

Short Communication

Body Constitution of Young Male Workers in Kyoto, Japan in the World War II Period

Shunen INUI, Tetsuya ASaeda, Katsuya FURUKI, Hidenobu KAWABATA, Soichiro KASAI, Takafumi ESAKI and Masayuki IKEDA

Kyoto Industrial Health Association

Key words: Body mass index, Height, Weight, World War II, Workers

It is well known that the body size of young people may be reduced during wartime and that it was especially true during the World War II. For example, the reduction in growth was remarkable in primary school children in Sendai, Japan, in the 1940s¹. Records of body measurements of working populations are however extremely scarce, possibly because they were destroyed during the wartime. We have succeeded in locating a report by Miyagi *et al.*² on the health status of young male workers in the city of Kyoto as measured during the World War II, which was submitted in 1943 to the Government of Japan. It is the purpose of the present communication to make the data² open to the public and to evaluate the observation in comparison with the findings in counterpart current populations.

Materials

The data reported by Miyagi *et al.*² included the height and the weight of workers in small- to medium-scale industries in Kyoto. The measurements were repeated at least three times, once each in April and October 1942 and then in April 1943, on about 1,500 male workers at 14 to 24 years of age, a majority (80.2%) being 15–19 year-old. There were small variations in the number of the examinees depending on the occasions of the measurements, yet it appeared quite likely that the same workers were examined on the three occasions and that the variation was attributable to the absence from the health examination. The records on height and weight are reproduced in Tables 1 and 2, respectively. The body mass index {BMI or weight (in kg)/[height (in m)]²} was calculated by the present authors using average weight and height in the absence of data on individuals.

Results and Discussion

Table 1 shows the growth of the young people in height. It should be noted that the values are based on the cross-sectional measurement of the people of various ages and not on the cohort study of the same individuals. Nevertheless, it appears likely that growth in height was

terminated by the age of 20 years at latest. The same analysis in weight in Table 2 also suggests the termination of growth in weight at about 20 years of age. The body size of boys therefore reached a plateau at 163.3 cm in height and 51.7 kg in weight (i.e., the measures of 20 year-old boys in April, 1943). Their average BMI was 19.8 (Table 2). It should be noted that the examinees never reached 21 in BMI on a group basis. The largest BMI among the groups was 20.3 when 17 year-old boys were examined in October, 1942. An important point to be taken into account in evaluating the values for those at ≥20 years of age is the possible effect of the military draft. The number of workers aged 20 years and over was much less than those at younger ages, very probably because many of those at ≥20 years were drafted

Table 1. Height of the examinees by age and time of measurement

Age ^a in years	Height (in cm) measured in:		
	April, 1942	October, 1942	April, 1943
14	145.5 ± 8.3 (83)	148.3 ± 8.5 (81)	151.3 ± 8.3 (82)
15	150.4 ± 7.4 (259)	152.1 ± 7.4 (256)	154.4 ± 6.7 (266)
16	154.0 ± 7.5 (349)	156.8 ± 7.0 (305)	157.9 ± 6.6 (329)
17	158.2 ± 5.3 (249)	159.0 ± 5.1 (251)	159.7 ± 4.9 (258)
18	161.0 ± 5.5 (179)	161.1 ± 5.5 (174)	161.3 ± 5.5 (186)
19	161.2 ± 6.5 (170)	161.9 ± 6.4 (160)	161.7 ± 6.4 (170)
20	161.8 ± 6.2 (59)	161.8 ± 6.2 (60)	161.8 ± 6.4 (62)
21	161.4 ± 6.7 (37)	161.7 ± 5.6 (39)	161.7 ± 6.6 (43)
22	160.8 ± 6.7 (41)	160.7 ± 6.8 (45)	160.6 ± 6.9 (47)
23	160.7 ± 6.8 (43)	160.3 ± 7.1 (47)	160.5 ± 7.1 (48)
24	161.3 ± 5.1 (34)	161.4 ± 5.1 (31)	161.5 ± 4.0 (34)

Cited from Miyagi *et al.*². Values are mean ± standard deviation (number of the examinees in parenthesis). ^aAge by the year of birth as in 1942, e.g., boys born in 1928 were grouped as 14 years-old.

