

GROWTH PATTERNS OF JAVANESE AND CAPE COLOURED CHILDREN: ANTHROPOMETRIC STUDY IN WELL-OFF CHILDREN

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ABSTRACT

Growing children in certain populations are not always following the same pattern as children in other populations. The purpose of this research is to prove that children from good socio-economic conditions growing in two clearly distinct populations may not have similar patterns of growth. A total of 1691 children (737 boys and 954 girls) middle to upper socioeconomic status, aged 6 to 19 years, were measured during the study. The variables measured were body height, weight, trunk length, upper limb length, lower limb length, humerus biepicondylar breadth, subscapular and abdominal skinfold thicknesses. Javanese schoolchildren's anthropometric measurements were compared to those of Cape Coloured. The averages of most length measurements for Javanese schoolchildren were closer to those for urban Cape Coloured children in the early years, and became closer to those for rural Cape Coloured children in the later years. This is not likely to mean that the younger Javanese children lived in a better environment, had better health care, or were generally richer than the older children. General conditions have not changed much in 17 years in Malang, up to the time of this measurement. Those two facts simply mean that Javanese schoolchildren follow a different pattern of growth from Cape Coloured children and those children measured to create the NHANES growth reference. This confirms that Javanese schoolchildren have different size and shape which cannot be explained simply by their having a lower quality of environment and nutrition. There must be a strong genetic influence in the regulation of their size and shape.

Key words: socio-economic, Indonesia, South Africa, size, shape.

INTRODUCTION

Very often, the growth of children in a developing country must be compared to international growth reference—such as NCHS, from the United States. The purpose of the comparison is to monitor the growth of the child, whether the child is growing normally, and whether the child is healthy. However, growing children in certain populations are not always following the same pattern as children in other populations. Even children who come from well to do families who

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have enough resources to provide good nutrition and good health care may not grow in accordance with the growth reference. It is not only that individual children may grow in channels above or below the median of the reference, but the majority may have different pattern of growth, for instance fitting closely the reference in pre -pubertal period and then deviating below it at puberty and postpubertally (eg. Henneberg and Louw 1998).

The purpose of this research is to prove that children from good socio -economic conditions growing in two clearly distinct populations may not have similar patterns of growth—the timing and the magnitude of the growth of certain parts of the body may not be the same.

MATERIAL AND METHODS

A total of 1691 Javanese children (737 boys and 954 girls), aged 6 to 19 years, were measured during the study. The children had mid - to high socio-economic background to ensure that they did not have any problems regarding maintaining their health status and daily nutritious intake. The data from South Africa was obtained from earlier published article, and the detailed information can be obtained from Henneberg and Louw (1998).

The variables measured were body height, weight, trunk length, upper limb length, lower limb length, humerus biepicondylar breadth, subscapular and abdominal skinfold thicknesses. Javanese schoolchildren's anthropometric measurements were compared to those of well -off Cape Coloured. Averages of anthropometric measurements of low socio -economic status Cape Coloured children and NHANES (from the U.S.A.) were used for comparison, when the information is available. The averages for Cape Coloured schoolchildren were taken from Henneberg and Louw (1998).

The age at menarche was obtained using probit analysis. It was compared to the age of menarche of the urban (Cape Coloured girls obtained in the same way. Student t -test was used to decide whether the difference between the Javanese age of menarche and those of Cape Coloured girls was significant.

The data available from the South African Cape Coloured sample are: age at menarche, height (B-v), weight, trunk length (the difference between (B-sst) and (B-sy)), lower limb length (B-sy), upper limb length (a-da), elbow (humerus biepicondylar) breadth, and abdominal skinfold thickness.

The averages, standard deviations and the number of individuals in every age group were calculated using the Statistical Package for the Social Sciences (SPSS). The averages were plotted together with those of the NHANES reference (Frisancho 1990) and the published results of data from Cape Coloured schoolchildren (Henneberg and Louw 1998).

RESULTS

The average menarcheal age of the well-off Javanese girls based on probit analysis was 12.15 years ($s=1.10$, $n=1194$). This average was significantly lower (to 9.2) than the age of menarche of urban (well-off) Cape Coloured girls (12.61, $s=1.25$, $n=857$) (Henneberg and Louw 1995).

The mean height measurements for Javanese children demonstrated that the average height of females was smaller during the younger years (7 to 8) than that of males. At age 9 years girls' height overtook the boys', but later (at 13 years) the height of boys exceeded that of girls. Although girls' height overtook the boys' at age 9 to 12 years, the boys' averages of weight remained heavier than those of girls.

Figure 1 to Figure 4 showed that the Malang schoolchildren's weight and height were on average lower than those of NHANES.

