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Comparison of Various Serum Protein Values in the Japanese and the Japanese-Americans Resident in the United States

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ABSTRACT

Measurements were made of various types of proteins, that is α_1-antitrypsin, α_1-acid glycoprotein, α_2-HS glycoprotein, haptoglobin, α_2-macroglobulin, transferrin, C_3, IgG, IgA and IgM, in the serum of the Japanese-Americans living in Hawaii and the Japanese-Americans living in Los Angeles who are assumed to be genetically almost identical to the Japanese in Hiroshima Prefecture but are known to have a higher intake of animal fats but a lower intake of complex carbohydrates. These were compared with those of the Japanese in Hiroshima Prefecture.

α_2-macroglobulin values in serum of the male Japanese-Americans living in Hawaii of ages 30—39 years, 40—49 years, and 50—59 years were significantly lower than those of the residents in Hiroshima Prefecture, but no significant difference in these values could be observed between the Japanese-Americans living in Los Angeles and the Japanese in Hiroshima Prefecture. No significant difference could be observed in the values of other serum proteins in all age groups. These findings indicate that the difference in intake volume of animal fats and complex carbohydrates did not affect these serum protein values.

Many residents of Hiroshima Prefecture have migrated from Hiroshima Prefecture to the United States since the early Meiji period and are now living in the Island of Hawaii and the Los Angeles district as pure Japanese. Genetically, these Japanese-Americans show no appreciable difference from the residents of Hiroshima Prefecture, but their living environment and in particular their dietary pattern have westernized far earlier and more extensively than those of the Japanese in Hiroshima Prefecture. It is considered that measurement of various serum proteins of the Japanese-Americans in Hawaii and Los Angeles in meaningful in studying the effects of environmental factors, particularly the effect of diet, on the values of various serum proteins.

MATERIALS AND METHODS

The subjects of the present study are 625 Japanese living in Hiroshima Prefecture, 384 Japanese-Americans resident in Hawaii, and 526 Japanese-Americans resident in Los Angeles. Their distribution by age and sex is shown in Table 1.

Various serum proteins were determined by the single radial immunodiffusion method[6].

RESULTS

A comparison was made of α_1-antitrypsin value by age and sex between the Japanese living in Hiroshima and the Japanese-Americans

Table 1. Number of cases studied

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
30 — 39	Male	18	10	18
	Female	23	11	31
40 — 49	Male	48	17	36
	Female	122	26	51
50 — 59	Male	69	34	53
	Female	197	61	97
60 — 69	Male	51	57	78
	Female	75	65	87
70 — 79	Male	15	57	46
	Female	7	46	29
Total		625	384	526

Table 2. Level of serum α_1-antitrypsin

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	233 ± 50	215 ± 13	203 ± 47
	Female	234 ± 41	251 ± 68	230 ± 57
40 — 49	Male	221 ± 40	219 ± 82	236 ± 62
	Female	222 ± 41	221 ± 29	248 ± 59
50 — 59	Male	215 ± 31	228 ± 56	224 ± 54
	Female	229 ± 42	227 ± 43	216 ± 52
60 — 69	Male	234 ± 51	229 ± 45	229 ± 45
	Female	225 ± 41	230 ± 45	229 ± 51
70 — 79	Male	250 ± 62	253 ± 45	251 ± 72
	Female	230 ± 30	238 ± 63	223 ± 36

Mean ± S.D.

Table 3. Level of serum α_1-acid glycoprotein

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	75 ± 34	62 ± 13	74 ± 20
	Female	65 ± 23	63 ± 19	67 ± 21
40 — 49	Male	75 ± 33	79 ± 28	68 ± 14
	Female	61 ± 25	59 ± 16	67 ± 16
50 — 59	Male	69 ± 25	60 ± 19	71 ± 22
	Female	67 ± 28	63 ± 26	67 ± 17
60 — 69	Male	62 ± 23	60 ± 18	67 ± 14
	Female	56 ± 22	63 ± 20	66 ± 16
70 — 79	Male	57 ± 24	66 ± 24	70 ± 33
	Female	58 ± 15	67 ± 26	66 ± 17

Mean ± S.D.

resident in Hawaii or Los Angeles. As shown in Table 2, the results showed no significant difference in all age groups among the three resident groups. Furthermore, changes due to age and difference by sex could not be demonstrated.

