日本人青少年の身長，体重の経年変化の分析；

1929年から1988年（昭和4年から昭和63年）

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Analysis on annual changing trend of stature and body weight of Japanese children and youth ; from 1929 to 1988 (Syowa 4 th to 63rd)

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　戦中，戦後における日本人の体格の戦前のそれに比較した低下は，ヨーロッパ諸国において見られたと同様に見られた。しかし，戦後とくに1950年前半より同一年齢の者の体格は急激な向上を続け戦前のレベルに到達し，以後もその向上傾向は続き，発育加速化現象として広く発育発達研究者の間で討議された。この現象は日本のみならず世界諸国において見られたものであった。この現象は体格の大型化，性成熟の前傾化，最大発育速度出現の若年化によって特徴付けられるものであった。しかし，いつ開始し，いつ終了し，どのくらいの年数続いたのか等についてはいまだ明確な結論は出されていない。とくに，いつ終了したと判断してよいかに就いては検討されていない。そこで，発育加速化の一つの特徴である体格の大型化の観点から，本研究では1928年から1988年までの身長，体重の経年平均値を資料として，任意の年の変化傾向を，この任意の年を中央に含む5年間の変化傾向に直線を当てはめて推定し，この推定された変化傾向の経年変化を考察する事から上記の問題の解決を試みた。発育加速化現象は戦後のみならず，戦前（1936〜1940頃）にも短期間ではあるが出現していたと推測された。これは，従来論議されなかった事柄であり，さらに，詳細に検討が必要と考えられた。また，1940年代初期に始まった低下現象は1940年代後半まで続き，次いで Catch-up 傾向が始まり，1950年代初期から1960年代初期に至る10年の間でここで取り上げた年齢段階では Catch-up は終了している。Catch-up が終了して直ちに発育加速化現象が出現し，年齢，性によってわずかな差異はあるものの，ほぼ1970年前半まで続いたと推測された。そして，1975年以後は，1940年以前の経年変化傾向にもどっていると推測された。

Key words : Annual trend, Stature and body weight, Growth acceleration, Japanese children and youth, Regression coeffcient,

Ⅰ. Introduction

　Japanese have experienced several incidents which might influence their physical growth and development ; Chinese war, the Second World War, and the famine which continued from during the Second World War up to several years after the War finished. It has been well established that even stature of children of same age decreased in these incidents because of poor intake of nutrition. Then, along with reconstruction of socio-economical and cultural conditions in Japan, the physique of Japanese caught up with its prewar status sharply. Such a sharp increase of physique has been considered to have continued after catch-up with the prewar status completed.

　Such a sharp increase of physique of same age was closely related with the phenomena

that physical maturation also became earlier year by year. The phenomena of this type was reported in many countries ; France, England, Germany, Holland, Belgium and so on, which were exposed by the famine associated with the Second World War. This was defined as growth acceleration phenomena. It was said that this phenomena finished in 1970s in Japan. However, any definite evidences regarding this inference have not been reported yet. The annual report of physical fitness and motor ability on survey published by Japanese Ministry of Education, Science and Culture suggests that the annual increase of physique is still recognized in children and youth of same age. Therefore, this study was designed to clarify whether the growth acceleration finished or not in terms of annual increase of physique, when it finished if finished, and how this can be verified. Furthermore, this study may be expected to explore what is the present annual changing trend of physique of same age compared with the prewar trend and what are some specific characteristics of annual changing trend in physique of Japanese children and youth of same age up to today.

Ⅱ. Method and procedures

1) Data

The data used were extracted from annual statistics of physique reported in 1990 report of physical fitness and motor ability survey published by Ministry of Edcuation, Science and Culture, which is cited from School Health statistics reported also by Ministry of Education, Science and Culture. The sample sizes have been more than 20,000 for each age and sex, respectively, although there have been a little difference in size depending on survey year, age and sex. The sizes of pre-war era are not exact now, but School Health Statistics was the one of ministry statistics, so its sample size was nearly equal to total number of school children and youth. The ages investigated in this study

were limited from 6 to 15 years old, because the influence of famine associated with the Second World War was thought to be to greater extent in these ages than in others and the adolescent growth spurt term was involved in this age interval. Furthermore, catch-up trend was thought more definite in these ages than in others, so it culd be assumed reasonably that the growth acceleration was realized more significantly in those who were at those ages than others. The ages described in statistics stand for full age.

2) Determination of prewar trend

The Second World War which is considered to influence physical growth and developemnt severly started in December 8 th, 1941. Before this war, Japan already engaged in Chinese war and socio-economical situation was getting more serious gradually, but the annual trend of physique does not show any serious deterioration in children and youth. Thus, the prewar term was defined as the term over 1929 and 1941. In order to determine the prewar trend, however, the year when the maximum value in the prewar was searched in the term over 1929 and 1945, because the maximum value was recognized after 1941 in some ages, and its value in this term was determined,as shown in Figure 1. The linear regression equation on the converted year ; y_i - 1929 (actual year-1929), was determined with the data from 1929 to the year when the maximum value was recognized ; a_{max}, and the prewar trend of annual change was evaluated by its standardized regression coefficient.

3) Determination of the year of catch-up onset

The year when the minimum value was recognized in the term over the year when the maximum value was recognized in prewar term; a_{max}, and 1950 was determined as the year of catch-up onset, because the changing trend evaluated by c_i, which is described below, was
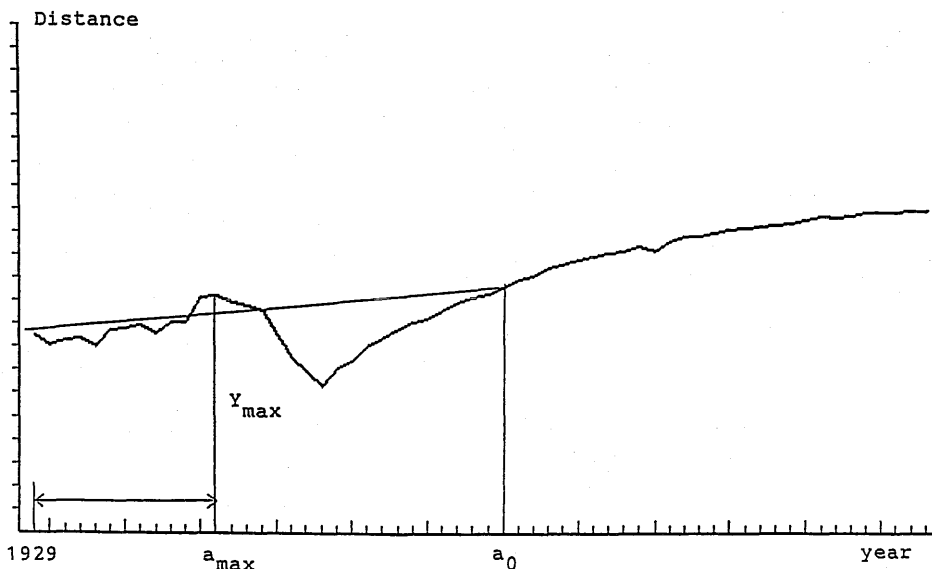
Distance

Figure 1, Explanation on determination of regression coefficient of prewar trend and determination of the year when catch-up with the prewar trend is completed.

1), Y_{max} denotes the maximum value from 1929 through 1945.

2), a_{max} demotes the year when the maximum value was recognized.

3), Secular trend in prewar and during War was estimated by linear regression line from 1929 through a_{max}.

4), a_0 denotes the year when the prewar trend was caught up by the actual annual mean distance data.

positive in boys and grils of all ages in 1950 and it means that the catch-up already started. Actually, for computational convenience, this year was searched from 1940 to 1950, because most maximums were found before 1941.

4) Determination of the year of catch-up completion

The year when the value extrapolated by the linear regression equation expressing the prewar trend is equal to or smaller than the annual data was determined as the year of catch-up completion, as shown in Figure 1.

5) Metrical evaluation of annual changing trend

The linear regression equation was determined with the data of successive five years. For instance, let c_i be the changing trend at a_i year. A linear regression equation was determined determined by five data at a_{i-2}, a_{i-1}, a_i, a_{i+1}, a_{i+2} years. For computational convenience, a_{i-2} was converted to 0, so the data denoting year were converted to 0, 1, 2, 3 and 4. The standardized regression coefficient of this equation ; c_i, was determined as representing the changing trend at a_i year. C_i means a relative mean velocity of changing trend at a_i year. The positive value of ci means the increasing trend, the negative one the decreasing and zero no-changing trend, so the annual changing trend can be evaluated by successive determination of c_i's.

Ⅲ. **Results**

1) Stature

Figures 2 and 3 show the annual changing

trend of stature of boys and girls aged from 6 to 15 in the term over 1929 and 1988. Until latter-half of 1930s, the gradual increasing trend was found in boys and girls of all ages, and then slight degree of deterioration could be rec-