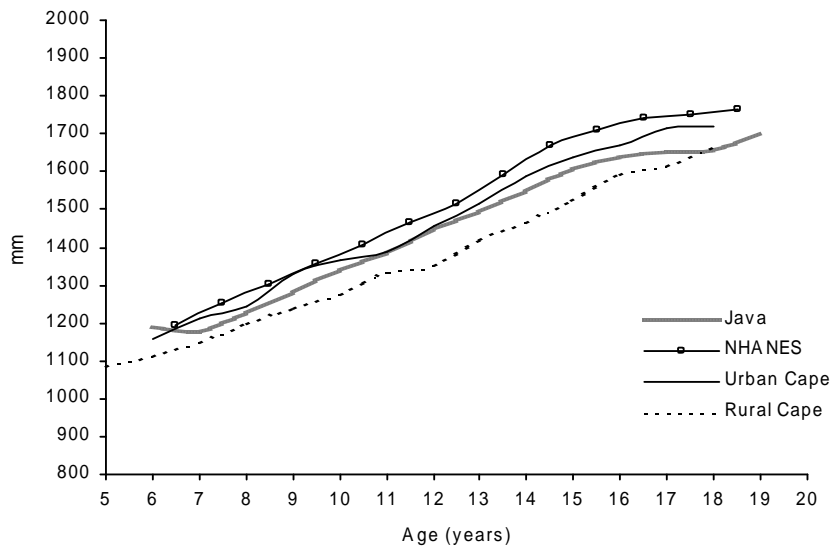


Figure 1. Height averages of Javanese males compared to South African Cape Coloured males

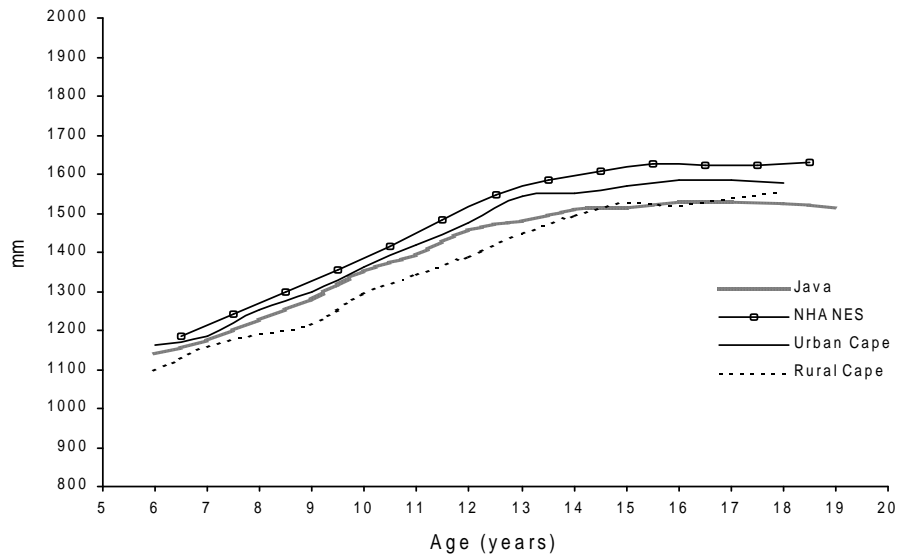


Figure 2. Height averages of Javanese females compared to South African Cape Coloured females

The averages for height of Javanese males were closer to those of urban South African Cape Coloured males than to their rural counterparts, until the age of 13 years. After the age of 13 years, the height averages were lower and more similar to the averages for rural South African Cape Coloured males (Figure 1). The height averages for Javanese females were closer to the averages for urban South African Cape Coloured girls until the age of 10 years, when the trend began to move towards the averages for rural South African Cape Coloured girls (Figure 2).

The averages for weight of Javanese males were similar to those of urban South African Cape Coloured, until the age of 15 years. The averages for weight of rural South African Cape Coloured males were substantially below those of urban South African Cape Coloured and Javanese boys (Figure 3). Javanese females' weight averages were similar to those of urban South African Cape Coloured until the age of 10 years. From age 11 the weight averages of the Javanese became lower and approached the averages of rural South African Cape Coloured (Figure 4).

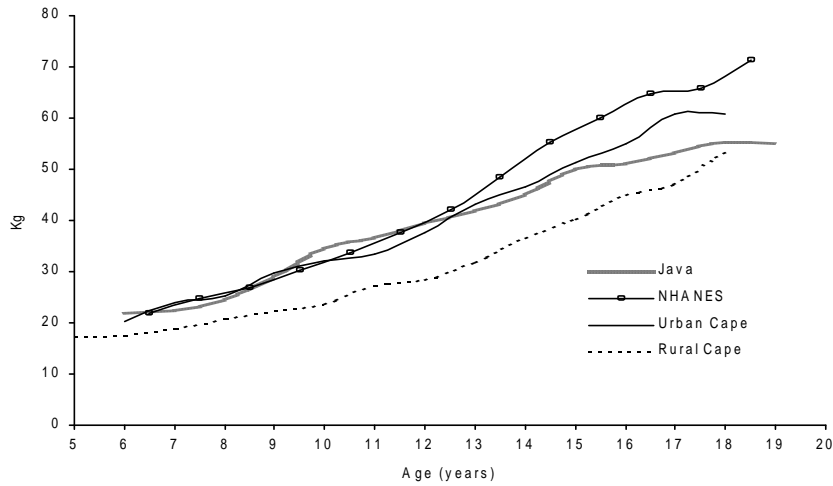


Figure 3. Weight averages of Javanese males compared to South African Cape Coloured males

