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SKELETAL MATURATION OF THE HAND OF GHANAIAN CHILDREN: A COMPARATIVE STUDY OF GHANAIAN AND JAPANESE CHILDREN

ABSTRACT: A total of 2,192 children (1,082 boys, 1,110 girls), with age-range between 0.5 – 19 years, were X-rayed on the lower left hand and wrist and anthropometrically examined at the Mamprobi Polyclinic in Accra in 1977 for collection of data on skeletal and physical growth and development, i. e. the measurement of height, weight, head and chest circumference.

The grades of skeletal maturation (0 – 5 points for round carpal bones and 0 – 10 points for long bones (epyphysis) have been determined, and the mean curves also assessed. Detailed results of the skeletal variants and the comparison of bone age with physical development will be published later by the experts. Ghanaian boys, and girls, mean curves have similar patterns, except for carpal bone groups, where scores increased rapidly at early and later ages, but increased slowly between ages of 5 – 9 years. Conversely, the carpal bone score increased speed at a constant rate. The result confirmed more rapid skeletal maturation in Ghanaian girls than in boys, similar to that of Japanese and Caucasians. Mean bone age acceleration (1 – 6) years in Ghanaian children is more pronounced than in Japanese children. After the 12th year, bone age acceleration of Ghanaian children is a bit retarded and takes a longer time to reach maturity in the hand than in Japanese children.

KEY WORDS: Skeletal maturation – Ghanaian children – Japanese children.

INTRODUCTION

The Japanese Medical Research Team, organised by the Japan International Co-operation Agency (JICA), visited the Republic of Ghana in October 1980, and teamed up with its Ghanaian counterparts with the aim of analysing data on human growth and development, with special emphasis on bone age, skeletal maturation and variants in the wrist and the hand, including the children's physical development patterns, which are influenced by their overall nutritional status in their environment. During the research team's stay in Ghana, the members exchanged expert views and opinions on the general problems connected with the analysis of the data collected during 1977 – 79, prior to the team's arrival in Ghana, with E. K. M. Agbenu, the Ghanaian counterpart of the research team, and other Ghanaian authorities on the research topic.

For the improvement of Ghanaian children's nutrition it is very important to establish the standard bone age of Ghanaian children and their norm of growth and physical development, (Agbenu 1967, 1969, 1976, 1977, 1982a, 1982b) and also to analyse the

skeletal variants in the development of bones in the hand. There are very few studies of skeletal maturation involving African children (Mackay D. H. 1952, Weiner J. B., Thambipillai 1952). Also, only a very few comparative studies with other racial groups have been carried out. At present, there are no studies of the bone age of African children compared to that of Japanese children. In the present investigation, the "skeletal age" of Ghanaian children and the comparison of two races (Ghanaian-Japanese children) was effected by using Sugiura-Nakazawa's method of scoring for skeletal maturation of the bone in the hand and wrist from x-ray films (Sugiura, Nakazawa 1978).

MATERIAL AND METHOD

The total number of children involved is about 2 200, with an age range between 0.5 – 19 years, i. e. 1,082 boys and 1,110 girls whose left hand and wrist were x-rayed and their physical measurements taken at Mamprobi Polyclinic in Accra Ghana from 1977 – 1979 (*Table 1*).

RESULTS

The frequency of occurrence of skeletal maturation and the development of bones in the left hand and wrist is here presented.

(i) The mean skeletal score and sex differences of Ghanaian children are shown in *Fig. 1*, indicating ages in years. The mean curves have a similar pattern for boys and girls (*Fig. 1*), except for the carpal bone group, in which the score increased rapidly at early and later ages, but increased slowly between 5 – 9 years. On the other hand the carpal bone score increases at a constant rate.

TABLE 1. *Number of individuals examined*

Age (Years)	Male	Female	Total
0	55	50	105
1	54	50	104
2	59	50	109
3	61	50	111
4	61	50	111
5	50	50	100
6	50	50	100
7	56	50	106
8	52	50	102
9	62	64	126
10	73	67	140
11	60	56	116
12	57	66	123
13	51	54	105
14	47	71	118
15	53	87	140
16	54	74	128
17	67	52	119
18	44	42	86
19	16	27	43
Total	1082	1110	2192

Stages of maturation

Carpal bone

0. The center is not visible.
1. Primitive rounded center. But more developed than 0.
2. Still smoothed rounded surface but more developed than 1.
3. Beginning to form the final shape with slight concave and convex surfaces.
4. The shape is developed and surface articulation with the adjacent bone begins to become distinct.
5. Completely developed. The bones overlap each other.