ognized a little before 1940 in some ages. Then, the sharp increasing trend was found definitely in boys and girls of growth spurt ages for only one or two years. After 1941, when the Second World War broke out, the significant deteriora-
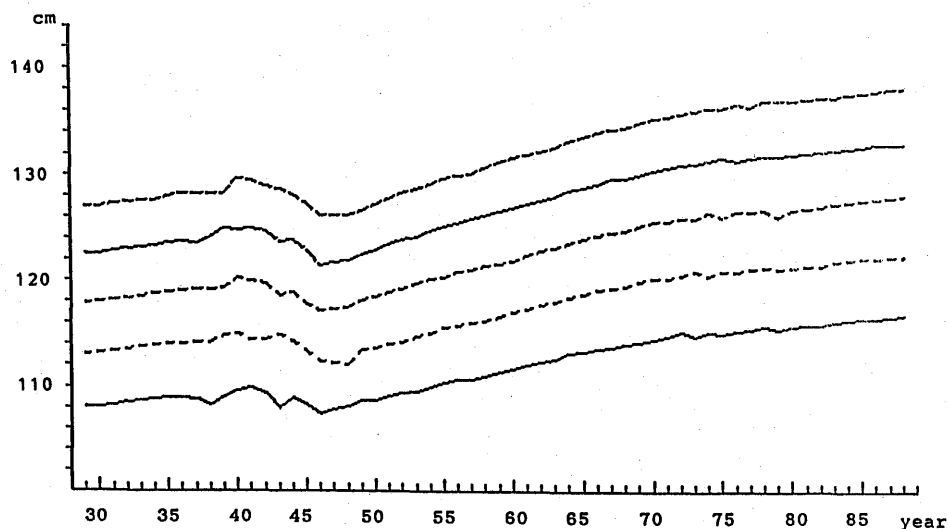
Figure 2-1, Secular trend of stature ; 6 to 10 years boy
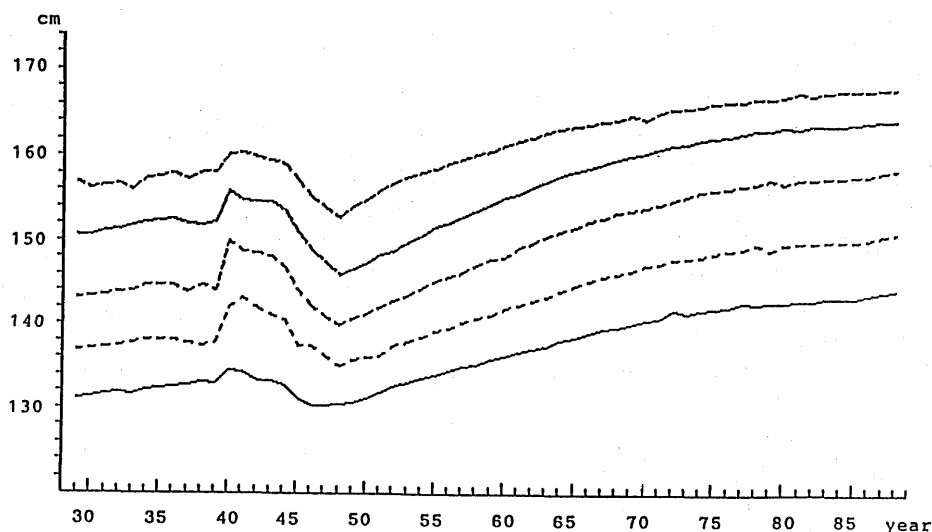
Figure 2-2, Secular trend of stature ; 11 to 15 years boy

tion trend started and continued up to a few years after War ended. Such a deterioration trend was found more significantly in boys and girls of growth spurt ages than others. Furthermore, this deterioration term seemed to be di-

vided into two terms ; (1), from the year when the maximum was found in the prewar up to one or two years before War ended, and (2), from that year to the year when the minimum was recognized. The deterioration

Figure 3-1, Secular trend of stature ; 6 to 10 years girl

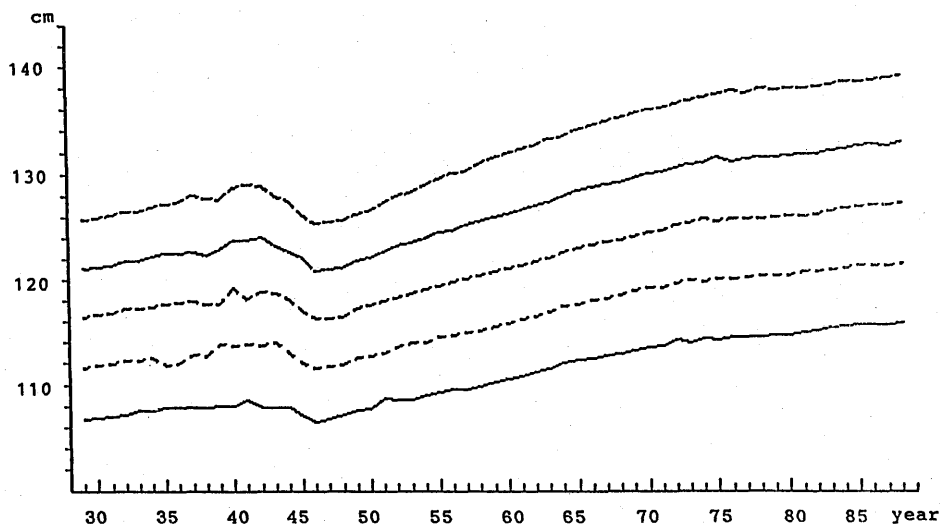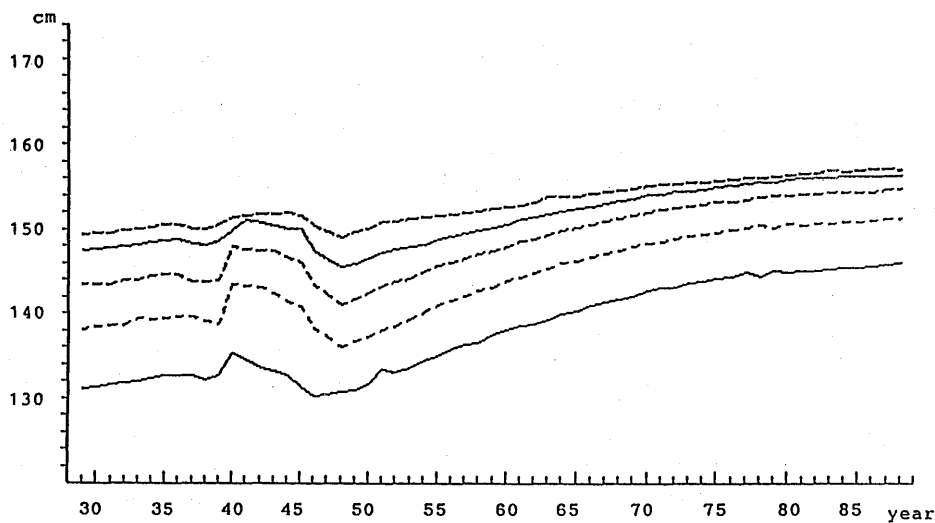Figure 3-2, Secular trend of stature ; 11 to 15 years girl

Table 1   Several statistical characteristics on secular trend of stature ; 1929 to 1988

	Age	Max. value before 1945 * 1		Min. value from 1940 to 1950 * 2		Catch-up with the estimated prewar trend * 3			Catch-up with the prewar maximum * 4		
		Year	Value (cm)	Year	Value (cm)	Year	years	Reg. co.	Year	years	Actual dis.(cm)
	6	1941	109.9	1946	107.4	1951	5	.120	1954	8	110.0
	7	1940	115.1	1948	112.1	1953	5	.166	1954	6	115.1
	8	1940	120.3	1946	117.2	1953	7	.175	1955	9	120.3
B	9	1939	125.0	1946	121.5	1954	8	.206	1955	9	125.1
o	10	1940	129.7	1948	126.1	1953	5	.190	1956	8	130.0
y	11	1940	134.5	1946	130.3	1954	8	.236	1955	9	134.5
s	12	1941	143.1	1948	135.0	1963	15	.347	1963	15	143.4
	13	1940	149.9	1946	139.8	1961	13	.317	1963	15	150.7
	14	1940	155.8	1948	146.0	1960	12	.285	1962	14	156.4
	15	1941	160.5	1948	152.7	1958	10	.299	1959	11	160.6
	6	1941	108.7	1946	106.5	1951	5	.132	1954	8	109.1
	7	1943	114.0	1946	111.6	1952	6	.169	1953	7	114.0
G	8	1940	119.3	1946	116.3	1952	6	.181	1955	9	119.4
i	9	1942	124.1	1946	120.8	1953	7	.218	1955	9	124.5
r	10	1941	129.1	1946	125.4	1954	8	.257	1955	9	129.5
l	11	1940	135.4	1946	130.2	1954	8	.242	1956	10	135.8
s	12	1940	143.6	1948	136.1	1956	8	.252	1960	12	144.0
	13	1940	148.0	1948	141.1	1956	8	.197	1960	12	148.1
	14	1941	151.1	1948	145.6	1958	10	.208	1961	13	151.4
	15	1944	152.0	1948	149.1	1953	5	.171	1957	9	152.1

Note ; *1,   The year when the maximum stature was recognized before 1945, and its maximum value of stature.

*2,   The year when the minimum stature was recognized in the term over 1940 and 1950, and its minimum value of stature.

*3,   The year when the actual mean of stature caught up the trend extrapolated by linear regression equation in the term over 1929 and the year when the maximum stature was recognized before 1945, the years needed to catch up and its standardized regression coefficient which suggests mean relative velocity of catch-up.

*4,   The year when the actual mean of stature caught up the maximum stature before 1945, the years needed to catch up, and the actual mean stature when catch-up was completed.

trend seemed to be sharper in the latter term than the former. This was found especially definite in the boys and girls of growth spurt ages. In girls of 15 years old as an exception, the deterionation trend was not found by 1944, and the minimum appeared in 1948. The amount of lowering was smaller than in other ages.

Then, around in 1946 through 1948, the minimum value appeared and then catch-up trend started. The statistics regarding these changing events of annual trend are shown in

Table 2　Several statistical characteristics on secular trend of body weight ; 1929 to 1988

	Age	Max. value before 1945 *1		Min. value from 1940 to 1950 *2		Catch-up with the estimated prewar trend *3			Catch-up with the prewar maximum *4		
		Year	Value (kg)	Year	Value (kg)	Year	years	Reg. co.	Year	years	Actual dis.(kg)
	6	1941	18.6	1946	17.8	1948	2	.059	1952	6	18.6
	7	1940	20.2	1946	19.8	1947	1	.051	1952	6	20.6
	8	1941	22.5	1946	21.5	1949	3	.063	1951	5	22.5
B	9	1940	24.7	1946	23.6	1950	4	.087	1952	6	24.7
o	10	1940	27.0	1946	25.5	1951	5	.100	1953	7	27.1
y	11	1941	29.8	1946	27.8	1952	6	.117	1956	10	30.0
s	12	1940	35.3	1949	31.4	1956	7	.172	1963	14	35.6
	13	1940	40.4	1948	34.5	1961	13	.263	1962	14	40.4
	14	1940	45.9	1948	38.9	1959	11	.245	1962	14	46.1
	15	1940	50.0	1948	44.0	1956	8	.201	1957	9	50.1
	6	1938	17.9	1946	17.3	1947	1	.060	1948	2	17.9
	7	1940	19.9	1946	18.9	1948	2	.071	1952	6	20.0
G	8	1940	21.8	1943	21.2	1949	1	.082	1950	7	21.8
i	9	1942	23.9	1946	22.9	1949	3	.070	1952	5	24.0
r	10	1939	26.5	1946	25.2	1951	5	.095	1952	6	26.6
l	11	1940	30.3	1946	27.5	1952	6	.137	1955	9	30.5
s	12	1940	36.7	1948	32.2	1955	7	.145	1960	12	36.9
	13	1940	41.3	1948	35.9	1955	7	.153	1959	11	41.4
	14	1941	45.0	1948	40.1	1956	8	.192	1959	11	45.1
	15	1941	47.2	1948	43.9	1953	5	.127	1956	8	47.3

Note ;　*1,　The year when the maximum body weight was recognized before 1945, and its maximum value of body weight.