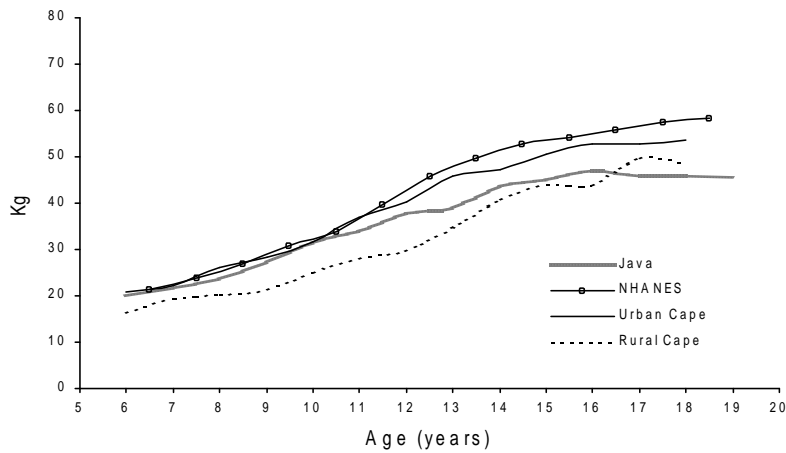


Figure 4. Weight averages of Javanese females compared to South African Cape Coloured females

The averages of trunk length for Javanese females exceeded those for boys from age 9 to 11 years. Up to age 16 years the averages for trunk length of Javanese males were similar to the averages for urban South African Cape Coloured males, while those for rural Cape Coloured males were below both other groups until the age of 18 (Figure 5). The average of trunk length for Javanese males began to approach those for rural Cape Coloured males at age 17 years.

For females the averages for trunk length of the three groups were closer (Figure 6), but the averages for rural Cape Coloured females were still below those for the other two groups, in all age groups being measured.

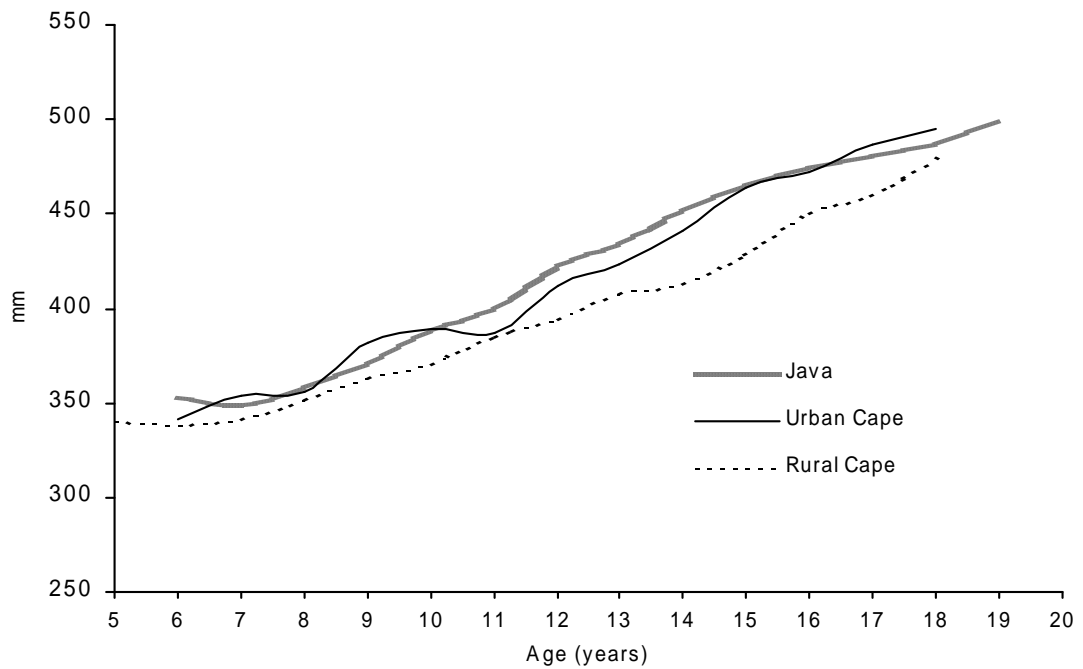


Figure 5. Trunk length averages of Javanese males compared to South African Cape Coloured males

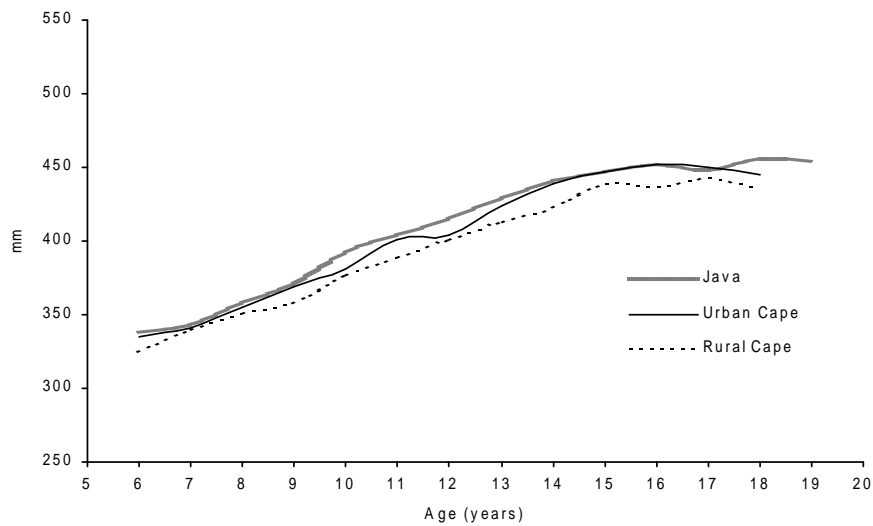


Figure 6. Trunk length averages of Javanese females compared to South African Cape Coloured females