α_1-acid glycoprotein value in the serum did not show any significant difference in all age groups among the three resident groups as shown in Table 3. In addition, changes due to age and difference by sex could not be demonstrated.

Table 4. Level of serum α_2-HS glycoprotein

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	67 ± 18	69 ± 15	69 ± 10
	Female	60 ± 17	71 ± 10	71 ± 16
40 — 49	Male	64 ± 14	66 ± 8	73 ± 20
	Female	69 ± 17	65 ± 11	69 ± 13
50 — 59	Male	66 ± 16	67 ± 9	67 ± 14
	Female	67 ± 15	67 ± 13	70 ± 15
60 — 69	Male	62 ± 13	66 ± 12	68 ± 12
	Female	66 ± 16	66 ± 11	69 ± 13
70 — 79	Male	69 ± 17	63 ± 14	70 ± 16
	Female	68 ± 15	65 ± 12	69 ± 13

Mean ± S.D.

Table 5. Level of serum haptoglobin

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	85 ± 58	106 ± 45	108 ± 53
	Female	105 ± 89	146 ± 90	128 ± 67
40 — 49	Male	112 ± 84	143 ± 82	116 ± 62
	Female	101 ± 66	138 ± 67	124 ± 65
50 — 59	Male	126 ± 78	135 ± 76	153 ± 86
	Female	102 ± 72	142 ± 82	134 ± 72
60 — 69	Male	114 ± 82	147 ± 81	152 ± 72
	Female	115 ± 62	143 ± 71	145 ± 74
70 — 79	Male	123 ± 78	153 ± 91	144 ± 77
	Female	131 ± 81	146 ± 63	182 ± 103

Mean ± S.D.

Table 6. Level of serum α_2-macroglobulin

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	240 ± 85	181 ± 40*	219 ± 35
	Female	248 ± 46	232 ± 84	277 ± 52
40 — 49	Male	242 ± 77	156 ± 41*	229 ± 50
	Female	250 ± 60	231 ± 90	278 ± 50
50 — 59	Male	235 ± 57	135 ± 76*	238 ± 62
	Female	259 ± 54	233 ± 63	273 ± 72
60 — 69	Male	251 ± 61	224 ± 81	263 ± 61
	Female	266 ± 69	243 ± 79	268 ± 61
70 — 79	Male	297 ± 96	265 ± 98	306 ± 105
	Female	277 ± 49	248 ± 64	305 ± 47

Mean ± S.D.

* This value is significantly lower than that of the Japanese in Hiroshima Prefecture ($p < 0.05$)

α_2-HS glycoprotein value in the serum showed no significant difference among the three resident groups as shown in Table 4. Furthermore, changes due to age and difference by sex could not be demonstrated.

As shown in Table 5, serum haptoglobin value did not demonstrate and significant difference among the three resident groups in all age groups.

As shown in Table 6, α_2-macroglobulin value

Table 7. Level of serum C_3

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	99 ± 38	80 ± 11	81 ± 17
	Female	85 ± 14	85 ± 13	79 ± 18
40 — 49	Male	92 ± 24	92 ± 12	86 ± 18
	Female	88 ± 18	85 ± 13	90 ± 16
50 — 59	Male	90 ± 18	89 ± 11	87 ± 16
	Female	95 ± 18	91 ± 15	94 ± 27
60 — 69	Male	85 ± 18	90 ± 14	89 ± 20
	Female	92 ± 15	92 ± 12	94 ± 17
70 — 79	Male	90 ± 15	85 ± 12	96 ± 20
	Female	98 ± 21	76 ± 17	94 ± 18

Mean ± S.D.

