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Symposium: Human Body Composition

Chairman: Dr. Alex F. Roche

“Body composition of the Japanese”

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Mr. chairman, members of the Symposium, ladies and gentlemen.

It is a great pleasure for me to be here and to be allowed to speak about “The characteristics of body composition in the Japanese”.

Today I would like to review the present state of knowledge concerning the body composition of Japanese population.

In 1980, a comprehensive study on the body composition of the Japanese was promoted by a grant from Japanese Ministry of Education, Culture, and Sciences. About twenty anthropologists in this field participated into the study. I, and Dr. Yasukouchi, and Dr. Sato, were members of the research group. So, my report will closely relate with the previous study.

May I have the first slide please?

(Slide 1): The growing changes in the stature are shown in the range of age between 5 years old and 18 years old. The large open circles mean the mean values of the stature of the Japanese, and those broken lines show the range of ±1 standard deviation. As you can see from this slide, the Japanese are taller than people in Singapore or India, and their general tendency of the changes in stature resembles those of Caucasians, such as people in Czechoslovakia, Netherlands, and Sweden, at least before puberty. But, the growing rates of the Japanese become smaller after 14 years old for males and 12 years old for females comparing with the Caucasians.

Second slide, please.

(Slide 2): These figures in this slide show the changes in body weight. The symbols are the same as the first slide. The Japanese are heavier than the Singaporean or Indian and become lighter than such Caucasian as the Swedish, the Dutch, or the Czechoslovak after about 15 years old. We can see the general tendency of body weight is similar to that of the stature.

Next slide, please.

(Slide 3): These slide shows the skin-fold thickness at triceps and sub-scapular sites of male group aged from 3 to 18 years old. The large open circles and broken lines mark the mean values and standard deviation of the Japanese. We can see the triceps and sub-scapular skin-folds are thicker in Japanese if we would compare it with the values of Singapore, Sudan, Poland, England, Germany, India, and Switzerland. Therefore, if we would follow the general knowledge between body density and sub-scapular or triceps skin-fold, Japanese males might be more dense and less fat than the other male group mentioned above. However, I would like to call your inspection to the next slide.

Next slide, please.

(Slide 4): This is intend to give you a figure of the allometry between body weight and total body fat and power coefficients of allometric function. The value 0.990 was obtained from about 1,000 male Japanese aged from 6 to 20 years old. The other power coefficients were calculated from published data of other researchers whose name were shown in this figure. We can see the line for Japanese in the lowest part. This makes a sharp contrast with the previous figure. The isometric pattern between body fat and body weight of Japanese also should be noted.

Next slide, please.

(Slide 5): Now we can see the allometry between lean body mass and body weight in this slide. Almost all the lines show isometric pattern. The line for Japanese male is almost similar to the lines for the other male groups.

I wonder if I could have the next three slides in sequence.

(Slide 6): This figure was made from data of about 800 Japanese females. The lines for the other ethnic groups are quoted from previous researchers whose names are shown in the slide. We can see triceps and sub-scapular skin-folds are thick also in Japanese females.

(Slide 7): The allometry between body weight and total body fat is almost similar among Japanese, German, Norwegian, English females. They all show a positive allometry. The line for Japanese females does not locate in: the low part of figure, being different from the case of male Japanese.

(Slide 8): The relation between growth of lean body mass and that of body weight is similar to that between growths of body fat and body weight except being negative allometry.

Next slide, please.

(Slide 9): This side shows changes in triceps and sub-scapular skin-folds with progress of aging above 18

years old. The open circles and solid lines mark triceps and open triangles and broken lines mar sub-scapular skin-folds, which were obtained from about 3,800 persons. We can see an obvious contrast between the lines of male triceps skin-fold and the other three lines, the latter showing increase tendencies and the former decreasing or constant.

Next three slides in sequence, please.

(Slide 10): I would like to compare the body fat between young and old generations. The data was obtained from 34 old people aged 60 to 81 years old and 23 young persons aged 18 to 24 years old. This slide shows 12 sites of body on which skin-fold thickness was measured.