Epiphysis of Long Bones

0. The center of the epiphysis is not visible.
1. The center is evident (visible as a single deposit of calcium or primitive rounded center).
2. More developed than stage 1, but not yet forming its own shape.
3. Beginning to form its own shape.
4. The outline concave and convex, but the width of the epiphysis is smaller than that of the shaft.
5. The width of epiphysis is the same as that of the shaft.
6. Beginning of "capping", but there remains a gap between the epiphysis and the shaft.
7. The gap has narrowed. The proximal and distal surfaces of the epiphysis are parallel and zigzag-shaped.
8. Fusion of the epiphysis and the shaft has begun.
9. Fusion of the epiphysis and the shaft is complete, but the line of fusion is still visible over the majority of its length.
10. The line of fusion has entirely disappeared (adult bone).

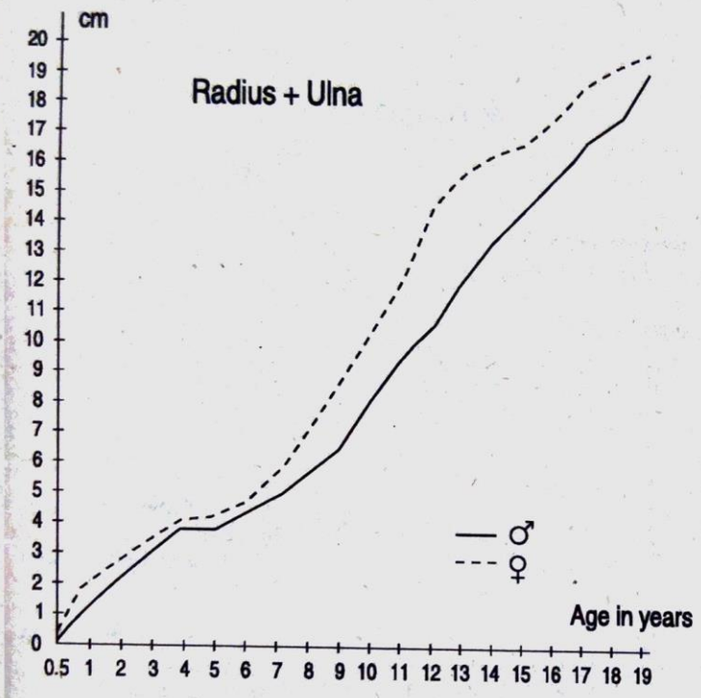
The fact that skeletal maturation is more rapid in girls than boys has been confirmed also in Japanese and Caucasians.

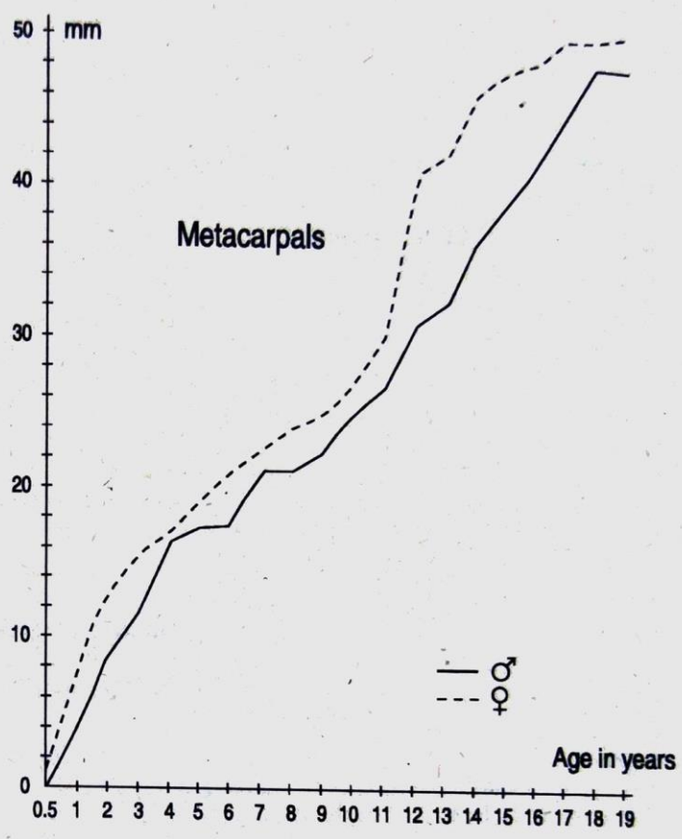
Comparative study of bone age of Ghanaian and Japanese children

