± 41.0[b]	106.0 ± 32.7[b]	53.8 ± 21.4	207.8 ± 155.5[b]	2.4 ± 2.2[b]
	p-value		< 0.001	< 0.001	0.124	0.002	0.023
BMI	< 23.0	94	179.6 ± 33.0[a]	91.7 ± 25.1[a]	62.6 ± 19.6[a]	126.4 ± 109.3[a]	1.7 ± 1.2[a]
	23.0 ≤ < 24.9	37	196.0 ± 41.1[ab]	103.6 ± 31.5[ab]	52.1 ± 16.2[b]	201.0 ± 168.8[b]	2.0 ± 0.8[ab]
	25 ≥	54	211.0 ± 40.1[b]	118.16 ± 33.5[b]	52.8 ± 15.9[b]	200.2 ± 107.6[b]	2.5 ± 2.0[b]
	p-value		< 0.001	< 0.001	0.001	< 0.001	0.009

1) Mean ± S.D.
2) Means in each column not sharing a common superscript letter are significantly different($p < 0.05$) by Tukey's multiple comparison
3) Ratio of LDL-C to HDL-C

Table 4. Comparisons of plasmalipid profiles among age groups according to dietary fat and cholesterol intake[1,2]

Subclass	Age group	N	Fat intake from animal source(g)	Fat intake from plant source(g)	Total C (mg/dl)	LDL-C (mg/dl)	HDL-C (mg/dl)	TG (mg/dl)	LPH
Percent energy intake of fat < 20%	Total	80	17.0 ± 9.1	17.3 ± 7.4	193.7 ± 40.5	103.7 ± 30.7	53.5 ± 20.4	182.8 ± 140.4	2.3 ± 2.0
	21 – 34	17	20.9 ± 10.4	21.0 ± 11.1^{a}	172.2 ± 33.1^{a}	87.8 ± 20.3^{a}	53.4 ± 22.5	155.1 ± 152.1	1.9 ± 1.8
	35 – 44	33	16.6 ± 9.1	16.7 ± 5.8^{ab}	205.9 ± 42.4^{b}	115.2 ± 32.2^{b}	56.7 ± 16.0	170.0 ± 96.9	2.2 ± 0.8
	45 – 65	30	15.3 ± 7.9	15.7 ± 5.7^{b}	192.6 ± 37.9^{ab}	100.1 ± 29.7^{ab}	50.0 ± 23.5	212.6 ± 170.3	2.6 ± 2.9
	p-value		0.116	0.049	0.018	0.007	0.426	0.323	0.549
Percent energy intake of fat ≥ 20%	Total	105	41.4 ± 36.2	28.8 ± 17.7	190.7 ± 38.2	100.4 ± 31.5	60.8 ± 16.4	147.6 ± 115.6	1.8 ± 0.8
	21 – 34	46	40.9 ± 35.5	34.7 ± 21.6^{a}	176.1 ± 30.9^{a}	89.5 ± 24.1^{a}	63.7 ± 15.8	114.7 ± 108.0^{a}	1.5 ± 0.7^{a}
	35 – 44	36	42.5 ± 43.6	24.2 ± 13.6^{b}	195.4 ± 36.4^{b}	105.9 ± 33.3^{b}	58.3 ± 16.3	155.4 ± 97.3^{ab}	1.9 ± 0.8^{ab}
	45 – 65	23	40.7 ± 23.9	24.4 ± 10.1^{ab}	212.8 ± 43.0^{b}	113.6 ± 35.3^{b}	58.8 ± 17.6	201.4 ± 137.4^{b}	2.1 ± 1.0^{b}
	p-value		0.976	0.010	< 0.001	0.004	0.283	0.011	0.009
Dietary cholesterol intake < 300mg	Total	87	22.6 ± 18.9	21.0 ± 13.0	196.1 ± 41.0	106.0 ± 33.7	56.6 ± 18.0	167.6 ± 128.5	2.0 ± 1.0
	21 – 34	24	25.6 ± 20.0	28.9 ± 13.6^{a}	181.0 ± 38.4	91.2 ± 25.5^{a}	53.1 ± 21.7	183.7 ± 170.6	2.0 ± 1.6
	35 – 44	35	20.3 ± 16.0	18.7 ± 13.2^{b}	204.8 ± 39.1	116.1 ± 33.8^{b}	58.9 ± 15.9	148.5 ± 95.1	2.1 ± 0.8
	45 – 65	28	23.0 ± 21.4	17.2 ± 9.0^{b}	198.3 ± 43.1	106.0 ± 36.0^{ab}	56.7 ± 17.3	177.9 ± 124.9	1.9 ± 0.7
	p-value		0.580	0.001	0.085	0.018	0.478	0.519	0.707
Dietary cholesterol intake ≥ 300mg	Total	98	38.1 ± 36.3	26.3 ± 16.7	188.4 ± 37.3	98.1 ± 28.3	58.5 ± 19.1	158.6 ± 127.6	2.0 ± 1.7
	21 – 34	39	41.6 ± 36.4	32.3 ± 23.5^{a}	171.3 ± 25.9^{a}	87.7 ± 21.5^{a}	65.7 ± 13.9^{a}	89.9 ± 54.9^{a}	1.4 ± 0.6^{a}
	35 – 44	34	40.2 ± 44.5	22.6 ± 8.3^{b}	195.9 ± 40.0^{b}	104.4 ± 31.3^{b}	59.2 ± 16.3^{ab}	176.7 ± 97.6^{b}	2.0 ± 0.8^{ab}
	45 – 65	25	30.0 ± 20.2	22.1 ± 8.2^{b}	204.8 ± 39.2^{b}	105.9 ± 29.2^{b}	50.6 ± 25.2^{b}	241.2 ± 180.7^{b}	2.9 ± 3.1^{b}
	p-value		0.428	0.015	< 0.001	0.010	0.005	< 0.001	0.004

