Secular trend of growth in pre-school children in Singapore

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An anthropometric study was conducted on more than 13 500 children aged 0–6 years in 1988. Percentile charts were plotted for height for age, weight for age, weight for height and head circumference for age. When compared to an earlier study done in 1972, it was found that Singapore pre-school children had increased in height by 4.4 %; weight by 10.9 %; and head circumference by 4.1 %. When the median height for age, weight for age and head circumference for age were plotted against those of the NCHS charts (1978), Singapore's pre-school children were generally shorter, lighter and had smaller head circumferences than their American counterparts of the same age. But, the median weight-for-height for each age group was comparable to the Americans. The results indicate the secular trend of growth in Singapore children and a trend towards reaching their full genetic potential for growth.

Introduction

Anthropometric studies of pre-school children have a short history in Singapore. The first study was conducted in 1954 by Millis[1]. The most recent in-depth study was carried out from 1972 to 1975 by Wong et al.[2,3]. After a lapse of about 15 years it was felt that there was a need for a revision of the growth reference charts. A cross sectional anthropometric study of 13 565 children aged 0–6 years was carried out between March 1987 and January 1988 to fulfil this need. The sample of children was obtained from 10 government polyclinics, 21 nursery schools and 18 kindergartens throughout Singapore. Detailed descriptions of the sampling method, equipment and techniques used have been described elsewhere[4]. In this large-scale study, trained personnel collected single measurements of length or height, weight and head circumference of the children, using standardized methods and well-calibrated equipment. Percentile charts for boys and girls were drawn for the following parameters: height for age; weight for age; head circumference for age; and weight for height. In this paper, comparisons of these parameters with Wong's study and the National Centre for Health Statistics/Communicable Diseases Centre/World Health Organisation (NCHS/CDC/WHO) reference curves[5] were made to assess the secular trend of growth of Singaporean children.

Methods

The 50th percentiles of height for age, weight for age and head circumference for age from the anthropometric study of pre-school children conducted in 1988 were plotted against those from Wong's study and the NCHS's reference curves, respectively. The median weight for height of the present study was also plotted against those of the NCHS's.

Results and discussion

Comparison of parameters with previous local study

Figures 1–6 show the relationship between the 50th percentile curves of the various parameters in the present study with those of the previous local study by Wong et al. When comparing height, weight and head circumference, children from the present study generally had greater values for all parameters. On average there were increases of 4.5 % in height, 11.5 % in weight and 4.3 % in head circumference for boys, and increases of 4.3 %, 10.3 % and 3.9 % respectively, for girls (Table 1).

Table 1. Average increase (%) in growth parameters over previous study.

	Boys (%)	Girls (%)
Height	4.5	4.3
Weight	11.5	10.3
Head circumference	4.3	3.9

If the medians (50th percentiles) of the height and weight of children in the present study were plotted on the percentile charts developed by Wong, the medians of the present study would lie between the 75th and 90th percentiles, except for girls' height, which was between the 50th and 90th percentiles. For head circumference, the medians for both girls and boys fell somewhere between the 75th and 97th percentiles of the previous growth charts. This has been referred to as 'the secular trend' in growth, where children are getting larger and growing to maturity more rapidly. Factors such as improved nutrition, control of infectious diseases through immunization and better sanitation, more widespread health and medical care and population mobility (both geographically to urban areas and socially upward) appeared to be responsible. This phenomenon has been well documented in many European countries, Canada, the United States, Jamaica, Chile, Australia, New Zealand, Japan and Hong Kong[6].

Comparison with NCHS's curves

Figures 7–14 show comparisons between the present study and the National Centre for Health Statistics (NCHS) standards for median height for age, median weight for age, median head circumference for age and median weight for height.

Compared with Americans, the standards for children in the present study were consistently lower than those of the NCHS for height, weight and head circumference by age 9.5

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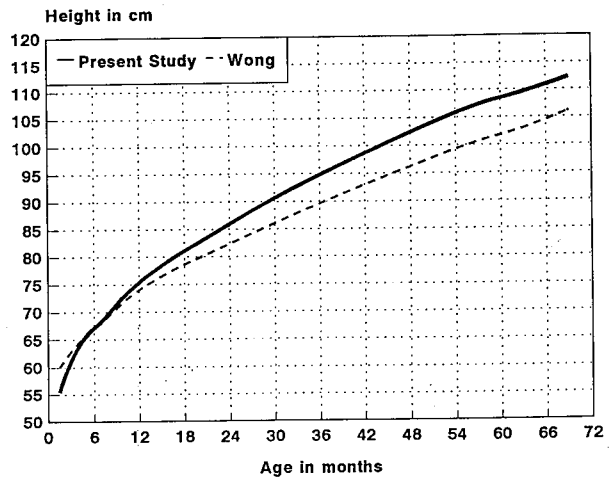

Figure 1. Comparison of height between present study and Wong's (boys).