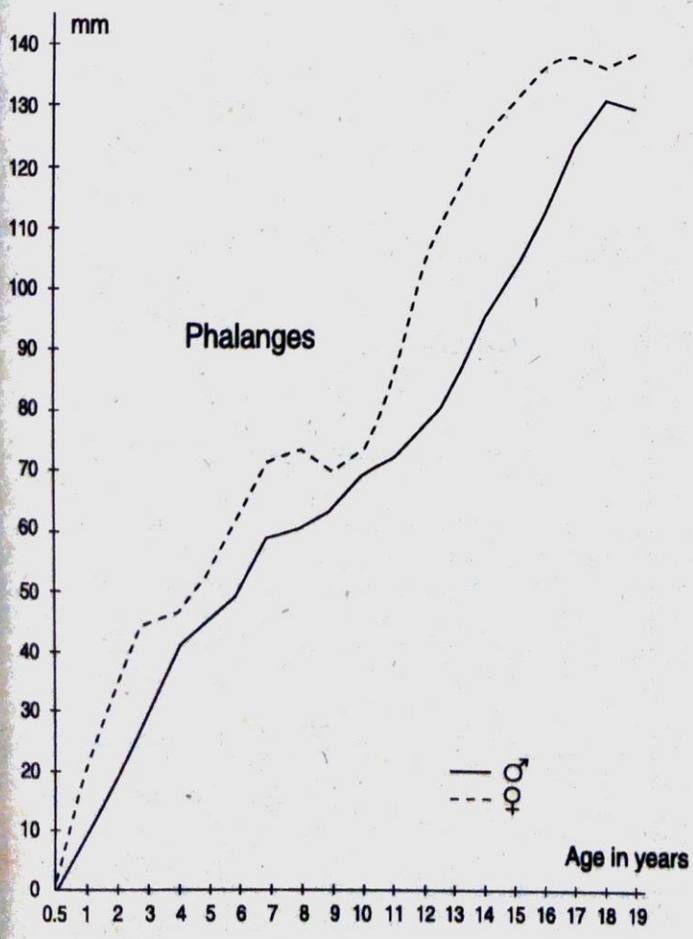
The results obtained after statistically analyzing the data are summarized as follows:

a) In both races (*Fig. 2*), the scores increased slowly between 5 – 9 years, except for the carpal bone group.

b) The bone age of Ghanaian children is more accelerated between 1 – 6 years than that of Japanese children.