　　　*2,　The year when the minimum body weight was recognized in the term over 1940 and 1950, and its minimum value of body weight.

　　　*3,　The year when the actual mean of body weight caught up the trend extrapolated by linear regression equation in the term over 1929 and the year when the maximum body weight was recognized before 1945, the years needed to catch up and its standardized regression coefficient which suggests mean relative velocity of catch-up.

　　　*4,　The year when the actual mean of body weight caught up the maximum body weight before 1945, the years needed to catch up, and the actual mean body weight when catch-up was completed.

the first and second columns of Tables 1 and 2. Then,the year when the catch-up completed is shown in the third column of Tables 1 and 2. In boys and girls of growth spurt ages ; 12, 13 and 14 years old, catch-up was completed later than in those of other ages. Although any significant variation was not found in the years when the maximum appeared and the ones when the minimum appeared, the boys of 12 years old needed 15

Table 3 Statistics of detrioration trend

Sex	Age	Stature			Body weight		
		Duration (years)	Amount (cm)	R. A. (%)	Duration (years)	Amount (kg)	R. A. (%)
B o y s	6	5	2.50	2.27	5	.80	4.30
	7	8	3.00	2.61	6	.40	1.98
	8	6	3.10	2.58	5	1.00	4.44
	9	7	3.50	2.80	6	1.10	4.45
	10	8	3.60	2.78	6	1.15	5.56
	11	6	4.20	3.12	5	2.00	6.71
	12	7	8.10	5.66	9	3.90	11.05
	13	6	10.10	6.74	8	5.90	14.60
	14	8	9.80	6.29	8	7.00	15.25
	15	7	7.80	4.86	8	6.00	12.00
G i r l s	6	5	2.20	2.02	8	.60	3.35
	7	3	2.40	2.11	6	1.00	5.03
	8	6	3.00	2.51	3	.60	2.75
	9	4	3.30	2.66	4	1.00	4.18
	10	5	3.70	2.87	7	1.30	4.19
	11	6	5.20	3.84	6	2.80	9.24
	12	8	7.50	5.22	8	4.50	12.26
	13	8	6.90	4.66	8	5.40	13.08
	14	7	5.50	3.64	7	4.90	10.89
	15	4	2.90	1.19	7	3.30	6.99

Note ; 1), Duration denotes the years from the year when the maximum appeared before 1945 to the year when the minimum appeared in the term over 1940 and 1950.

2), Amout denotes the amount of decrease in this duration.

3), R. A. means relative amount of decrease ; Amount of decrease ＊100/maximum.

years to catch up with the prewar trend and the girls of 14 years old 10 years. As shown in the third column of Tables 1 and 2, the older the more years needed to complete the catch-up with the prewar trend at ages younger than 14. At 12, 13, 14 and 15 years old the standardized regression coefficients were larger in boys than girls, but they were larger in girls than in boys at ages younger than 12. It suggests that catch-up trend is sharper in both boys and girls at growth spurt ages than at other ages.

The amounts of decrease from the maximum in prewar to the minimum in the term over 1940 and 1950 are shown in Table 3. Although the durations of the term in which deterioration was recognized were not equal in all ages for both sexes, the shortest was 3 years for girls aged 7 and the longest 8 years. The amount of decrease was larger in those of growth spurt ages than in those of other ages. This suggests that those who were at the growth spurt ages needed more years to catch up with the prewar trend, even though mean rates of catch-up were larger. Therefore, the famine to which most of children and youth were exposed during the War and after the War influenced more seriously those of growth spurt ages. The

fourth column of Tables 1 and 2 shows the year when actual distance data became equal to or greater than the maximum value before 1945 which is shown in the first column, the years needed to reach that, and the actual distance value at this time. More years were naturally needed to reach the maximum before 1945 than the prewar trend. From 1953 up to first-half of 1960s, the boys and girls of all ages reached the maximum value in prewar. Then,it could be
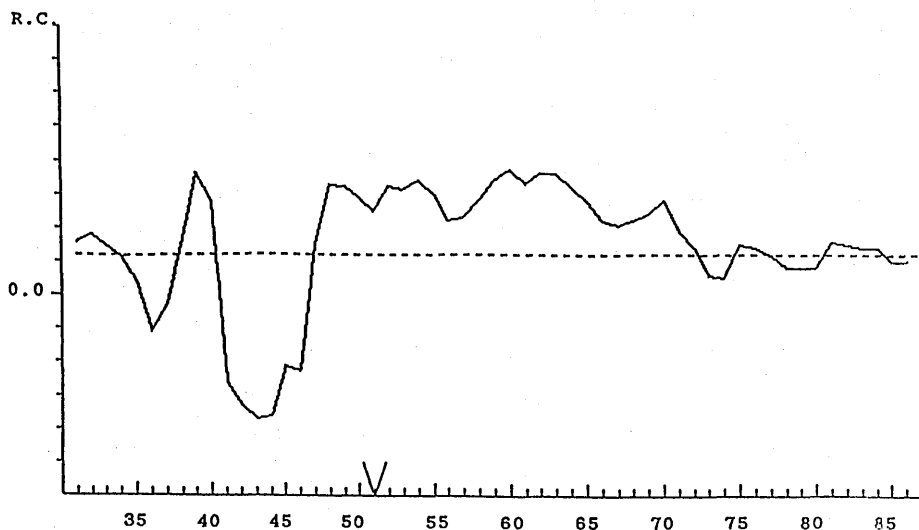

Figure 4 , Successive regression coefficient of secular trend of stature ; 6 year-old boy
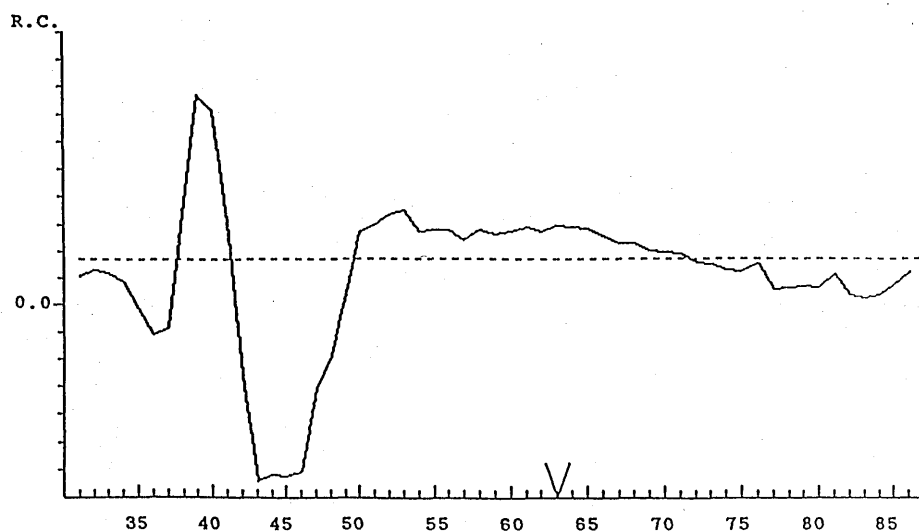

Figure 5 , Successive regression coefficient of secular trend of stature ; 12 year-old boy

inferred that catch-up trend started in latter-half of 1940s in both boys and girls of most ages and it did not complete until first-half of 1960s.

Figure 4 shows the successive standardized regression coefficients computed by successive five annual data of boys of 6 years old, and V sign denotes the year when catch-up with the prewar trend completed. The dotted line means the standardized regression coefficient representing the prewar trend. The deterioration trend started in 1934 and its amount was maxmum in 1936 and it was turned over by the increasing trend in 1938. This increasing trend, however, continued only for 3 years, so the coefficient became negative soon in 1941. However, the coefficient of 1939 seemed to be almost maximum in all ones up to 1986, and it was equal to or a little larger than those of catch-up trend after War. Since the stature of boys aged 6 caught up with the prewar trend in 1951, the changing rate of annual trend represented by standardized regression coefficient was so larger than that of prewar trend represented by dotted line up to 1972. Therefore, the growth acceleration started in 1951 and continued to 1972 for boys aged 6 . Tables 4 and 5 show the successive standardized regression coefficients for boys and girls aged from 6 and 15. Figure 6 was drawn with these successive standardized regression coefficients of boys aged 6 in Table 4 .

Until mid-year between the year when the minimum distance appeared and the year when catch-up with the prewer trend completed, the coefficients increased and thereafter, they began to decrease, but they were all larger than the ones representing the prewar trend even after catch-up with the prewar trend completed. In other words, the sharper incresing trend than that of the prewar was still found until several yesrs after catch-up achieved. Such a sharper incresing trend continued to the first-half of 1970s, although some difference of a few years was found between different ages.