The averages for trunk length of Javanese males and females were similar to those for urban Cape Coloured males and females, while the averages for trunk length of rural males and females were somewhat lower than those of the other two groups. The nearest coincidence of averages for rural Cape Coloured and Javanese children happened at a later age in males (18 years) than in

females (17 years). This indicates that the growth of trunk length is more dependent on socio-economic conditions than on the population of origin.

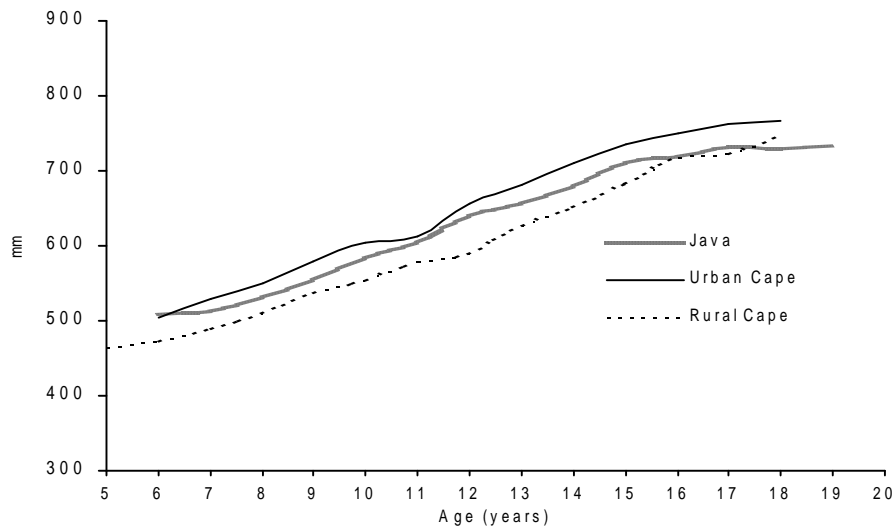


Figure 7. Upper limb length averages of Javanese males compared to South African Cape Coloured males

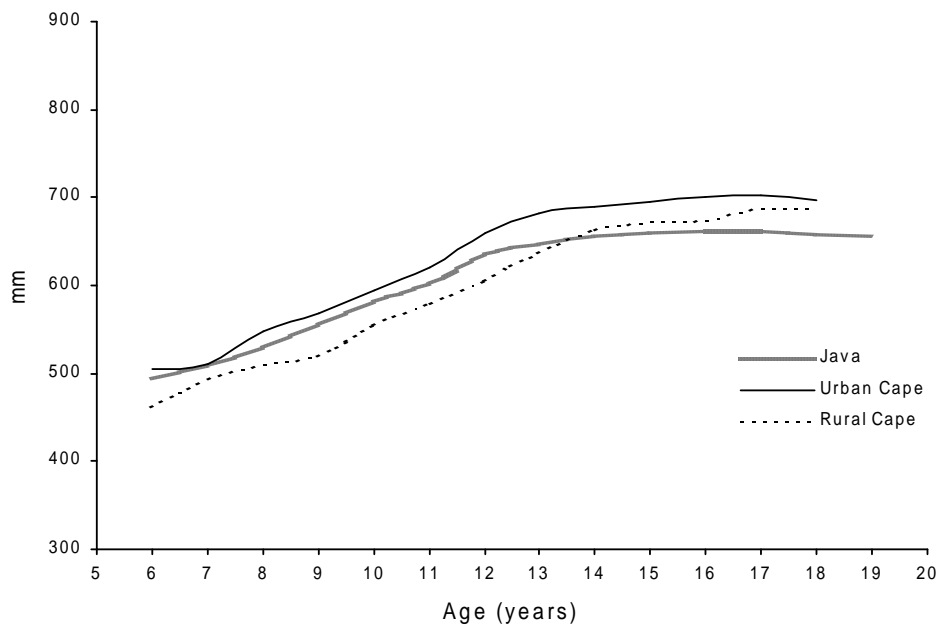


Figure 8. Upper limb length averages of Javanese females compared to South African Cape Coloured females

The average of upper limb length for Javanese females exceeded those for boys at age 9 years. The averages for length of the upper and lower limbs of Javanese boys were smaller at all

ages than the averages for South African Cape Coloured urban boys (Figures 7 and 10). In general, therefore, Javanese boys had relatively shorter limbs than the high socioeconomic status (urban) Cape Coloured boys. This explains the difference in body height.