Table 8. Level of serum transferrin

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	254 ± 48	285 ± 31	291 ± 56
	Female	279 ± 77	297 ± 42	310 ± 59
40 — 49	Male	265 ± 56	266 ± 47	304 ± 58
	Female	271 ± 61	287 ± 43	316 ± 73
50 — 59	Male	273 ± 63	291 ± 44	308 ± 69
	Female	265 ± 54	289 ± 56	283 ± 64
60 — 69	Male	245 ± 48	271 ± 54	282 ± 58
	Female	257 ± 53	288 ± 58	280 ± 56
70 — 79	Male	275 ± 61	265 ± 53	287 ± 60
	Female	245 ± 41	272 ± 43	293 ± 50

Mean ± S.D.

Table 9. Level of serum IgG

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	1,597 ± 291	1,702 ± 563	1,742 ± 299
	Female	2,164 ± 629	2,085 ± 497	1,791 ± 379
40 — 49	Male	1,832 ± 437	1,915 ± 479	1,703 ± 369
	Female	2,196 ± 483	2,251 ± 457	1,804 ± 376
50 — 59	Male	1,939 ± 427	2,060 ± 567	1,809 ± 444
	Female	2,173 ± 513	2,190 ± 645	1,797 ± 455
60 — 69	Male	2,116 ± 506	2,115 ± 530	1,770 ± 415
	Female	2,235 ± 560	2,242 ± 684	1,866 ± 429
70 — 79	Male	1,989 ± 321	2,333 ± 650	2,009 ± 441
	Female	1,940 ± 225	2,211 ± 639	1,799 ± 282

Mean ± S.D.

was significantly lower in males resident in Hawaii in the 30—39 year old group, 40—49 year old group, and 50—59 year old group in comparison with that of the Japanese living in Hiroshima Prefecture, but no significant difference could be observed in the Japanese-Americans living in Los Angeles.

As shown in Table 7, the mean and standard deviation of serum C_3 value in Japanese-Americans living in Hawaii was 76 ± 16 mg/dl in females in the seventies and in comparison with 98 ± 21 mg/dl in the Japanese in

Table 10. Level of serum IgA

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	337 ± 112	272 ± 95	328 ± 125
	Female	294 ± 121	260 ± 101	292 ± 145
40 — 49	Male	325 ± 130	269 ± 90	312 ± 132
	Female	326 ± 113	288 ± 84	315 ± 111
50 — 59	Male	316 ± 98	341 ± 140	303 ± 141
	Female	316 ± 101	304 ± 127	423 ± 183
60 — 69	Male	336 ± 124	360 ± 134	323 ± 130
	Female	284 ± 99	361 ± 162	330 ± 120
70 — 79	Male	394 ± 165	348 ± 127	363 ± 143
	Female	288 ± 158	342 ± 154	351 ± 135

Mean ± S.D.

Table 11. Level of serum IgM

Age	Sex	Japanese stayed in		
		Hiroshima	Hawaii	Los Angeles
		(mg/dl)	(mg/dl)	(mg/dl)
30 — 39	Male	144 ± 62	138 ± 49	122 ± 40
	Female	206 ± 69	226 ± 85	185 ± 40
40 — 49	Male	141 ± 65	145 ± 59	135 ± 44
	Female	204 ± 71	208 ± 75	164 ± 58
50 — 59	Male	145 ± 71	158 ± 72	126 ± 39
	Female	176 ± 70	183 ± 70	147 ± 50
60 — 69	Male	135 ± 58	133 ± 69	119 ± 39
	Female	150 ± 60	159 ± 74	145 ± 62
70 — 79	Male	128 ± 47	130 ± 75	120 ± 47
	Female	152 ± 91	153 ± 73	144 ± 74

Mean ± S.D.

Hiroshima Prefecture was significantly low. Serum C_3 value in the Japanese-Americans resident in Hawaii and Los Angeles belonging to other age groups did not show a significant difference from that of the Japanese resident in Hiroshima Prefecture.

