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Trend of HDL increase among Japanese people continues in National Health and Nutrition Survey

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We recently reported that plasma HDL levels markedly increased among Japanese people over 20 years, from the late eighties to 2010. The overall increase was as high as 7%–10% in men and 13%–15% in women, as observed in National Health and Nutrition Survey and other cohort studies[1, 2]. This increase was much higher than the moderate increase in HDL-cholesterol by 2%–6% as observed in the United States for the same time period with variations among various ethnic groups[3, 4], widening the gap of HDL-cholesterol levels between the two countries. To our knowledge, no such report has been found for any other population though similar data should be available and analyzable in many populations. Interestingly, non-HDL-cholesterol levels slightly decreased to the same extent over the same period in the both countries. These findings were unlikely to be an artifact such as failure in standardization of assay systems based on several circumstantial evidences, although we were unable to come up to any rational interpretation for this puzzling trend[1]. The data comparable between the two countries[2] are rearranged and summarized in **Table 1** to make direct comparison easier.

After these findings were reported, more recent results of National Health & Nutrition Survey (2011–2015) have accumulated and been made available[5]. I, therefore, analyzed these new plasma lipoprotein profiles to follow up our previous observation with the aim of finding whether the trend of the plasma HDL increase continues among Japanese people.

Longitudinal trends of HDL-cholesterol, non-HDL-cholesterol, and triglyceride levels are shown in **Fig. 1**, including these recent data, for all and for those who did not take lipid-lowering drugs separately when available. The trend of increase in HDL-cholesterol levels is extended beyond 2010 both in males and females causing a wider gap between the sexes (panel A). On the contrary, non-HDL-cholesterol levels show no difference between the sex groups with slight longitudinal decreasing tendencies (panel B). There was no significant difference noted in these trends after excluding those who take anti-hyperlipidemic drugs. Plasma triglyceride levels may reciprocally influence HDL-cholesterol levels through the exchange of cholesteryl ester in HDL and triglyceride in other lipoproteins by cholesteryl ester transfer protein[6]. However, it showed no apparent change throughout the period of the survey (Panel C), excluding the possibility that decrease in triglyceride caused the increase in HDL. Thus, the trend of change in plasma lipoprotein profile of Japanese people continues.

Panels D–G show age distribution profiles of HDL-cholesterol and non-HDL-cholesterol in 2015 in comparison with those in 1990 and 2000 that were shown in the previous report[1]. Even though these three sets of the data have been obtained from unrelated independent surveys, the age-dependent profiles are almost superimposable on each other, indicating reliability of the data. The profiles of HDL-cholesterol are consistent with its increasing trends both in men and women, though it is more visible in women. In contrast, non-HDL-cholesterol level shows no apparent change during this 25-year period.

It is thus obvious that the marked and puzzling increase in HDL-cholesterol level among Japanese people continues beyond the previously reported period[1, 2], without prominent change in other lipoprotein profiles. No clear reason has yet been implicated for this trend; however, the cause of this trend needs to be clarified. Change in lifestyle is one of the significant issues in our society, including food intake, preference consumption, level of exercise, social stress etc. The most prominent change took place in the

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Table 1. Change of HDL and nonHDL parameters in populations, mg/dl, *Mean 95 (% CI). **Mean ± SE

				1988-1994	2007-2010	% Change	*P*
HDL-Cholesterol	US	All Ethnic	Men	45.7 (45.5-47.1)*	47.7 (46.8-48.5)	4.3	<0.001
			Women	55.5 (55.5-57.6)	58.3 (57.4-59.1)	5.0	<0.001
		Hispanic	Men	45.2 (44.3-46)	46.0 (44.9-47.2)	1.8	0.25
			Women	52.1 (51.8-54.1)	53.8 (52.1-55.4)	3.3	0.07
		nonHispanic White	Men	45.0 (45-46.8)	47.2 (46.1-48.3)	4.9	0.002
			Women	55.8 (55.6-58.5)	58.9 (57.6-60.2)	5.6	<0.001
		nonHispanic black	Men	52.6 (50.0-53.1)	53.5 (52.3-54.8)	1.7	0.28
			Women	57.4 (56.3-58.7)	59.4 (57.9-60.9)	3.5	0.03
	JAPAN	NHNS	Men	51.3 ± 14.9**	56.8 ± 15.4	10.6	<0.001
			Women	59.0 ± 15.1	66.6 ± 15.5	14.2	<0.001
		SRL	Men	49.4 ± 15.5	53.1 ± 14.2	7.3	<0.001
			Women	56.1 ± 15.7	63.9 ± 15.7	13.9	<0.001
ApoA-I	JAPAN	SRL	Men	123.6 ± 4.8	134.9 ± 3.2	9.1	0.01
			Women	133.2 ± 6.8	151.0 ± 3.5	13.4	0.02
nonHDL-Cholesterol	US	All Ethnic	Men	158 (154-159)	149 (148-151)	−5.7	<0.001
			Women	151 (145-149)	142 (140-144)	−6.0	<0.001
		Hispanic	Men	159 (154-163)	157 (153-160)	−1.3	0.28
			Women	152 (143-149)	144 (141-146)	−5.3	<0.001
		nonHispanic White	Men	159 (154-160)	149 (147-151)	−6.3	<0.001
			Women	151 (146-151)	143 (141-145)	−5.3	<0.001
		nonHispanic black	Men	148 (139-148)	139 (135-142)	−6.1	<0.001
			Women	147 (139-147)	134 (131-147)	−8.8	<0.001
	JAPAN	NHNS	Men	148	142	−4.0	
			Women	145	140	−3.2	