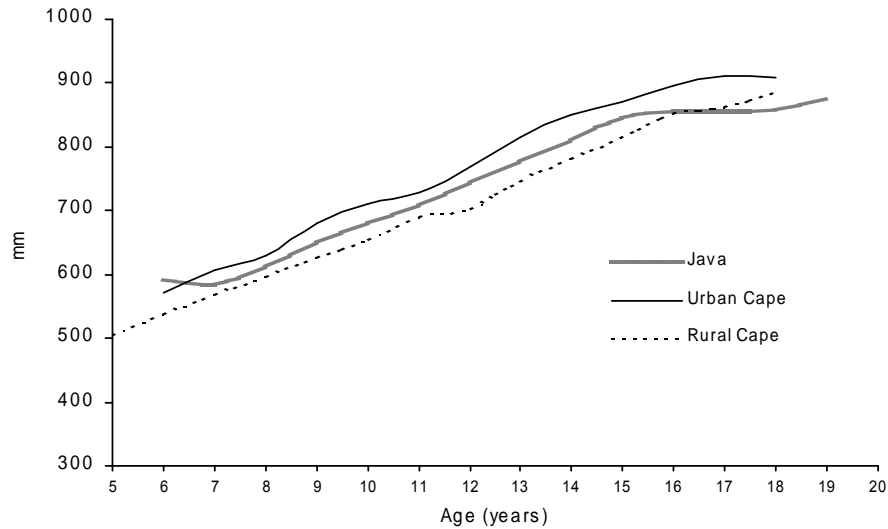


Figure 9. Lower limb length averages of Javanese males compared to South African Cape Coloured males

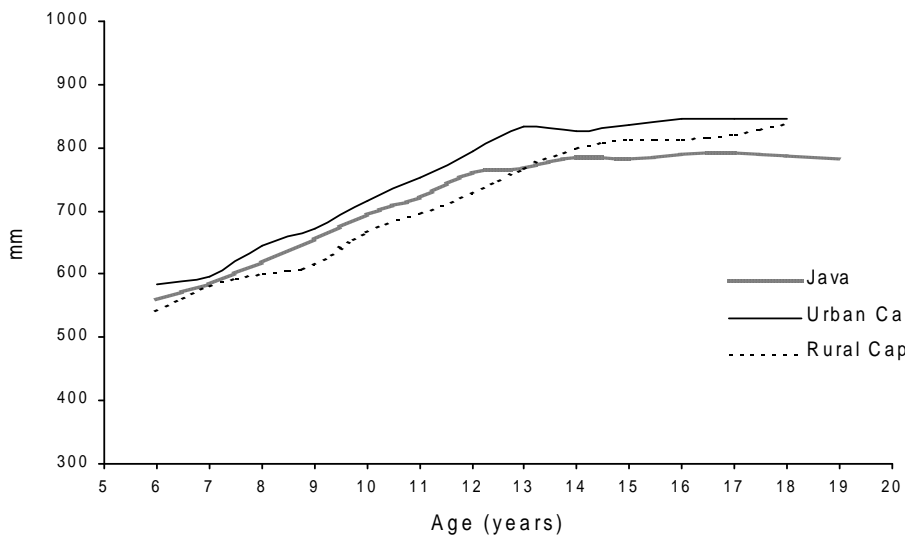


Figure 10. Lower limb length averages of Javanese females compared to South African Cape Coloured females

The averages of lower limb length for Javanese females exceeded those for boys at age 8 to 12 years. It is important to note that post-pubertally limb lengths of Javanese children became shorter than those of well-to-do Cape coloured individuals and became similar, or even lower

than those of low socio-economic status Cape Coloured males and females.

Time of differentiation between Javanese and urban Cape Coloured boys

At the age of 13 years the averages for male Javanese schoolchildren in general differentiated from those for urban Cape Coloured males on the measurements of upper limb length (Figures 7). The abdominal skinfold thickness started to differentiate at the age of 12 years (Figure 15).

Generally, at age 16 years Javanese males' averages were closer or more similar to rural Cape Coloured males than urban males. Some other averages of Javanese and rural males became closer at a later age (18 years), such as trunk length (Figures 5), or even later at age 19 years for abdominal skinfold thickness (Figure 15).

Time of differentiation between Javanese and urban Cape Coloured girls

Similar trends were found in the Javanese females when they were compared to South African Cape Coloured girls. At the early ages (6 to 10 years) most of the averages for the Javanese females were similar to those of urban Cape Coloured females. By the age of 11 years, the averages started to differentiate and the averages for the Javanese females approached those of rural Cape Coloured females. This trend was found in upper limb length and lower limb length (Figures 8 and 10).

Time of coincidence between Javanese and Cape Coloured schoolchildren

Most of the averages for Javanese females became closer to those for rural Cape Coloured females at an earlier age compared to the Javanese males' averages approaching those of rural Cape Coloured males. Generally, the lines of the averages for Javanese females and rural Cape Coloured females coincided at the age of 13 years and onward. The averages of upper limb length and lower limb length coincided at the age of 13 (Figures 8 and 10). However, the averages of abdominal skinfold thickness for Javanese females were above those for both urban and rural Cape Coloured females at all times (Figure 16).