1) Mean ± S.D.

2) Means in each row not sharing a common superscript letter are significantly($p < 0.05$) different by Tukey's multiple comparisons.

Table 5. Correlation between plasma lipids and different variables[1]

	Total	Age group(yr)		
		21 - 34	35 - 44	45 - 65
Total Cholesterol(mg/dl)				
Total fat intake(g)	0.018	0.164	0.152	0.288*
Animal fat intake(g)	0.050	0.240	0.097	0.281*
Plant fat intake(g)	0.143	0.013	0.200	0.129
Cholesterol intake(mg)	0.074	0.021	0.069	0.018
Body fat(%)	0.465***	0.447***	0.499***	0.348*
HDL-Cholesterol(mg/dl)				
Total fat intake(g)	0.010	0.102	0.177	0.040
Animal fat intake(g)	0.022	0.175	0.128	0.047
Plant fat intake(g)	0.020	0.048	0.187	0.002
Cholesterol intake(mg)	0.069	0.165	0.034	0.011
Body fat(%)	0.367***	0.353**	0.397**	0.308*
LDL-Cholesterol(mg/dl)				
Total fat intake(g)	0.050	0.139	0.149	0.149
Animal fat intake(g)	0.020	0.170	0.126	0.102
Plant fat intake(g)	0.084	0.043	0.100	0.167
Cholesterol intake(mg)	0.125	0.017	0.162	0.059
Body fat(%)	0.462***	0.509***	0.480***	0.334*
Triglyceride				
Total fat intake(g)	0.025	0.001	0.091	0.249
Animal fat intake(g)	0.083	0.016	0.123	0.293*(p=0.033)
Plant fat intake(g)	0.103	0.023	0.081	0.007
Cholesterol intake(mg)	0.012	0.160	0.165	0.117
Body fat(%)	0.418***	0.359**	0.533***	0.320*
Body fat				
Total fat intake(g)	0.067	0.181	0.061	0.121
Animal fat intake(g)	0.090	0.156	0.083	0.135
Plant fat intake(g)	0.011	0.159	0.055	0.015
Cholesterol intake(mg)	0.085	0.042	0.078	0.157

1) Values are Pearson's correlation coefficients.
* : $p<0.05$, ** : $p<0.01$, *** : $p<0.01$

dietary fat intake from plant sources in the younger group was significantly higher than the other age groups. The finding of higher dietary fat intake and lower plasma lipid profiles in the younger group could be explained by higher consumption of plant fat as well as physiological differences and physical activity levels associated with increased energy expenditure and energy intake. Unfortunately, the amount of physical exercise in the present subjects is not known. However, since most subjects were industrial employees or farmers involved with heavy physical activities except for a few subjects over 60 who were retired, it is reasonable to assume that younger groups could be associated with higher physical activities.

According to Table 1, even though older participants in the present study were significantly shorter than younger ones and no significant difference was observed from participants' weights, BMI values of different age groups were not significantly different. Therefore, body fat content, instead of BMI, was used to test the association of plasma lipids although a strong association has been reported between BMI and plasma concentrations of total and LDL-cholesterol(Lamon-Fava et al. 1994). As with BMI, percent body fat showed a strong correlation with all of the plasma lipids and lipoproteins tested in the present study regardless of age. Dietary intake, however, showed some associations with total cholesterol concentration only

in the older age group. Dietary animal fat intake was also correlated with triglyceride levels in the older group. It has been proposed that the age-related increase in plasma total and LDL cholesterol are associated with a decrease of the LDL receptor activity in the liver(Miller 1984). For the elderly, due to decreased physiological ability of cholesterol metabolism, dietary intake would show more effects than for younger subjects. Dietary fat intake, especially animal fat intake, was more influential than dietary cholesterol intake. Dietary cholesterol intake, in the present study, did not significantly affect any of the plasma lipids or lipoproteins. Consistently, several epidemiological studies that have compared dietary cholesterol intake and plasma cholesterol concentrations have not found significant associations(Katan et al. 1988 : Shekelle et al. 1981 : Porter et al. 1977).

In conclusion, body fat was a more effective predictor of plasma antherogenic lipid profiles than dietary intake levels. However, even if total energy, total and animal fat and cholesterol intake levels were decreased, plasma lipids would be affected more as aging proceeds. These results support the concept that control of body weight to reduce body fat is a key element in maintaining a healthy lipoprotein profile in both young and elderly populations.

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