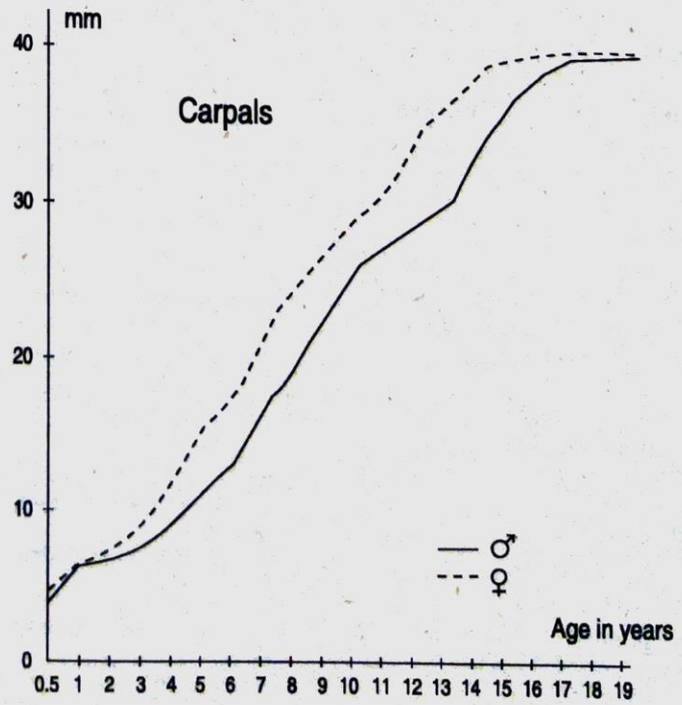


FIGURE 1. *Mean skeletal score of Ghanaian children.*

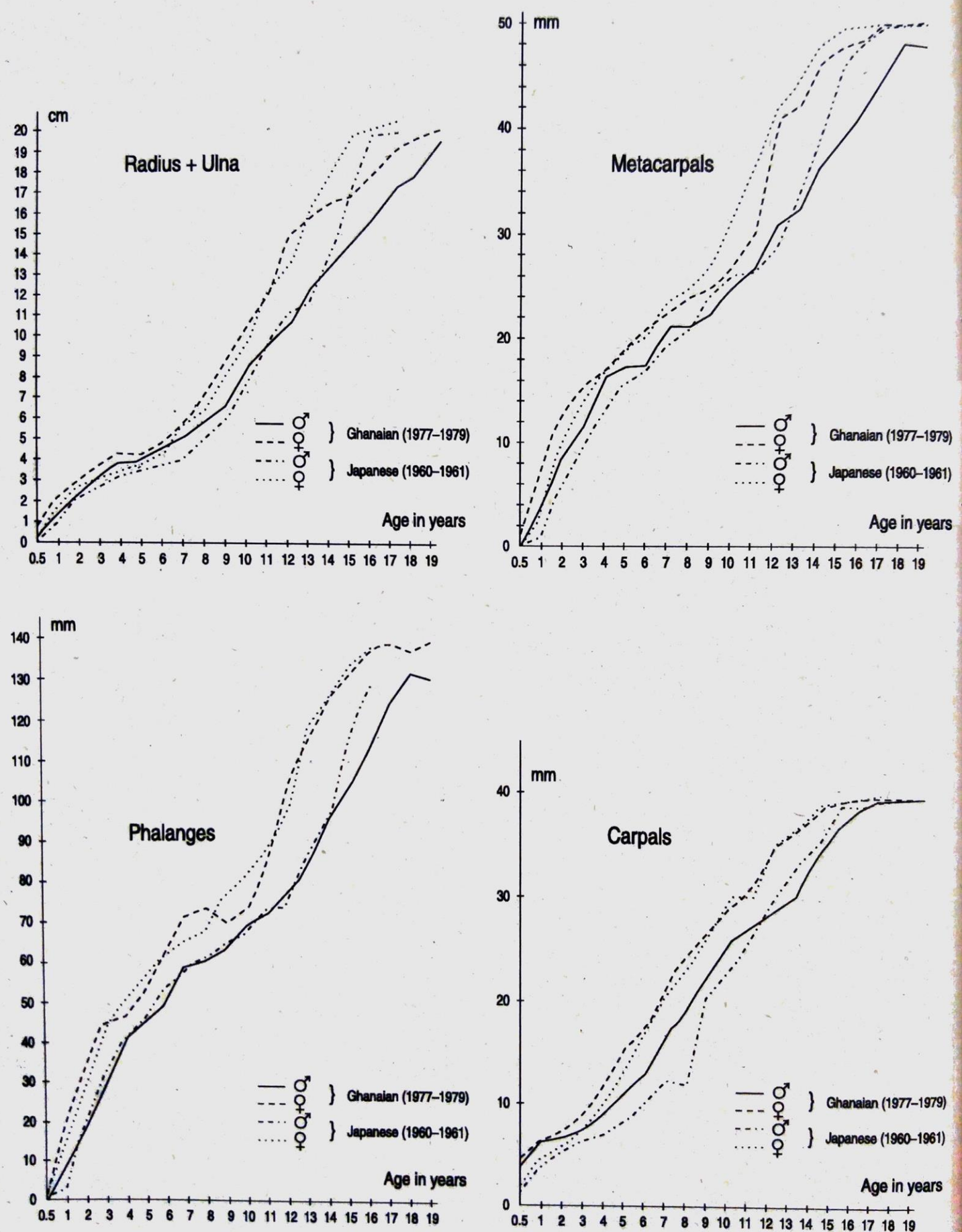


FIGURE 2. *Comparison of Ghanaian and Japanese children. (Mean skeletal score).*

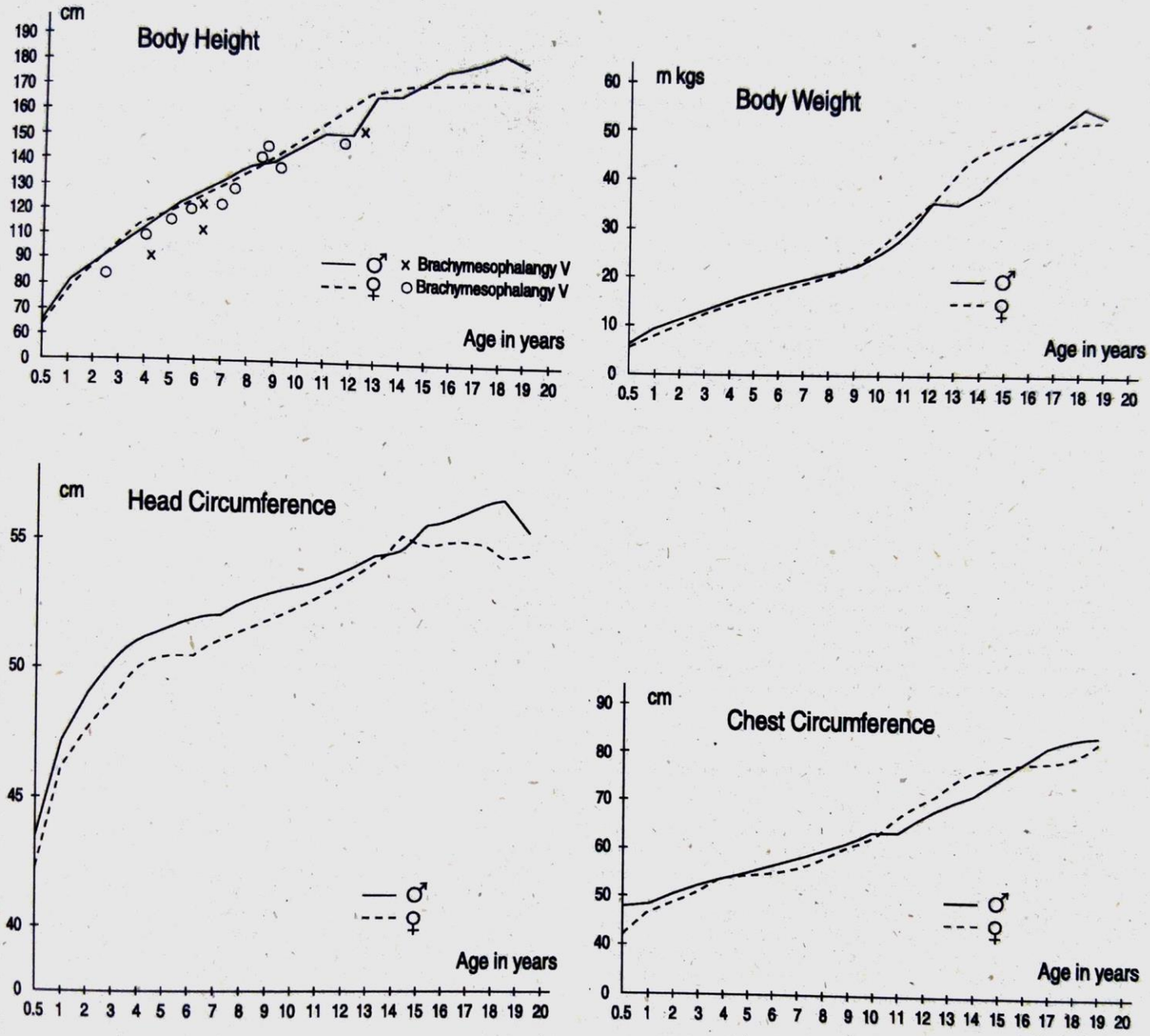


FIGURE 3. *Ghanain mean physical measurements.*

Nevertheless, after the 12th year the bone age of Ghanaian children is a bit more retarded, in comparison with Japanese children (*Fig. 2*).

c) Ghanaian children take a longer time to reach skeletal maturity in the hand than Japanese children.

DISCUSSION

The height, weight, chest and head circumferences of Ghanaian children are shown in *Fig. 3*. Though at present the body height of the Ghanaian child is indicated as being almost equal to that of the Japanese, it is possible that a greater increase in body height would be attained by Ghanaian children with an improvement of their nutritional status (E. K. M. Agbenu 1982 – 1990, Addy A. Hutton 1976).

It has long been established that African children are ahead of white children in skeletal maturity at birth and for the first one or two years. This is associated with an advance in motoric growth, such as earlier sitting-up and crawling. This growth advancement of Africans over European children disappears by about the 3rd year, either partially or entirely, because of inadequate nutrition or malnutrition.

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