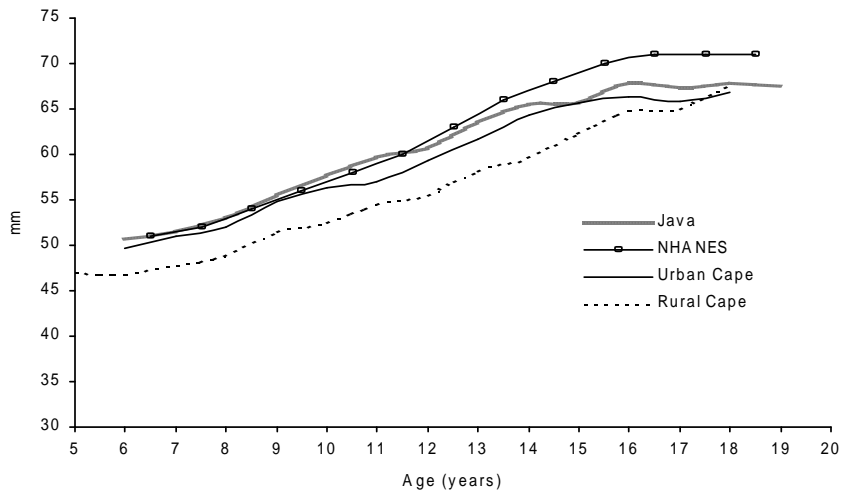


Figure 11. Humerus biepicondylar breadth averages of Javanese males compared to South African Cape Coloured males

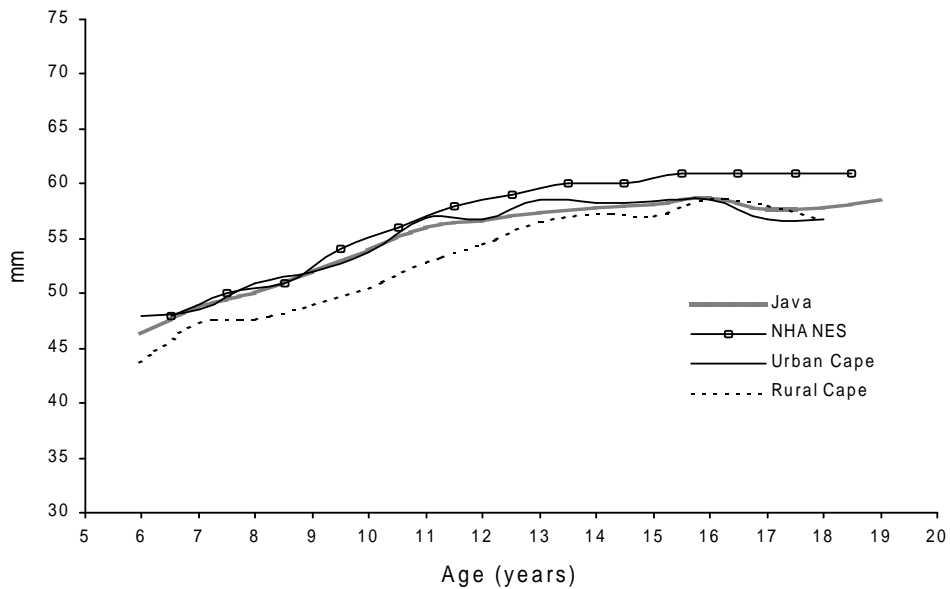


Figure 12. Humerus biepicondylar breadth averages of Javanese females compared to South African Cape Coloured females

The averages of humerus biepicondylar (elbow) breadth showed interesting patterns for both sexes (Figures 11 and 12). In males, at age 16 years the averages for the three groups (Javanese, and urban and rural Cape Coloured) approached each other, indicating that there was a 'catch up growth' of rural averages. Finally the averages of the three groups became similar at age 17 years. From age 6 to 15 years, the averages of elbow breadth for Javanese males were similar to those of urban Cape Coloured (Figure 11).

The averages of humerus biepicondylar breadth for Javanese females were similar to those of urban males from age 6 to 12 years. The averages for the three groups (Javanese, and urban and rural Cape Coloured) became similar when rural averages caught up at the age of 13 years (Figure 12).

The averages of subscapular skinfold for Javanese females were generally similar or below those for Javanese males, but Javanese females gained more subscapular skinfold thickness after they experienced menarche.

The averages of subscapular skinfold for male Javanese children were above the NHANES 50th percentile in all age groups being measured (Figure 13). The averages of subscapular skinfold of the females were also above 50th percentile of NHANES (Figure 14).

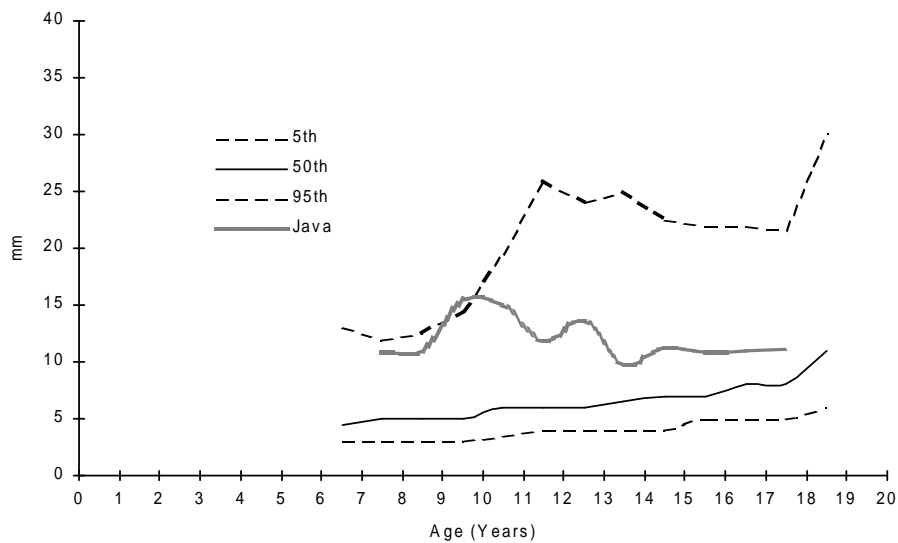


Figure 13. Subscapular skinfold thickness averages of Javanese males compared to 5th, 50th, and 95th NHANES reference