Data are extracted from references 1-4. NHNS, National Health and Nutrition Survey; SRL, commercially measured clinical data provided by SRL Co. Ltd.

post-war period from 1945 to the early seventies, characterized by the drastic increase of fat and protein at the expense of relative decrease in carbohydrate consumption, resulting in the increase of total caloric intake[7]. These changes were gradually stabilized after this period. However, the second seemingly ongoing significant change in the past 20 years or so is the sharp decrease in fish intake and reciprocal increase in meat although overall protein and fat intake show no visible change[2]. Increase in fish oil intake represented by n-3 fatty acids is generally considered to increase in HDL along with decrease in triglyceride[8-10] perhaps partly due to the above-mentioned mechanism[6]. The increase in HDL is thus contradictory to this change. Serum triglyceride level shows no change during this period (**Fig. 1**).

Nevertheless, we must focus on this phenomenon to monitor how long and to what extent this trend continues. This may influence our public health parameters, especially those involving cardiovascular or atherosclerotic diseases.

Conflict of Interest

The author has no conflict of interest.

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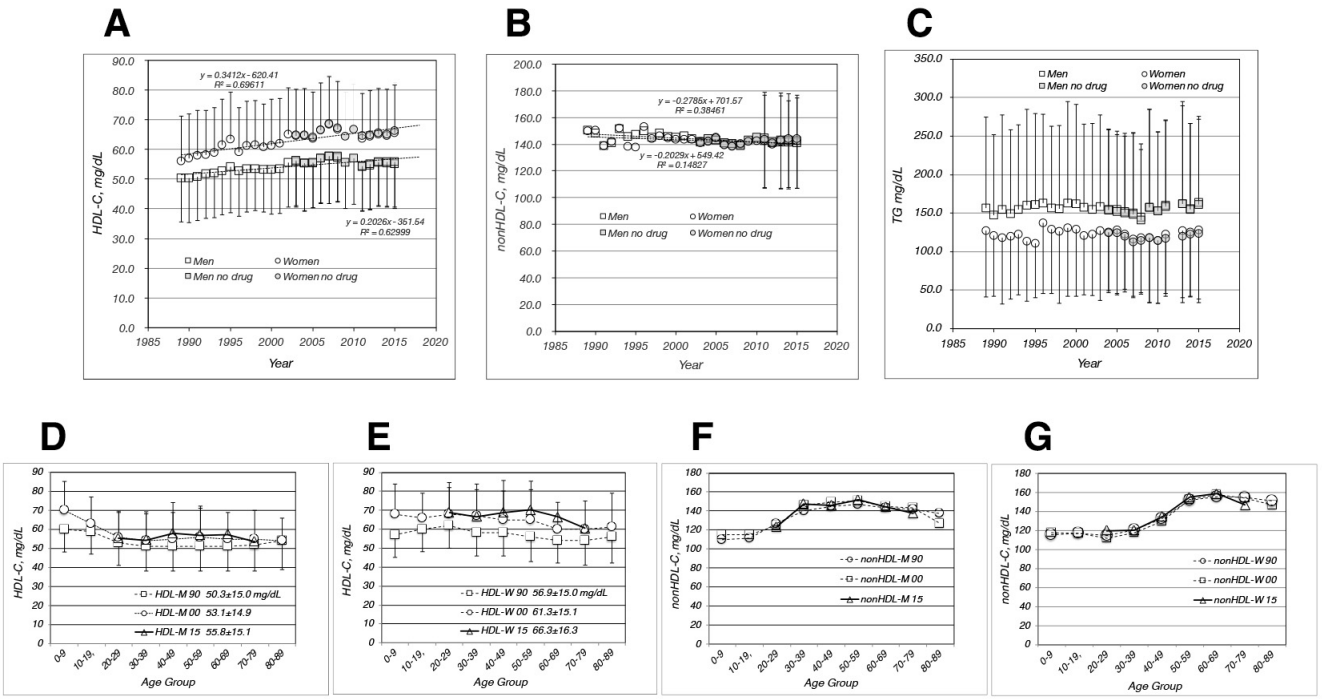

Fig. 1. Changes in HDL-cholesterol, nonHDL-cholesterol and triglyceride among Japanese during the period from 1989 to 2015 are shown in panels A, B and C, respectively

The data of total and those not taking lipid-lowering drugs are shown separately after 2003 when those data are available. Age distribution profiles of HDL-cholesterol and nonHDL-cholesterol are shown in panels D-E and panels F-G (M: men and W: Women), respectively, from the survey in 1990, 2000 and 2015. The former two sets of the data are duplication from the reference 1. HDL-cholesterol levels are listed with the legends for symbols.

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