Table 2. Weight and BMI of the examinees by age and time of measurement

Age ^a in years	Weight (in kg) measured in:		
	April, 1942	October, 1942	April, 1943
14	38.1 ± 6.7 (18.0)	41.2 ± 1.3 (18.8)	41.8 ± 6.8 (18.2)
15	40.3 ± 5.8 (17.9)	42.6 ± 5.8 (18.4)	44.0 ± 5.7 (18.5)
16	42.9 ± 6.6 (18.1)	45.8 ± 5.9 (18.6)	47.6 ± 6.1 (19.1)
17	49.5 ± 4.7 (19.8)	51.4 ± 5.7 (20.3)	51.1 ± 5.3 (20.0)
18	50.8 ± 5.0 (19.6)	51.5 ± 5.1 (19.8)	51.7 ± 5.0 (19.8)
19	51.1 ± 5.4 (19.7)	51.9 ± 5.6 (19.8)	51.7 ± 5.1 (19.8)
20	51.1 ± 5.4 (19.5)	51.4 ± 5.7 (19.6)	51.7 ± 5.5 (19.8)
21	48.9 ± 4.6 (18.8)	49.0 ± 4.6 (18.8)	50.0 ± 4.4 (19.1)
22	49.5 ± 5.4 (19.1)	51.6 ± 5.2 (20.0)	50.5 ± 5.5 (19.6)
23	49.7 ± 3.7 (19.2)	50.5 ± 4.4 (19.7)	50.6 ± 4.6 (19.6)
24	49.6 ± 2.2 (19.1)	49.8 ± 5.5 (19.1)	50.3 ± 4.9 (19.3)

Cited from Miyagi *et al.*². Values are mean ± standard deviation of weight. Values in parentheses are BMIs defined as weight (in kg)/[height (in m)]². ^aAge is defined as under Table 1.

Received June 20, 1996; Accepted Sept 2, 1996

Correspondence to: M. Ikeda, Kyoto Industrial Health Association, 67 Nishinokyo-Kitatsuboicho, Nakagyo-ku, Kyoto 604, Japan

Table 3. Height of 11 to 24 year-old male Japanese, reported in literature

Age ^a	1941 ^b	1949 ^b	1959 ^b	1970 ^b	1980 ^b	1989 ^b	1993 ^c	1993 ^d	1995 ^d
11	131.1	132.8	136	139.0	143.5	144.6	143.8	144.7	144.9
12	135.9	137.7	142	145.2	150.5	151.4	152.4	151.8	152.0
13	141.5	143.9	147	152.3	158.0	159.0	158.5	159.4	159.6
14	147.5	152.4	152	158.4	164.0	164.9	164.6	165.0	165.1
15	153.4	157.0	156	161.9	167.0	168.5	168.1	168.4	168.5
16	157.4	159.5	159	164.0	168.5	169.9	169.6	170.0	170.0
17	159.4	161.0	161	165.4	170.0	170.8	171.4	170.7	170.8
18	160.0	161.7	162	166.2	170.5	171.3	171.3		
19	160.0	161.8	163	166.6	170.5	171.5	171.1		
20	160.0	161.9	163	—	170.0	—	170.5		
21	—	—	163	—	170.0	—	169.6		
22	160.0 ^e	161.8 ^c	163	166.5 ^f	169.5	171.1 ^f	169.5		
23	—	—	162	—	169.5	—	171.1		
24	—	—	162	—	169.5	—	172.0		

^a Age as in 1941 is probably defined as under Table 1, whereas those in 1949 and thereafter are by the date of birth. ^b Estimated standard body size for calculation of nutrient intake, possibly the autumn values; cited from the Ministry of Health and Welfare³). ^c Measured in autumn; cited from the Ministry of Health and Welfare⁴). ^d Measured in spring; cited from the Ministry of Education, Science and Culture⁵). ^e Values for 21 to 30 years of age. ^f Values for 20 to 29 years of age.

and moved out of the workshops. Stout boys were more prone to be drafted, and as a result only boys with poorer physical constitution might be left in the industries.