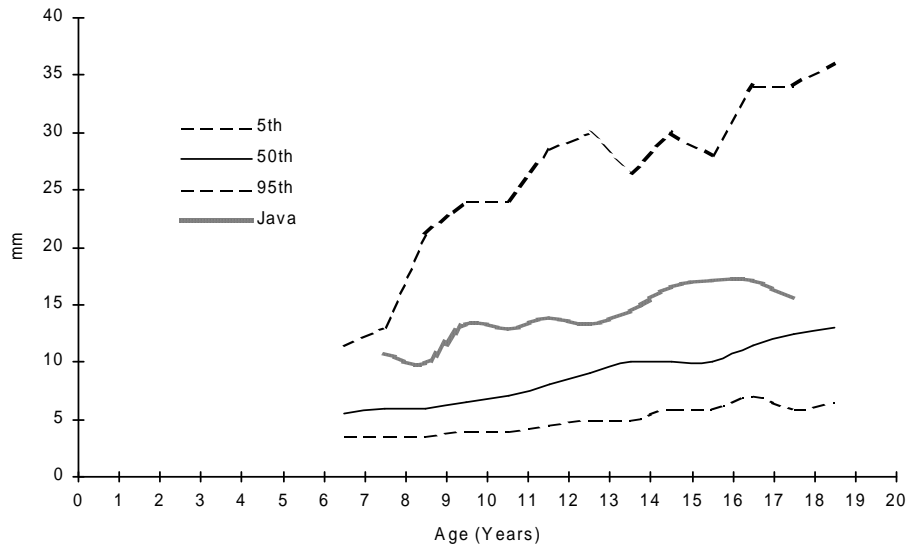


Figure 14. Subscapular skinfold thickness averages of Javanese females compared to 5th, 50th, and 95th NHANES reference

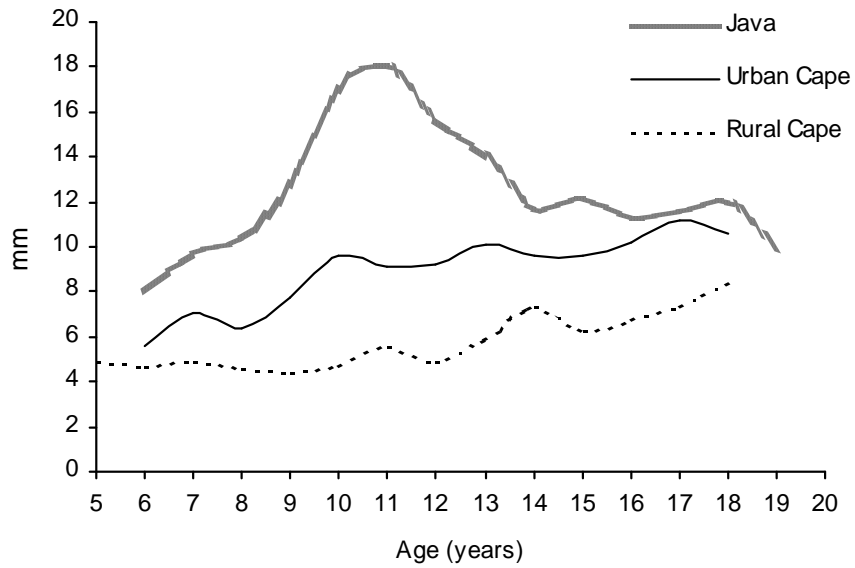


Figure 15. Abdominal skinfold thickness averages of Javanese males compared to South African Cape Coloured males

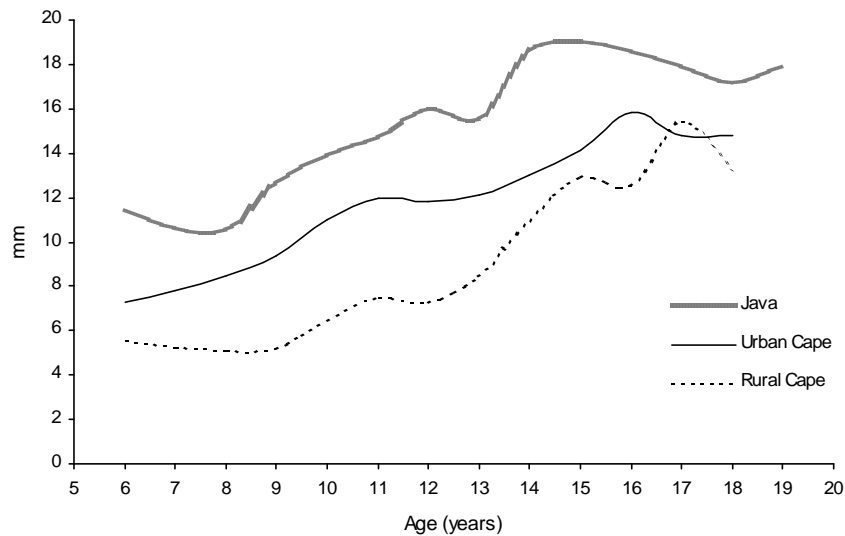


Figure 16. Abdominal skinfold thickness averages of Javanese females compared to South African Cape Coloured females