The year when growth acceleration ended was determined by the year when the standardized regression coefficients representing the prewar trend became larger than successive ones. These years are shown in Table 6 , together with the year when catch-up completed and their duration from this year to that year when growth acceleration ended. As shown in Table 6 , the growth acceleration finished in 1970 through 1975, and the durations of growth accelertion were longer than 18 years and shorter than 22 years in boys and girls aged younger than growth spurt ages. In those who are older than the growth spurt ages, the durations were shorter in both sexes. Particularly, in boys of 12 years old, it was only 8 years, for catch-up with the prewar trend required more years. Figure 5 shows the successive standardized regression coefficients for boys aged 12. The largest coefficient was found in 1939. This means that an increasing trend was sharper in those days than in the postwar. In both sexes of all ages, such large coefficients appeared before 1940, although they were different in magnitude. Particularly, it was larger in those of growth spurt ages than in those of the younger. Before such large coefficients appeared, even negative ones were found in boys aged 6 , 12, 13 and 14, and girls aged 7 , 8 , and older than 11, so it could be inferred that deterioration trend appeared in 1935 through 1937 for boys, and in 1933 through 1937 for girls, although the durations were a few years ; 3 years at longest. As shown in Tables 4 and 5 , the degree of deterioration in those days was smaller than in 1940 through 1950, but its catch-up trend was sharper at somes ages ; particularly at the growth spurt ages, than those during and after War. These greater positive coeffecients mean that the sharp increasing trend appeared even in the prewar until 1940 or 1941 to catch up with the trend before deterioration appeared. No studies discussed about such events in the perwar, but it could be inferred that deteriora-

Table 4 , Successive regression coefficients of stature ; boys

	Age	6	7	8	9	10	11	12	13	14	15
	*1	51	53	53	54	53	54	63	61	60	58
*4	*2 / *3	0.120	0.166	0.175	0.206	0.190	0.236	0.347	0.317	0.285	0.299
3	31	0.160	0.150	0.150	0.160	0.160	0.120	0.220	0.210	0.300	-0.140
4	32	0.180	0.170	0.190	0.170	0.160	0.160	0.270	0.320	0.370	0.200
5	33	0.150	0.160	0.190	0.170	0.160	0.180	0.250	0.310	0.350	0.270
6	34	0.120	0.130	0.180	0.180	0.190	0.210	0.180	0.270	0.300	0.380
7	35	0.040	0.110	0.140	0.140	0.180	0.270	-0.020	-0.010	0.070	0.280
8	36	-0.110	0.080	0.080	0.170	0.170	0.210	-0.210	-0.080	-0.120	0.100
9	37	-0.030	0.200	0.090	0.340	0.070	0.170	-0.160	-0.150	-0.110	0.130
10	38	0.170	0.290	0.280	0.360	0.300	0.410	0.770	1.030	0.680	0.570
11	39	0.360	0.150	0.300	0.350	0.400	0.430	1.540	1.500	0.980	0.870
12	40	0.280	0.020	0.190	0.120	0.270	0.190	1.430	1.260	0.830	0.580
13	41	-0.260	-0.060	-0.200	-0.270	0.010	-0.040	0.630	0.730	0.360	0.260
14	42	-0.330	-0.100	-0.420	-0.330	-0.410	-0.450	-0.510	-0.670	-0.450	-0.330
15	43	-0.370	-0.250	-0.520	-0.530	-0.550	-0.660	-1.280	-1.120	-0.870	-0.760
16	44	-0.360	-0.580	-0.580	-0.730	-0.720	-0.810	-1.240	-1.720	-1.480	-1.210
17	45	-0.210	-0.730	-0.430	-0.630	-0.700	-0.830	-1.250	-1.940	-1.890	-1.540
18	46	-0.225	-0.565	-0.350	-0.490	-0.510	-0.545	-1.215	-1.715	-1.890	-1.600
19	47	0.150	0.010	0.080	-0.040	-0.120	-0.110	-0.610	-0.910	-1.160	-0.820
20	48	0.325	0.365	0.320	0.350	0.250	0.185	-0.365	-0.205	-0.420	-0.030
21	49	0.320	0.520	0.420	0.440	0.420	0.360	0.090	0.390	0.310	0.650
22	50	0.290	0.480	0.440	0.500	0.550	0.540	0.540	0.770	0.730	1.010
23	51	0.250	0.320	0.400	0.460	0.540	0.640	0.600	0.730	0.790	0.880
24	52	0.320	0.370	0.420	0.440	0.500	0.630	0.670	0.770	0.810	0.810
25	53	0.310	0.390	0.370	0.420	0.460	0.530	0.710	0.770	0.840	0.610
26	54	0.340	0.400	0.380	0.390	0.430	0.480	0.550	0.760	0.880	0.570
27	55	0.300	0.310	0.330	0.390	0.370	0.470	0.560	0.700	0.790	0.550
28	56	0.220	0.260	0.330	0.350	0.370	0.410	0.560	0.640	0.730	0.570
29	57	0.230	0.240	0.320	0.350	0.390	0.460	0.490	0.650	0.650	0.530
30	58	0.280	0.300	0.280	0.350	0.430	0.430	0.560	0.620	0.690	0.480
31	59	0.340	0.340	0.330	0.350	0.450	0.470	0.530	0.680	0.650	0.490
32	60	0.370	0.370	0.380	0.370	0.370	0.490	0.550	0.670	0.680	0.500
33	61	0.330	0.350	0.420	0.380	0.360	0.410	0.580	0.730	0.690	0.540
34	62	0.360	0.370	0.420	0.420	0.400	0.470	0.550	0.770	0.700	0.500
35	63	0.360	0.380	0.390	0.410	0.440	0.450	0.600	0.640	0.700	0.460
36	64	0.320	0.360	0.360	0.380	0.450	0.480	0.590	0.620	0.580	0.400
37	65	0.280	0.320	0.330	0.380	0.400	0.480	0.570	0.540	0.510	0.320
38	66	0.220	0.250	0.270	0.320	0.330	0.400	0.520	0.550	0.470	0.270
39	67	0.210	0.240	0.260	0.300	0.310	0.370	0.460	0.480	0.440	0.270
40	68	0.220	0.270	0.300	0.300	0.320	0.350	0.460	0.400	0.440	0.160
41	69	0.240	0.230	0.280	0.270	0.320	0.340	0.410	0.380	0.420	0.200
42	70	0.280	0.230	0.280	0.300	0.320	0.500	0.400	0.380	0.390	0.280
43	71	0.190	0.230	0.200	0.270	0.270	0.430	0.390	0.450	0.370	0.300
44	72	0.140	0.130	0.220	0.230	0.270	0.310	0.320	0.460	0.340	0.370
45	73	0.060	0.160	0.150	0.240	0.240	0.230	0.310	0.430	0.330	0.240
46	74	0.050	0.090	0.130	0.130	0.240	0.110	0.270	0.330	0.310	0.210
47	75	0.150	0.120	0.150	0.120	0.140	0.260	0.260	0.280	0.290	0.200
48	76	0.140	0.190	0.120	0.110	0.150	0.200	0.310	0.250	0.270	0.170
49	77	0.120	0.100	0.020	0.090	0.150	0.170	0.130	0.280	0.220	0.150
50	78	0.080	0.080	-0.020	0.130	0.110	0.130	0.140	0.160	0.230	0.150
51	79	0.080	0.040	0.040	0.090	0.140	0.070	0.150	0.130	0.140	0.210
52	80	0.080	0.060	0.140	0.110	0.060	0.090	0.130	0.110	0.140	0.160
53	81	0.160	0.140	0.270	0.130	0.100	0.090	0.230	0.120	0.140	0.140
54	82	0.150	0.180	0.180	0.140	0.120	0.130	0.080	0.180	0.080	0.120
55	83	0.140	0.190	0.180	0.130	0.130	0.120	0.060	0.100	0.120	0.080
56	84	0.140	0.170	0.170	0.170	0.150	0.180	0.080	0.100	0.080	0.120
57	85	0.100	0.120	0.150	0.180	0.190	0.180	0.160	0.140	0.110	0.090
58	86	0.100	0.080	0.130	0.140	0.170	0.240	0.250	0.220	0.120	0.060

Note ;　* 1 : The year when catch-up with the prewar trend completed.
　* 2 : The standardized regression coefficient at the year when catch-up completed.
　* 3 : The Christian year ; A.D.
　* 4 : The data number.

Table 5 , Successive regression coefficients of stature ; girls

	Age	6	7	8	9	10	11	12	13	14	15
	*1	51	52	52	53	54	54	56	56	58	53
*4	*2 *3	0.132	0.169	0.181	0.218	0.257	0.242	0.252	0.197	0.208	0.171
3	31	0.200	0.190	0.220	0.190	0.210	0.240	0.290	0.170	0.170	0.150
4	32	0.210	0.190	0.200	0.240	0.230	0.240	0.280	0.270	0.210	0.180
5	33	0.220	-0.010	0.200	0.250	0.250	0.240	0.230	0.300	0.220	0.240
6	34	0.180	-0.130	0.170	0.220	0.250	0.240	0.200	0.210	0.230	0.200
7	35	0.090	0.030	0.180	0.190	0.340	0.190	0.070	-0.050	0.070	0.050
8	36	0.030	0.120	0.080	0.040	0.240	-0.010	-0.020	-0.260	-0.090	-0.070
9	37	0.010	0.480	-0.030	0.080	0.120	-0.060	-0.190	-0.250	-0.060	-0.040
10	38	0.040	0.440	0.250	0.270	0.240	0.510	0.690	0.680	0.250	0.230
11	39	0.180	0.290	0.170	0.380	0.300	0.680	1.180	1.200	0.710	0.430
12	40	0.060	0.200	0.260	0.430	0.380	0.470	1.260	1.110	0.740	0.440
13	41	-0.060	0.030	0.160	0.090	0.060	-0.080	0.680	0.670	0.420	0.260
14	42	-0.120	-0.130	-0.180	-0.280	-0.380	-0.680	-0.520	-0.290	-0.050	0.110
15	43	-0.320	-0.460	-0.300	-0.500	-0.710	-0.730	-0.670	-0.410	-0.250	0.010
16	44	-0.360	-0.640	-0.690	-0.780	-0.880	-0.860	-1.130	-0.930	-0.680	-0.290
17	45	-0.350	-0.590	-0.650	-0.660	-0.680	-0.790	-1.360	-1.350	-1.030	-0.550
18	46	-0.165	-0.245	-0.405	-0.435	-0.435	-0.470	-1.450	-1.475	-1.265	-0.770
19	47	0.190	0.170	0.070	-0.030	0.010	-0.020	-1.040	-1.110	-1.030	-0.520
20	48	0.345	0.335	0.355	0.345	0.305	0.350	-0.240	-0.275	-0.235	-0.060
21	49	0.450	0.340	0.450	0.450	0.440	0.670	0.320	0.330	0.250	0.350
22	50	0.390	0.370	0.450	0.530	0.570	0.700	0.600	0.690	0.550	0.500
23	51	0.260	0.340	0.370	0.460	0.560	0.660	0.630	0.610	0.510	0.380
24	52	0.240	0.360	0.400	0.460	0.560	0.580	0.700	0.590	0.410	0.290
25	53	0.150	0.370	0.370	0.430	0.530	0.440	0.740	0.600	0.380	0.190
26	54	0.270	0.280	0.380	0.380	0.540	0.670	0.800	0.610	0.410	0.220
27	55	0.270	0.260	0.330	0.410	0.500	0.670	0.700	0.590	0.420	0.200
28	56	0.200	0.260	0.310	0.370	0.490	0.560	0.640	0.510	0.390	0.200
29	57	0.230	0.250	0.330	0.380	0.490	0.620	0.540	0.480	0.340	0.200
30	58	0.260	0.300	0.310	0.400	0.510	0.590	0.570	0.500	0.350	0.200
31	59	0.330	0.330	0.350	0.380	0.540	0.610	0.540	0.540	0.440	0.220
32	60	0.370	0.350	0.350	0.390	0.410	0.560	0.540	0.500	0.450	0.250
33	61	0.340	0.350	0.350	0.360	0.420	0.420	0.550	0.470	0.390	0.340
34	62	0.380	0.410	0.390	0.410	0.390	0.450	0.530	0.430	0.360	0.330
35	63	0.380	0.400	0.410	0.450	0.450	0.470	0.520	0.390	0.290	0.260
36	64	0.350	0.380	0.410	0.450	0.490	0.530	0.470	0.420	0.310	0.210
37	65	0.310	0.310	0.370	0.420	0.450	0.520	0.430	0.380	0.310	0.160
38	66	0.220	0.250	0.300	0.320	0.440	0.440	0.390	0.370	0.280	0.210
39	67	0.220	0.290	0.270	0.290	0.370	0.410	0.420	0.350	0.300	0.200
40	68	0.230	0.310	0.290	0.320	0.390	0.450	0.400	0.350	0.340	0.190
41	69	0.210	0.270	0.270	0.320	0.370	0.480	0.340	0.350	0.300	0.220
42	70	0.270	0.250	0.310	0.320	0.370	0.410	0.330	0.310	0.270	0.180
43	71	0.190	0.240	0.300	0.290	0.340	0.350	0.300	0.250	0.190	0.160
44	72	0.210	0.170	0.310	0.260	0.310	0.250	0.290	0.210	0.130	0.110
45	73	0.160	0.170	0.220	0.310	0.300	0.270	0.270	0.200	0.180	0.090
46	74	0.100	0.110	0.130	0.190	0.290	0.290	0.220	0.190	0.170	0.140
47	75	0.130	0.100	0.100	0.130	0.180	0.290	0.220	0.190	0.200	0.150
48	76	0.040	0.140	0.040	0.090	0.170	0.170	0.230	0.190	0.190	0.140
49	77	0.060	0.080	0.100	0.060	0.120	0.160	0.170	0.210	0.160	0.120
50	78	0.050	0.070	0.070	0.140	0.080	0.110	0.150	0.170	0.190	0.110
51	79	0.120	0.110	0.070	0.100	0.100	0.070	0.100	0.150	0.180	0.130
52	80	0.160	0.120	0.110	0.100	0.030	0.120	0.070	0.100	0.140	0.140
53	81	0.200	0.150	0.140	0.120	0.070	0.050	0.100	0.090	0.110	0.160
54	82	0.200	0.160	0.190	0.150	0.120	0.120	0.060	0.110	0.070	0.110
55	83	0.160	0.160	0.210	0.180	0.160	0.140	0.100	0.060	0.080	0.100
56	84	0.140	0.180	0.190	0.200	0.160	0.150	0.100	0.050	0.080	0.110
57	85	0.080	0.110	0.130	0.140	0.180	0.140	0.120	0.060	0.050	0.070
58	86	0.070	0.080	0.100	0.110	0.160	0.130	0.110	0.060	0.020	0.050