As shown in Table 8, no significant difference could be demonstrated in serum transferrin value in any of the age groups.

Serum IgG value did not show any significant difference among the three groups in any of the age groups as shown in Table 9.

No significant difference could be demonstrated in serum IgA value among the three groups in any of the age groups as shown in Table 10.

As shown in Table 11, serum IgM value did not show any significant difference in any of the age groups. However, in the Japanese living in Hiroshima Prefecture and in the Japanese-Americans resident in Hawaii and Los Angeles the females showed a higher value than the males.

DISCUSSION

The authors have published previously the results of their epidemiological study on diabetes mellitus among the Japanese-Americans resident in Hawaii and the Japanese living in Hiroshima Prefecture[4]. In the present survey, study was made in three areas including the Japanese-Americans resident in the Los Angeles area. Blood was drawn from all the examinees and determination was made on the various serum proteins. The subjects of the present survey are Japanese-Americans resident in the United States. They are pure Japanese who have migrated mostly from Hiroshima Prefecture. It is therefore assumed that they are genetically not different from the Japanese subjects of Hiroshima Prefecture.

In our previous report, the nutrient intake of the Japanese living in Hiroshima Prefecture and

that of the Japanese-Americans resident in Hawaii and Los Angeles was described[2]. According to the results of that diet survey, the total mean daily energy intake did not show any large difference among the three different areas, but the intake of animal fats by the Japanese-Americans in Hawaii and Los Angeles was 1.4 to 1.7 fold greater than that by the Japanese living in Hiroshima Prefecture, whereas the intake of complex carbohydrates was 1.6 to 1.8 fold greater by the Japanese living in Hiroshima.

It was considered meaningful to measure the various serum proteins (α_1-antitrypsin, α_1-acid glycoprotein, α_2-HS glycoprotein, haptoglobin, α_2-macroglobulin, C_3, transferrin, IgG, IgA and IgM) of the Japanese living in Hiroshima Prefecture and of the Japanese-Americans resident in Hawaii and Los Angeles who are assumed to be genetically identical but whose dietary pattern is different from that of the Japanese in Hiroshima Prefecture.

Of these various serum proteins, significant difference could be demonstrated between the Japanese-Americans in Hawaii and the Japanese in Hiroshima Prefecture in only α_2-macroglobulin. α_2-macroglobulin is primarily produced in the liver and is known to act as anti-protease of trypsin, plasmin, thrombin, and elastase[3,7]. Furthermore, it has been reported that α_2-macroglobulin value is markedly high in childhood when compared to that during adulthood[1]. This suggests that α_2-macroglobulin has an important function in the growth process.

The results of our study indicated that only in males belonging to the 30—39, 40—49 and 50—59 year old groups of the Japanese-Americans of Hawaii was the serum α_2-macroglobulin value significantly higher than that of the Japanese living in Hiroshima Prefecture, but no significant difference could be observed between the Japanese-Americans resident in Los Angeles and the Japanese living in Hiroshima Prefecture. Furthermore, serum α_2-macroglobulin value in the females was higher than that in the males. Similar results have been reported by Ganrot el al[1].

This difference may be hormonally conditioned, as similar changes are produced by synthetical estrogen-progesteron preparations ('the pill')[5].

As α_2-macroglobulin value is affected by sex hormones, it is very interesting that among the Japanese-Americans resident in Hawaii only the males belonging the relatively young age group showed a low α_2-macroglobulin value. The detailed mechanism involved is yet unknown.

It is assumed that α_1-antitrypsin, α_1-acid glycoprotein, α_2-HS glycoprotein, haptoglobin, C_3, transferrin, IgG, IgA and IgM are chiefly produced in the liver, but no significant difference in the values of these serum proteins could not be demonstrated among the three areas. This suggests that the difference in the intake of animal fats and complex carbohydrates does not affect the values of these serum proteins.

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