(Slide 11): This shows the mean values of skin-fold thickness at the 12 sites. Male values are shown in the left and female one shown in the right. Open circles connected with thin broken lines mark the value of young generation and filled circles with solid lines mark that of old generation. Thick broken lines and thick solid ones indicate the average values of 12 subcutaneous fat of young and old generations, respectively. The age-related difference in subcutaneous fat shows an opposite tendency between both the sex groups. The average value of the thickness is larger in young generation in the females, but that is larger in old group in the males. In the females, the fat at such extremity as triceps, knee, thigh, and calf is much thicker in the young generation. On the contrary, thicker subcutaneous fat at the trunk such as chest and abdomen appears to cause the larger average value of the skin-fold thickness in the males.

(Slide 12): In this aside, the total body fat percentage was estimated by D_2O dilution method. We can see the total fat percentage is larger also in the females. Subcutaneous fat weight was estimated by applying a prediction equation, which is shown at the bottom of this figure, and then, the total body fat was divided into subcutaneous fat and internal fat. We can see remarkable increases in internal fat with age in both the sex groups and an obvious decrease in subcutaneous fat with age in the females.

Next slide, please.

(Slide 13): We calculated the relationship between age and several items pertaining to body fat by means of using the data obtained from old persons above 58 years of age. This slide shows a schematized figure about it. You may see a significant positive correlation between age and internal fat and a significant negative correlation between age and subcutaneous fat.

Next slide, please.

(Slide 14): Several researchers have investigated the relationship between body composition and physical work capacity of Japanese including the relative growth between both the items. This slide shows the allometry between body weight and maximal oxygen intake of Japanese males. The figure consists of the

data collected from 2,087 male Japanese aged 3 to 24 years old. These data were cited from 22 representative literatures published within these few years. Each circle shows the average value obtained from the population which had been treated as a group in the literatures. We can see that the values obtained from these different literatures are considerably consistent. When the body weight is expressed in kg and maximal oxygen intake in l/min, the power coefficient of the allometric function is calculated to be 1.035.

Next slide, please.

(Slide 15): This is the case in female Japanese. Similarly, the data were collected from persons aged 3 to 24 years old. The total numbers of investigated females were 1,583. We can see the power coefficient is calculated at 0.715. This value is smaller than 1.035 of the males.

Next slide, please.

(Slide 16): Since the data in the previous two slides were cited from recent literatures published within these few years, I would like to compare them which the data in old literatures published 30 years before. In this slide I can show you the comparable data obtained in 1948 and 1956. The allometric relation calculated from the recent data is superimposed on this figure by a broken line. We can see the allometric function between body weight and maximal oxygen intake calculated from the old data is almost equivalent to that from the recent data.

Next slide, please.

(Slide 17): This slide shows the old cases in female Japanese. The recent tendency is superimposed on the old one by the broken line. We can see a clear similarity between both the lines. These two slides mean there is no obvious difference between the recent time and 30 years before in the relative growth between body weight and maximal oxygen intake. It may be interesting when we compare it with the accelerated tendency of physical growth of the Japanese in these thirty years.

Next slide, please.

(Slide 18): In this slide I would like to show you an example of comparisons of the allometry of the Japanese with those of the other races or ethnic groups which were calculated from the data in previous literatures. The names of authors of the literatures are shown in this slide. We can see that the values of power function of the allometric functions for the male groups are nearly 1.0 and those for the female groups are nearly 0.7. The values of 0.6 for the German males and of 0.9 for Norwegian females could be

regarded as the exceptions. The values for Japanese males and females stay within the average range, though the lines for them locate in slightly lower parts of the figures.

That's all for the slides. Now, I have light on, please. I introduced you about the outline of characteristics of body composition of the Japanese. I would like to expect to compare it with the characteristics of the other races or ethnic groups. The Japanese Ministry of Education, Culture, and Sciences made a grant towards the expenses incurred by the investigation on body composition of the Japanese, this year. About 15 anthropologists including us are participating into the new research plan. The first report of the investigation will be published in the next spring on the Annals of Physiological Anthropology. In closing, I wish to express my great appreciation to the Chairman for the privilege and the opportunity of talking about this subject.