Note ;　* 1 : The year when catch-up with the prewar trend completed.
　　　　* 2 : The standardized regression coefficient at the year when catch-up completed.
　　　　* 3 : The Christian year ; A.D.
　　　　* 4 : The data number.

Table 6   The years and durations of growth
acceleration ; Stature

	Boys			Girls		
Age	I	II	III	I	II	III
	(A. D.)	(A. D.)	(years)	(A. D.)	(A. D.)	(years)
6	51	72	21	51	73	22
7	53	71	18	52	73	21
8	53	72	19	52	73	21
9	54	73	19	53	73	20
10	53	74	21	54	74	20
11	54	72	18	54	75	21
12	63	71	8	56	73	17
13	60	74	14	56	73	17
14	60	75	15	58	70	12
15	58	72	14	53	70	17

Note ; I : The year when catch-up with the
prewar trend finished.

II : The year when growth acceleration
finished ; the latest year when suc-
cessive standardized regression
coefficient was larger than that of
prewar trend.

III : The duration from I to II.

tion and catch-up were actually recognized in
the prewar and the mean velocities of catch-up
trend were even greater in boys and girls of
growth spurt ages than those of the postwar
catch-up trend.

2)   Body weight

Figures 6 and 7 show the annual changing
trend of body weight of boys and girls aged
from 6 to 15 in the term over 1929 and 1988.
As in stature, the gradual increasing trend was
found until latter-half of 1930s in boys and
girls of all ages. A slight degree of deteriora-
tion could be recognized a little before 1940 for
those of growth spurt ages, and thereafter, the
sharp increasing trend was found definitely in
those of growth spurt ages. Although the de-
terioration started in 1938 for girls of 6 years

old and in 1939 for girls of 10 years old, it
started after 1940 and continued up to a few
years after the Second World War ended in
boys and girls of most ages. Such a deteriora-
tion trend was found more seriously in boys
and girls of growth spurt ages than those of
other ages, and, just as in stature, the term of
deterioration could be divided into two terms ;
sharp term and sharper one. This division was
found especially definite for the boys and girls
of growth spurt ages.

Then, around in 1946 through 1949, the
minimum values appeared in boys and girls of
all ages and then chatch-up trend onset. The
statistics regarding these changing events of
annual trend are shown in the first and second
columns of Table 2. Any significant differ-
ences were not found in the years when max-
imum value appeared between different ages,

but those of growth spurt ages were found later in the year when the minimum was recognized than others.

In the boys and girls of growth spurt ages ; 12, 13 and 14 years old, catch-up with the pre- war trend completed later than in those of other ages. The older the later the catch-up completed in those aged younger than 15. Furthermore, the older the longer duration was required to catch up with the prewar trend,
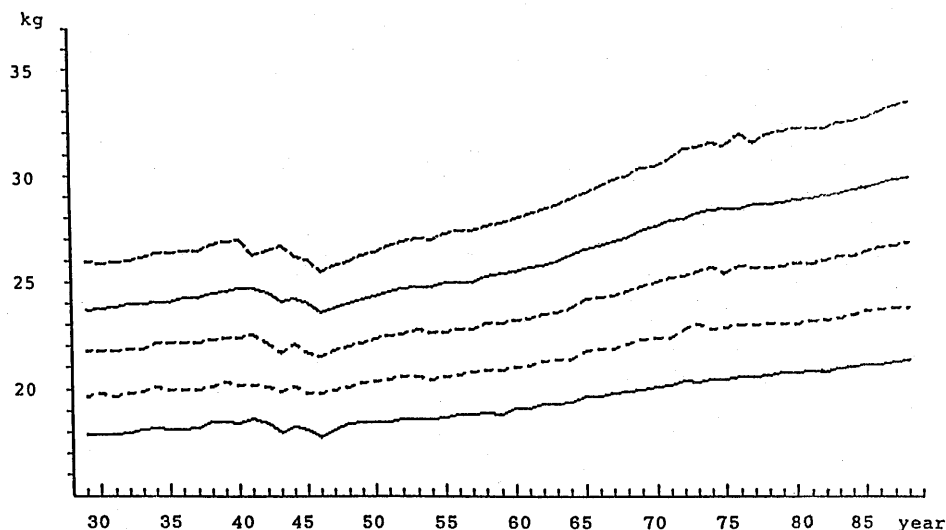
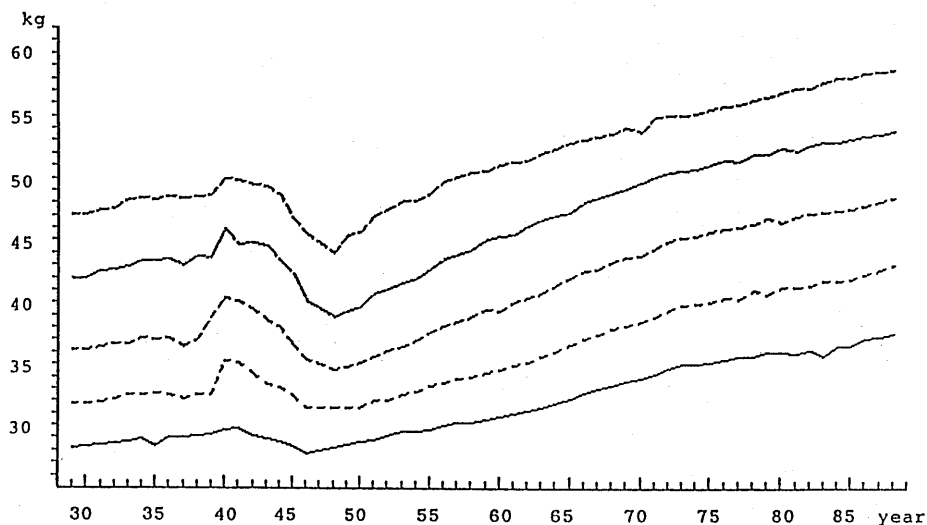Figure 6-1, Secular trend of body weight ; 6 to 10 years boy

Figure 6-2, Secular trend of body weight ; 11 to 15 years boy

even though their mean velocities evaluated by standardized regression coefficient at the year when catch-up completed were larger. In the ages of growth spurt, boys were a few years later to complete the catch-up than girls, but the mean velocities of catch-up trend were larger in boys than in girls. This may suggest that boys were more sensitive to influences in physical growth by the famine and some other conditions to which they were exposed in those
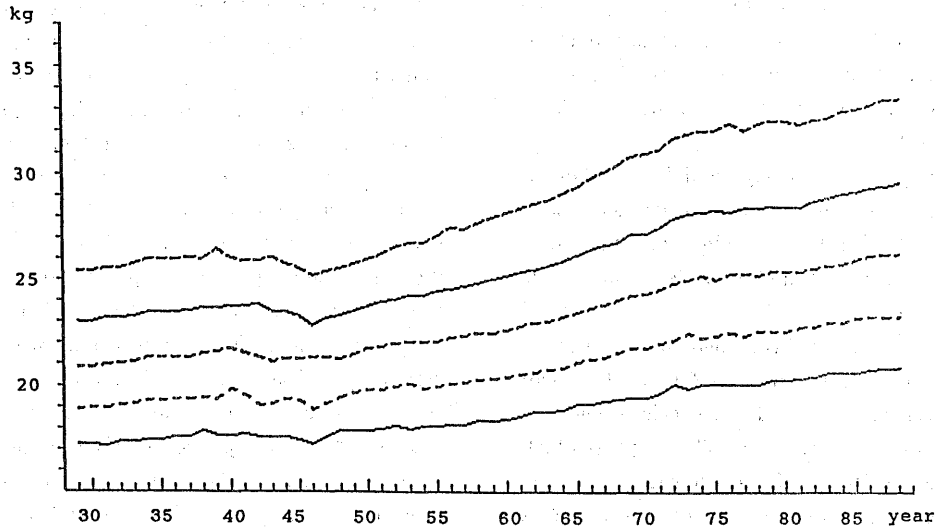