Tables 3 and 4 summarize 1941 to 1995 values of height and BMI, respectively, for general male Japanese at the ages of 14 to 24 years as reported in literature³⁻⁵). The values from the Ministry of Health and Welfare³⁻⁴) were either the estimates or the measures of a small number of people (i.e., about 100 boys per age) although they cover a wide range of ages, whereas the Ministry of Education, Science and Culture values⁵) are based on a huge number of measurements (i.e., over 40 thousand boys/age) but limited to school ages, although both data cover a whole country of Japan. Comparison of the data in Tables 1 and 2 with those in Tables 3 and 4 made it clear that the wartime young workers in Kyoto in 1942 were in fact 1–2 cm shorter in height and 0.5–1.0 smaller in BMI than the national standard of the time (i.e., the standard for the year 1941, set as a basis for estimating necessary food supply), probably reflecting the shortage of food supply at that time.

Both Tables 3 and 4 show rapid improvement in body size during the period from 1940 to 1980, followed by less rapid but steady increase from 1980 to 1995. Accordingly, young boys became taller and also gained in BMI. It is not possible to evaluate the extent of growth retardation of the

Table 4. Body mass index 11 to 24 year-old male Japanese, calculated from the height and weight values in literature

Age ^a	1941 ^b	1949 ^b	1959 ^b	1970 ^b	1980 ^b	1989 ^b	1993 ^c	1993 ^d	1995 ^d
11	16.3	16.4	16.5	16.5	18.0	17.8	18.6	18.3	18.4
12	17.3	17.0	16.9	17.1	18.5	18.4	19.1	19.1	19.1
13	18.4	17.6	17.8	17.7	19.2	19.1	19.0	19.4	19.6
14	18.4	18.6	18.8	19.1	19.7	19.8	20.0	20.1	20.1
15	19.2	19.3	19.7	20.0	20.4	20.4	20.5	21.1	21.1
16	19.8	19.9	20.4	20.5	21.0	20.9	21.2	21.3	21.3
17	20.6	20.3	20.6	20.8	21.1	21.1	20.8	21.6	21.6
18	21.3	20.6	20.8	21.0	21.2	21.2	21.4		
19	21.9	20.7	20.7	21.2	21.2	21.2	21.4		
20	22.3	20.9	20.9	—	21.3	—	21.9		
21	—	—	20.9	—	21.5	—	21.6		
22	21.6 ^e	21.2 ^c	20.9	21.5 ^f	21.6	21.9 ^f	21.8		
23	—	—	21.1	—	21.6	—	21.6		
24	—	—	21.1	—	21.8	—	22.5		

Notes ^{a, b, c, d, e} and ^f are as under Table 4.

male workers in the year 1942 in terms of age, but in fact they never reached present day height or BMI even after maturation (e.g., at 20 years of age). A simple comparison of the height and BMI of the 14–15 year-old male workers (Tables 1 and 2) with those of their present day counterparts would suggest that the former values are more or less similar to the values for current 11 to 12 year-old boys. If such be the case, it appears that there was growth retardation by three years in 1942.

Acknowledgments: The authors are grateful to Mr. K. Nakata, Kyoto Industrial Health Association, Kyoto, Japan for his interest in this work.

References

- 1) Kondo S, Takahashi E, Kato K, Takahashi S, Ikeda M. Secular trends in height and weight of Japanese pupils. *Tohoku J Exp Med* 1978; 126: 203–213.
- 2) Miyagi O, Nakamura M, Urugami T. Health status of workers in small to medium-scale industries in Kyoto, Japan: A report to the Government of Japan. Kyoto: Kyoto Industrial Health Association, 1943 (in Japanese).
- 3) Ministry of Health and Welfare, the Government of Japan. *Nutritional Status in Japan, 1993*. Tokyo: Ministry of Finance Printing Bureau, 1995 (in Japanese).
- 4) Ministry of Health and Welfare, the Government of Japan. *Recommended Dietary Allowances for Japanese, 5th Version*. Tokyo: Dai-ichi Shuppan Press, 1994 (in Japanese).
- 5) Ministry of Education, Science and Culture, the Government of Japan. *School Health Statistics, 1995*. Tokyo: Ministry of Finance Printing Bureau, 1996 (in Japanese).