DISCUSSION

This article presented the results of cross-sectional measurements of the physical growth of well-off Javanese in Malang (East Java, Indonesia), compared to those of Cape Coloured children in Africa. Several comparisons with NHANES (reference chart from the U.S.A.) were made to the data when the particular variables were available.

The difference of the age of menarche between the Javanese and the urban Cape Coloured was significant, although both came from good socio-economic backgrounds. This may be related to other differences in their growth patterns. They just simply do not grow in similar fashions.

When the data of body weights were compared to those of NHANES (Artaria 2001), 8% of males' weight-for-height fell under the 5th percentile, 50% under the 50th percentile, 86% under the 95th percentile and 14% at or above the 95th percentile. For females the percentage distribution was similar to that for males: 1% of females' weight-for-height fell under the 3rd percentile, 37% fell under the 50th percentile, 82% under the 97th percentile and 18% were at or above the 97th percentile of KMS. Using NHANES as the reference, 7% of females' weight-for-height fell under the 5th percentile, 52% under the 50th percentile, 95% under the 95th percentile and 5% were at or above the 95th percentile.

Although Javanese boys were heavier on average than US boys (using the NHANES reference) until the age of 11 years, thereafter the Javanese males lost parity in weight. Similar tendencies, of loss of parity in weight and height, of Indonesian children at adolescence compared

to the NCHS reference were found in other studies (Glinka 1981; Kristiani et al. 1998). The question is whether a simple difference in nutrition was the cause. Comparison of skinfold thickness indicates that the Javanese children had adequate nutrition, at least in terms of caloric value. The fact that compared to the NHANES reference Javanese had shorter stature in respective age groups might be caused by differences in genetic endowment. Environmental factors, such as lack of micronutrients, might also cause a physical growth differential (Bui Dai Thu Werner et al. 1999). At this stage it is difficult to pinpoint which environmental factors could be responsible. It is suspected, however, that lack of micronutrients would produce behavioural and cognitive problems in infancy and childhood (Allen 1993), as well as being associated with stunted growth (Allen 1995), which does not seem to be the case in these Javanese schoolchildren.

Comparisons of various growth measurements of the Javanese schoolchildren with those of urban and rural Cape Coloured children in South Africa revealed the differences in the averages between urban and rural Cape Coloured by the end of the growth process, as has been predicted. This confirmed that the shape and size of an adult is a result of ongoing interaction between environmental and genetic influences that occur while a person is growing (Eveleth and Tanner 1990). Lower averages of anthropometric measurements of rural Cape Coloured children compared to their urban counterparts, although they came from the same genetic pool indicate influence of environmental difference.

Data comparing Javanese and Cape Coloured schoolchildren told a different story. Most of the averages for the Javanese schoolchildren were closer to the averages for urban Cape Coloured children in earlier years, but later they became closer to the averages for rural Cape Coloured children. Although both Javanese and urban Cape Coloured children were from similarly well-to-do families in an urban setting, they have become different in size and shape at the end of the growth process.

The skinfold thickness averages for Javanese and Cape Coloured children showed that the two samples had different patterns of fat deposit. The Cape Coloured children tended to deposit more fat at the arm, i.e. the triceps skinfold thickness; and the Javanese children deposited more fat at the trunk, i.e. at the subscapular and at the abdomen. Different fat patterns in different populations are well recognised, as the amount of adipose tissue and lean body mass differs between individuals and populations, and the amount of subcutaneous fat deposit differs between ethnic groups (Eveleth and Tanner 1990:215). Towne (1998) stated that the distribution and amount of body fat are genetically controlled.

In Artaria (2001), the averages of height and weight of Javanese were closer to the 50th

percentile of the NHANES reference in early years, and became closer to the 5th percentile in later years. In this article, the averages of most length measurements for Javanese schoolchildren were closer to those of urban Cape Coloured children in the early years, and became closer to those of rural Cape Coloured children in the later years. This is not likely to mean that the younger Javanese children lived in a better environment, had better health care, or were generally richer than the older children. General conditions have not changed much in 17 years in Malang, up to the time of this measurement. Those two facts simply mean that Javanese schoolchildren follow a different pattern of growth from Cape Coloured children and those children measured to create the NHANES growth reference.

Even the averages of skinfold thickness for Javanese schoolchildren had a different pattern from those of NHANES and Cape Coloured children, especially in males. This confirms that Javanese schoolchildren have a different size and shape which cannot be explained simply by their having a lower quality of environment and nutrition. The sample came from urban Javanese schoolchildren who have middle to upper socioeconomic status. There must be a strong genetic influence in the regulation of their size and shape.

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