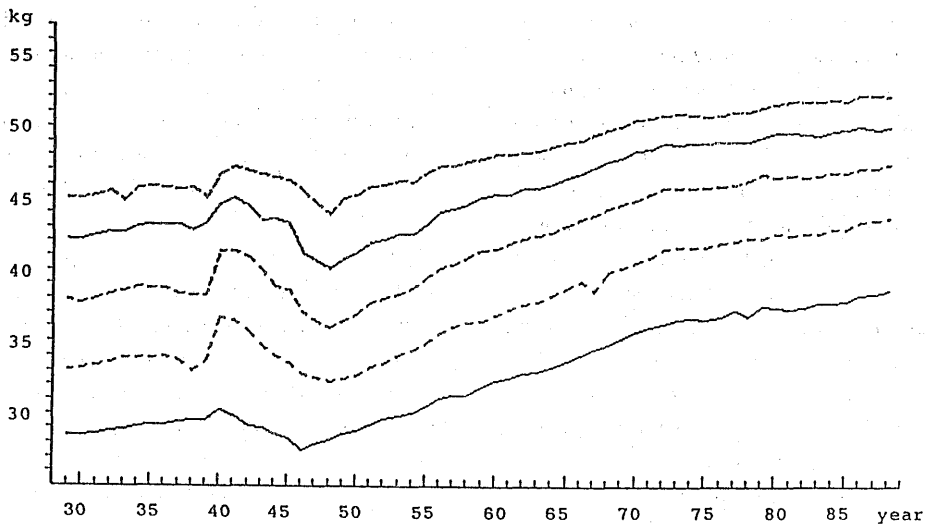Figure 7-1, Secular trend of body weight ; 6 to 10 years girl

Figure 7-2, Secular trend of body weight ; 11 to 15 years girl

days than girls.

The amounts of decrease from the maximum in the prewar to the minimum in the term over 1940 and 1950 are shown in Table 3 . Although the durations of the terms in which deterioration was found were not same in all ages for both sexes, the shortest was 3 years for the girls of 8 years old and the longest 9 years for the boys of 12 years old. It was rather longer in the boys and girls of growth spurt ages, just as in stature, and their amounts of decrease were larger in them, too.

By 11 years old in boys and 10 years old in grils, the relative amounts of decrease were 1.98% to 6.71% but, in older ages, they were greater than 9.24% and 15.25% at largest for the boys of 14 years old.

Compared in relative amount of decrease with stature, it cduld be inferred that body weight generally showed more serious degree of deterioration in both sexes. This is particularly significant in those of growth spurt ages. The mean relative amount of decrease was 3.97% ± 1.64 for stature and 7.98% ± 4.44 for body weight in boys, and 3.07% ± 1.19% for stature and 7.20% ± 3.68% for body weight in girls. Significant differences were found in them between stature and body weight, but no siginifical differences were found in mean duration of deterioration between both sexse. It has been well established that body weight is influenced more easily by various conditions, such as socio-economical, psychological, physical situation of living, than stature. That is why the deterioration trend was found more serious in body weight than stature. Furthermore, any significant differences were not found in these means ; mean duration, mean amount and mean relative amount of deterioration, between boys and girls, so it could be inferred that the same trend of deterioration was realizad in stature and body weight respectively for both boys and girls in those days.

The year when catch-up with the prewar trend completed seemed to get later and also

the years required to catch up with it increased along with age increase up to 14 years old in both sexes. The mean retes of catch-up also got larger due to age increase up to 14 years old. In other words, those who were at growth spurt ages during War followed by famine required more years to catch-up with the prewar trend even with larger velocity to catch up, so the year when such a catch-up completed was later than those of younger ages in both sexes. For the years required to catch up with the prewar trend, body weight seemed to be less than stature, except in those of growth spurt ages.

The durations required to catch up with the maximum in prewar were naturally longer than those for catch-up with the prewar trend, just as in stature. This is also shown in Table 2 . Catch-up with the prewar maximum was completed in 1952 through 1963 in all ages for both sexes. Therefore, it could be inferred that catch-up trend completed by 1963 at latest in both boys and girls and the deterioration caused by War and the famine after War could be recovered by 1963 at latest in both sexes.

Figure 8 shows the successive standardized regression coefficients of body weight for boys aged 6 , just as in Figure 4 for stature. The catch-up with the prewar trend seemed to be completed in 1948, because the coefficient at this year was larger than that of prewar trend, but the coefficient at 1950 was smaller than that of prewar trend. Thus, it could be inferred that such a growth acceleration trend as observed in stature was not found in body weight of boys aged 6 . However, the coefficients became larger than that of prewar trend in 1955 and it continued by 1975. This was found in boys aged from 6 to 10, and girls aged from 6 to 8 . In boys and girls aged older than these ages, such a decrease of coefficient was not found but the same changing trend as shown in stature was found. In boys and girls of these ages mentioned previously, the growth acceleration did not start by several years after catch-up finished. Then, it continued by the
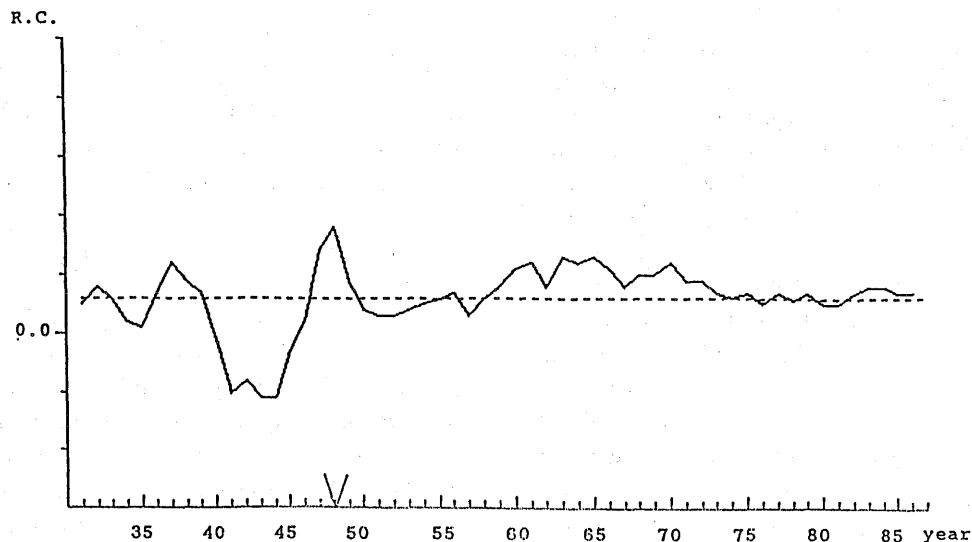
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Figure 8, Successive regression coefficient of secular trend of body weight ; 6 year-old boy

Table 7   The years and durations of growth
acceleration ; Body weight

Age	Boys			Girls		
	I	II	III	I	II	III
	(A. D.)	(A. D.)	(years)	(A. D.)	(A. D.)	(years)
6	48	75	27	47	73	26
7	47	73	26	48	73	25
8	49	74	25	49	73	24
9	50	75	25	49	74	25
10	51	74	23	51	74	23
11	52	78	26	52	73	21
12	56	79	23	55	73	18
13	61	73	12	55	72	17
14	59	72	13	56	71	15
15	56	72	16	53	71	18

Note ; I : The year when catch-up with the
prewar trend finished.

II : The year when growth acceleration
finished ; the latest year when suc-
cessive standardized regression
coefficient was larger than that of
prewar trend.

III : The duration from I to II.

years described in Table 7 , so the durations of growth acceleration were rather longer than those of stature. Although such characteristics of changing trends of coefficients as mentioned previously must be taken into consideration, the growth acceleration finished by 1979 at latest in boys and girls of all ages. Therefore, it could be inferred that the growth acceleration finished in the first-half of 1970s in stature, but it had to be inferred that it finished in 1970s in body weight. Furthermore, it was quite different from stature that growth acceleration did not seem to start soon after the catch-up completed in those aged younger than the growth spurt ages.

In those of growth spurt ages, the years of catch-up with the prewar trend were rather later than those of other ages, and the decline of coefficient below the one of prewar trend was not found, and then, the year when growth acceleration finished was rather later, so the duration of growth acceleration was longer than 20 years, as shown in Table 7 . But, in boys older than 13, and girls older than 12, the duration of the term in which acceleration was recognized was a little shorter than in the younger.

In the prewar, a slight degree of deterioration was found in boys aged 12 and 13, and girls aged older than 12, so the sharp increasing trend after this deterioration term ; so-called catch-up, appeared in them and it continued for a few years, just as in stature. This may be understood well in Figure 9 and also in Tables 8 and 9 . Therefore, as long as the annual changing trend of stature and body weight was investigated with successive standardized regression coefficient, a definite acceleration which continued for only 2 or 3 years appeared in the prewar ; in the term over 1933 and 1938, and the catch-up trend appeared soon after it finished. It lasted only for 2 or 3 years but the rate of catch-up was likely to be even larger than that of postwar catch-up trend in both stature and body weight.

Furthermore, since the latter-half of 1970s at earliest or the first-half of 1980s, the coefficints became larger than those of prewar trend in boys and girls of most ages, except 13and 14 for boys and 14 for girls. In other words. the recent annual trends show somewhat sharper increasing ones than the ones in the prewar for
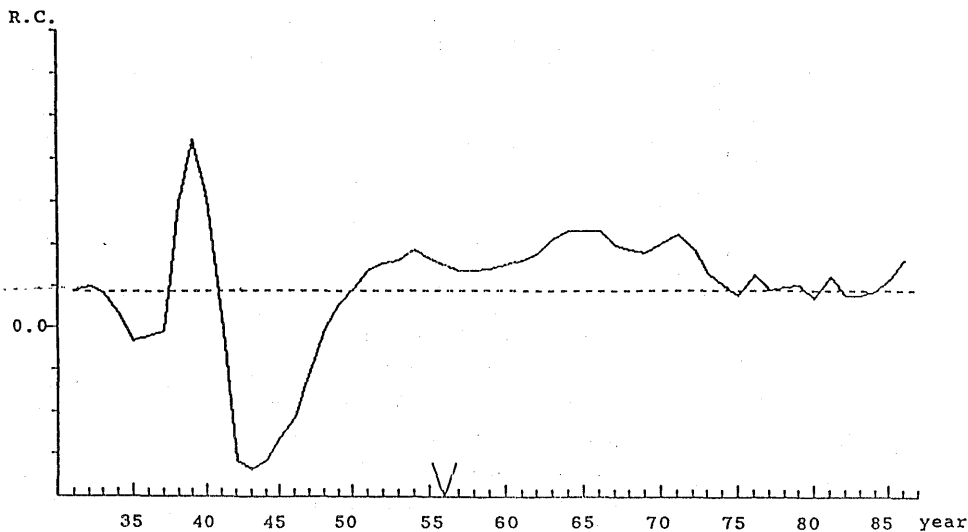

Figure 9 , Successive regression coefficient of secular trend of body weight ; 12 year-old boy

Table 8 , Successive regression coefficients of body weight ; boys

*4	*3	Age	6	7	8	9	10	11	12	13	14	15
		*1	48	47	49	50	51	52	56	61	59	56
		*2	0.059	0.051	0.063	0.087	0.100	0.117	0.172	0.263	0.245	0.201
3	31		0.050	0.040	0.030	0.080	0.060	0.120	0.180	0.150	0.270	0.290
4	32		0.080	0.080	0.090	0.070	0.120	0.120	0.200	0.230	0.320	0.350
5	33		0.060	0.090	0.110	0.050	0.110	-0.010	0.170	0.190	0.250	0.260
6	34		0.020	0.050	0.090	0.070	0.100	0.040	0.070	0.140	0.210	0.180
7	35		0.010	0.010	0.060	0.080	0.070	0.070	-0.060	-0.040	0.030	0.030
8	36		0.070	0.000	0.020	0.100	0.090	0.130	-0.040	-0.100	0.020	0.030
9	37		0.120	0.070	0.050	0.120	0.130	0.220	-0.020	0.340	0.060	0.060
10	38		0.090	0.070	0.060	0.110	0.140	0.150	0.590	0.880	0.540	0.320
11	39		0.070	0.050	0.070	0.100	-0.020	0.200	0.880	1.060	0.560	0.430
12	40		-0.010	-0.010	-0.030	0.010	-0.120	0.050	0.610	0.620	0.330	0.320
13	41		-0.100	-0.090	-0.170	-0.120	-0.090	-0.120	0.050	-0.150	0.090	0.090
14	42		-0.080	-0.050	-0.140	-0.160	-0.120	-0.270	-0.630	-0.630	-0.510	-0.330
15	43		-0.110	-0.080	-0.160	-0.170	-0.070	-0.350	-0.670	-0.850	-0.620	-0.710
16	44		-0.110	-0.070	-0.120	-0.190	-0.260	-0.340	-0.630	-1.020	-1.150	-1.060
17	45		-0.030	-0.010	-0.040	-0.120	-0.270	-0.250	-0.520	-0.980	-1.320	-1.210
18	46		0.020	0.020	-0.010	-0.060	-0.070	-0.130	-0.430	-0.860	-1.170	-1.110
19	47		0.140	0.130	0.150	0.080	0.090	0.080	-0.210	-0.450	-0.730	-0.410
20	48		0.180	0.150	0.220	0.200	0.230	0.230	-0.010	-0.080	-0.130	0.100
21	49		0.090	0.130	0.180	0.200	0.220	0.210	0.110	0.180	0.300	0.610
22	50		0.040	0.120	0.150	0.180	0.220	0.230	0.180	0.400	0.580	0.840
23	51		0.030	0.080	0.140	0.150	0.210	0.250	0.270	0.440	0.600	0.710
24	52		0.030	0.030	0.090	0.100	0.160	0.230	0.310	0.450	0.530	0.610
25	53		0.040	0.010	0.050	0.090	0.130	0.210	0.320	0.480	0.480	0.440
26	54		0.050	0.020	0.030	0.080	0.120	0.180	0.370	0.510	0.590	0.530
27	55		0.060	0.060	0.010	0.060	0.100	0.190	0.330	0.520	0.600	0.550
28	56		0.070	0.100	0.090	0.100	0.130	0.190	0.300	0.470	0.570	0.570
29	57		0.030	0.080	0.110	0.110	0.120	0.180	0.270	0.430	0.530	0.430
30	58		0.060	0.070	0.110	0.140	0.160	0.170	0.270	0.330	0.480	0.310
31	59		0.080	0.070	0.110	0.160	0.200	0.210	0.280	0.350	0.430	0.300
32	60		0.110	0.100	0.100	0.130	0.200	0.250	0.300	0.380	0.420	0.270
33	61		0.120	0.130	0.130	0.150	0.200	0.250	0.320	0.370	0.400	0.320
34	62		0.080	0.110	0.150	0.190	0.220	0.270	0.350	0.490	0.460	0.330
35	63		0.130	0.150	0.210	0.230	0.250	0.300	0.420	0.500	0.450	0.390
36	64		0.120	0.160	0.220	0.240	0.280	0.350	0.460	0.550	0.440	0.400
37	65		0.130	0.150	0.210	0.220	0.300	0.380	0.460	0.510	0.460	0.330
38	66		0.110	0.150	0.180	0.190	0.280	0.360	0.460	0.450	0.480	0.290
39	67		0.080	0.120	0.150	0.200	0.290	0.340	0.390	0.400	0.460	0.290
40	68		0.100	0.140	0.180	0.230	0.260	0.300	0.370	0.330	0.390	0.210
41	69		0.100	0.130	0.200	0.250	0.250	0.300	0.360	0.360	0.420	0.320
42	70		0.120	0.150	0.180	0.230	0.300	0.360	0.400	0.390	0.420	0.380
43	71		0.090	0.180	0.170	0.220	0.280	0.370	0.440	0.440	0.360	0.330
44	72		0.090	0.140	0.170	0.200	0.280	0.320	0.370	0.410	0.260	0.300
45	73		0.070	0.100	0.080	0.160	0.170	0.230	0.260	0.300	0.210	0.130
46	74		0.060	0.030	0.090	0.120	0.150	0.160	0.200	0.240	0.250	0.180
47	75		0.070	0.020	0.050	0.090	0.080	0.160	0.150	0.220	0.230	0.220
48	76		0.050	0.070	0.030	0.080	0.090	0.160	0.250	0.240	0.250	0.260
49	77		0.070	0.050	0.070	0.080	0.140	0.180	0.180	0.260	0.220	0.250
50	78		0.060	0.030	0.030	0.090	0.120	0.160	0.190	0.170	0.240	0.280
51	79		0.070	0.040	0.060	0.080	0.170	0.100	0.200	0.170	0.210	0.320
52	80		0.050	0.050	0.090	0.100	0.070	0.090	0.140	0.170	0.180	0.250
53	81		0.050	0.080	0.120	0.100	0.080	-0.070	0.240	0.170	0.210	0.270
54	82		0.070	0.100	0.120	0.120	0.110	0.050	0.150	0.220	0.170	0.270
55	83		0.080	0.120	0.140	0.130	0.140	0.150	0.150	0.140	0.200	0.240
56	84		0.080	0.130	0.140	0.150	0.180	0.270	0.170	0.140	0.160	0.270
57	85		0.070	0.130	0.140	0.170	0.200	0.380	0.230	0.200	0.170	0.200
58	86		0.070	0.100	0.150	0.160	0.220	0.270	0.320	0.260	0.200	0.170

Note ;　* 1 : The year when catch-up with the prewar trend completed.
　　　 * 2 : The standardized regression coefficient at the year when catch-up completed.
　　　 * 3 : The Christian year ; A.D.
　　　 * 4 : The data number.

Table 9, Successive regression coefficients of body weight ; girls

	Age	6	7	8	9	10	11	12	13	14	15
	*1	47	48	49	49	51	52	55	55	56	53
*4	*2 *3	0.060	0.071	0.082	0.070	0.095	0.137	0.145	0.153	0.192	0.127
3	31	0.030	0.070	0.080	0.080	0.100	0.110	0.200	0.180	0.180	0.010
4	32	0.060	0.080	0.120	0.110	0.140	0.150	0.190	0.270	0.230	0.120
5	33	0.070	0.080	0.110	0.090	0.120	0.150	0.130	0.190	0.200	0.170
6	34	0.050	0.070	0.080	0.080	0.100	0.110	0.080	0.100	0.150	0.170
7	35	0.050	0.050	0.040	0.060	0.060	0.110	-0.030	-0.050	0.110	0.160
8	36	0.090	0.050	0.040	0.050	0.010	0.100	-0.220	-0.160	-0.060	-0.050
9	37	0.070	0.030	0.080	0.060	0.100	0.090	-0.150	-0.150	-0.020	-0.190
10	38	0.030	0.100	0.110	0.070	0.060	0.230	0.540	0.510	0.290	0.120
11	39	0.020	0.080	0.060	0.050	-0.030	0.180	0.940	0.910	0.540	0.420
12	40	-0.050	-0.060	-0.050	0.050	-0.080	-0.040	0.820	0.850	0.490	0.460
13	41	-0.030	-0.120	-0.140	-0.030	-0.100	-0.220	0.090	0.320	0.020	0.360
14	42	-0.040	-0.140	-0.140	-0.090	-0.040	-0.430	-0.720	-0.630	-0.350	-0.090
15	43	-0.060	-0.030	-0.070	-0.140	-0.070	-0.370	-0.740	-0.750	-0.420	-0.220
16	44	-0.070	-0.030	0.010	-0.220	-0.190	-0.390	-0.690	-0.900	-0.660	-0.320
17	45	-0.030	-0.050	0.050	-0.120	-0.200	-0.330	-0.570	-0.870	-0.800	-0.500
18	46	0.070	0.010	0.010	-0.030	-0.060	-0.120	-0.470	-0.790	-0.960	-0.680
19	47	0.140	0.140	0.030	0.110	0.080	0.130	-0.290	-0.540	-0.610	-0.420
20	48	0.150	0.230	0.090	0.220	0.200	0.330	-0.030	-0.040	0.010	-0.030
21	49	0.080	0.150	0.150	0.200	0.200	0.320	0.200	0.340	0.350	0.370
22	50	0.050	0.110	0.180	0.180	0.240	0.340	0.350	0.540	0.510	0.510
23	51	0.040	0.100	0.140	0.170	0.260	0.340	0.430	0.470	0.430	0.340
24	52	0.040	0.050	0.080	0.130	0.220	0.330	0.440	0.420	0.340	0.240
25	53	0.020	0.030	0.050	0.120	0.200	0.310	0.410	0.410	0.310	0.200
26	54	0.030	0.010	0.060	0.120	0.210	0.360	0.500	0.550	0.470	0.310
27	55	0.050	0.040	0.080	0.110	0.190	0.380	0.500	0.570	0.510	0.310
28	56	0.070	0.100	0.110	0.140	0.210	0.320	0.510	0.540	0.510	0.330
29	57	0.080	0.100	0.100	0.150	0.200	0.300	0.400	0.470	0.430	0.230
30	58	0.080	0.100	0.090	0.160	0.200	0.300	0.310	0.360	0.320	0.210
31	59	0.090	0.100	0.120	0.170	0.250	0.340	0.310	0.360	0.270	0.210
32	60	0.100	0.100	0.140	0.150	0.220	0.360	0.320	0.310	0.240	0.150
33	61	0.110	0.100	0.150	0.150	0.200	0.250	0.330	0.270	0.180	0.110
34	62	0.100	0.100	0.140	0.170	0.220	0.240	0.310	0.290	0.210	0.120
35	63	0.130	0.140	0.150	0.200	0.250	0.290	0.340	0.310	0.280	0.200
36	64	0.120	0.160	0.180	0.250	0.300	0.340	0.410	0.360	0.290	0.240
37	65	0.130	0.160	0.200	0.260	0.330	0.400	0.240	0.390	0.350	0.290
38	66	0.110	0.160	0.200	0.230	0.330	0.380	0.320	0.390	0.370	0.300
39	67	0.080	0.150	0.200	0.230	0.340	0.370	0.370	0.350	0.340	0.290
40	68	0.080	0.140	0.180	0.190	0.310	0.390	0.450	0.330	0.360	0.330
41	69	0.090	0.140	0.170	0.200	0.260	0.390	0.550	0.340	0.310	0.290
42	70	0.160	0.140	0.190	0.250	0.290	0.380	0.390	0.350	0.300	0.260
43	71	0.140	0.180	0.190	0.250	0.290	0.340	0.370	0.320	0.230	0.210
44	72	0.140	0.150	0.200	0.260	0.280	0.260	0.270	0.210	0.130	0.090
45	73	0.080	0.090	0.110	0.190	0.210	0.160	0.150	0.100	0.080	0.020
46	74	0.020	0.050	0.080	0.080	0.150	0.100	0.080	0.040	0.030	-0.020
47	75	0.040	0.000	0.070	0.060	0.060	0.130	0.110	0.060	0.050	0.020
48	76	0.000	0.060	0.030	0.050	0.080	0.080	0.160	0.140	0.030	0.070
49	77	0.040	0.050	0.070	0.060	0.100	0.180	0.150	0.220	0.100	0.140
50	78	0.060	0.040	0.030	0.070	0.070	0.150	0.160	0.190	0.180	0.170
51	79	0.080	0.080	0.040	0.030	0.090	0.080	0.120	0.140	0.210	0.190
52	80	0.090	0.060	0.080	0.080	0.030	0.100	0.080	0.080	0.150	0.180
53	81	0.100	0.100	0.080	0.110	0.050	0.040	0.070	-0.020	0.010	0.100
54	82	0.110	0.100	0.110	0.160	0.130	0.100	0.080	0.060	0.000	0.060
55	83	0.080	0.100	0.140	0.170	0.180	0.130	0.140	0.070	0.060	0.010
56	84	0.060	0.120	0.150	0.150	0.180	0.170	0.210	0.140	0.140	0.080
57	85	0.050	0.090	0.160	0.150	0.210	0.170	0.230	0.130	0.110	0.110
58	86	0.060	0.070	0.130	0.130	0.170	0.210	0.200	0.130	0.040	0.080

Note ;　　* 1 : The year when catch-up with the prewar trend completed.
　　　　* 2 : The standardized regression coefficient at the year when catch-up completed.
　　　　* 3 : The Christian year ; A.D.
　　　　* 4 : The data number.

both boys and girls aged younger than the growth spurt ages, but this was not found in stature.

IV. Discussion

The annual chaging trend of stature and body weight has been often discussed to clarify the effect of nutrition upon rate of growth in Japan and also in several foreign countruies ; e.g., in Sweden by Abramson and Ernest (1954), England by Clements (1953), Japan by Kimura, Hagiya and Kitano (1959), Germany by Lenz and Ort (1958) and so on. Particularly, the effects of the famine associated with war have been discussed by many researchers, such as Tanner, J.M. (1962), Laporte, M (1946), Ellis, R.W.B. (1946), Kawahata, A. (1969) and so on. The deterioration of body size caused by the wartime famine was reported in many countries, as referred to the papers mentioned above. In Japan, such a deterioration was also recognized, as described already in this paper and several studies by Kawahata et al. (1969). Tanner (1962) stated that a uniform increase was recognized in stature and body weight of school children ged 6 to 17 of Germany, and Kawahata (1969) also reported the slow increasing trend continued in stature and body weight by 1940. The similar findings also were reported in papers by Weir (1952) and Clements (1953). In this study, however, the deteriortion was recognized in stature and body weight before 1940, although its degree was rather small and the duration of the term in which it contimued was only a few years.

The rates of catch-up after this were greater in boys and girls of growth spurt ages than those of postwar catch-up trend. During latter-half of 1920s and first-half of 1930s, Japanese were exposed by the economical depression, so they might experience malnutrition associated with it. Such relatively slight degree of malnutrition might result in relatively slight deterioration of body size especially for those of growth spurt ages. The deteriolation of this kind has never been discussed in any papers and reports published so far in any countries.

Japan already engaged in Chinese war since 1936 and the Second World War started in 1941, but such a deterioration could be recovered and caught up by 1940 in boys and girls of all ages. Kawahata (1969) defined the annual sharp increase in physique of same age as the one aspect of growth acceleration and reported that it started around 1955. This study, however, suggested such growth acceleration started in 1951 through 1963 for stature and in 1948 through 1961 for body weight, although some variation was found in the year of its onset due to age. Particularly, it was likely to be later for those of growth spurt ages. This study also concluded that the growth acceleration finished by the first-half of 1970s for stature and 1970s for body weight in both sexes. In other words, the year when growth acceleration of stature terminated was different from that of body weight. Generally it could be conconcluded that it is a little later in body weight than stature.

Matsuura (1982) analyzed the past annual trends of several physical fitness measures in order to predict their future status and reported that the growth and developmental acceleration finishied by the first-half of 1970s. His inference, however, was induced by fitting straight line to a series of annual data in some specific year interval and evaluating its tangent. He did not find any facts regarding the deterioration and catch-up in the prewar, which was mentioned previously, and the specific year interval was determined rather subjectively with visual inspection on annual trend data plotted on computer display. This problem could be resolved in this study with application of successive regression analysis, so the year when the growth acceleration finished could be identified rather objectively. Many studies have reported about the growth acceleration after War but no studies reported about whether it

is continuing or not at present, when it finished if finished, and why it can be concluded that the growth acceleratlion finished, and so on. This study, however, could give some answers about these questions.

In order to find out the characteristics of annual changing trend of stature and body weight in boys and girls aged from 6 to 15, the mean gradient of increase in the prewar, the mean gradient of catch-up trend, the mean rate of increase in the growth acceleration term, and the mean rates of change in a given term were evaluated by the standardized regression coefficient computed with successive five annual data. Then, several facts that have been never discussed in any studies were found in this study.

V. **Summary anb conclusions**

This study was designed to clarify several questions about annual changing trend of stature and body weight of Japanese children and youth, which were mentioned in the introduction of this paper. In order to analyze the annual changing trend, successive regression analysis was applied, and the standardized regression coefficient was utillized as one of indicators of changing trend at a given year. This implies the mean relative rate of change and resulted in some interesting facts regarding the annual trend of stature and body weight of boys and girls of same ages.

Then, the following conclusions were induced.

1) Slight deterioration was recognized for a few years in the prewar; around in latter-half of 1930s, and the catch-up trend also appeared. This was especially significant in boys and girls of growth spurt ages; 11, 12 and 13 years old.

2) The catch-up trend appeared in the prewar was even sharper than the one appeared in the postwar for those of growth spurt ages.

3) Deterioration caused by the poor intake of nutrition in and after the Second World War

started in 1940 or 1941 for both stature and body weight in both sexes. The catch-up associated with this deterioration started in latter-half of 1940s and completed in first-half of 1950s through first-half of 1960s.

4) In boys and girls aged younger than growth spurt ages, the catch-up started earlier in body weight than stature. But this was not found in those of growth spurt ages.

5) More durations were required to catch up with the prewar trend in boys and girls of growth spurt ages than others. This may imply that those who were in the age of growth spurt are more sensitive to the influences by the famine associated with Second World War.

6) In both stature and body weight, the duration required to catch up with the prewar trend was longer in boys than girls when they were at the ages of growth spurt, and the amount of deterioration also was larger in boys than girls. Thus, this may imply that boys are more sensitive to the influences by War followed by famine.

7) Relative amounts of deterioration were larger in body weight than stature in both sexes, but less durations were required to catch up with the prewar trend in body weight than stature. This implies the fact well established by many studies that body weight is more sensitive to the environmental conditions than stature.

8) In stature, the mean rate of increase evaluated by standardized regression coefficient computed with successive five annual data did not show any decrease by several years after the catch-up completed for both boys and girls of all ages. This is one of evidences implying appearance of growth acceleration soon after catch-up completed.

9) The growth acceleration continued up to the first-half of 1970s in stature for both boys and girls of all ages, although there were some differences in the year when it finished. Then, the durations of term in which growth acceleretion continued ranged from 8 to 22 years. The

durations raquired for catch-up with the pre-war trend were longer in boys and girls of growth spurt ages than those aged younger, so their durations of growth acceleration were shorter.

10) In body weight, the growth acceleration was also found after the catch-up with the pre-war trend of body weight, but it did not seem to start soon after the catch-up completed in boys and girls aged younger than growth spurt age; younger than 10 for boys and 9 for girls. However, it started soon after catch-up completed in boys and girls of growth spurt ages.

11) Growth acceleration appeared in both stature and body weight for both sexes, but stature was likely to be different in its nature from body weight.

12) In body weight, the recent annual trends show a little sharper increasing ones than the prewar trends in both boys and grils of most ages, but this was not found in stature.

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