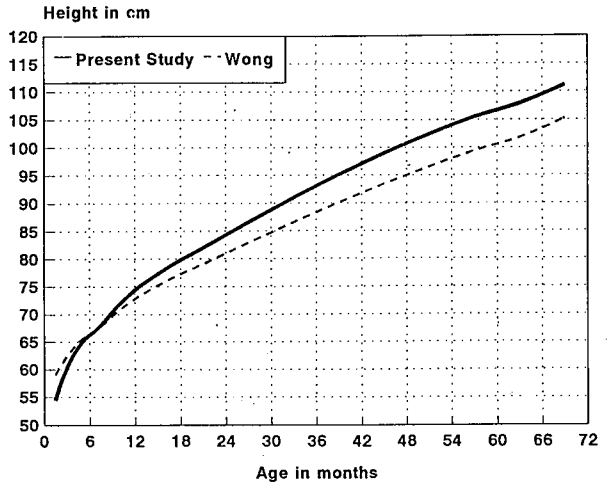

Figure 2. Comparison of head circumferences between present study and Wong's (girls).

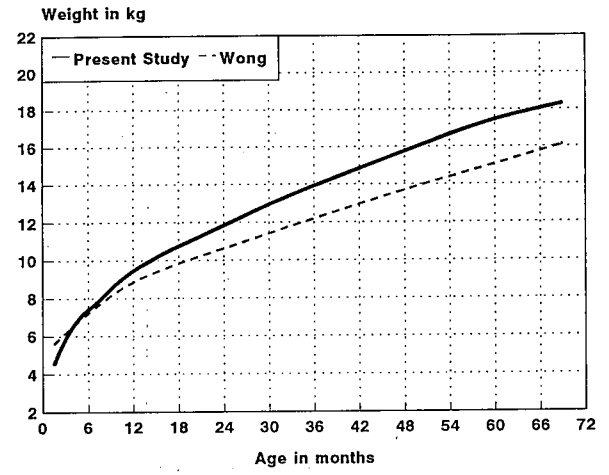

Figure 3. Comparison of weight between present study and Wong's (boys).

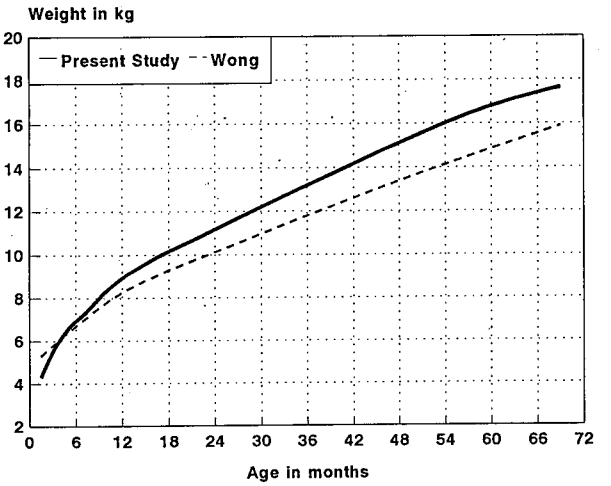

Figure 4 Comparison of weight between present study and Wong's (girls).

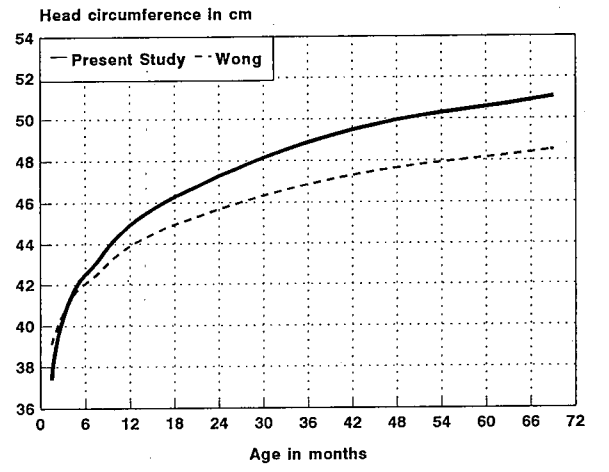

Figure 5. Comparison of head circumference between present study and Wong's (boys).

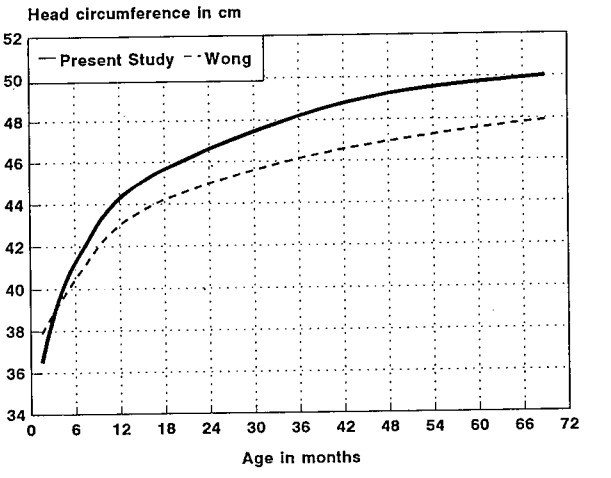

Figure 6. Comparison of head circumference between present study and Wong's (girls).

both sexes even though the NCHS data were collected in 1978 (Figs 7–12). When plotted on the percentile charts of the NCHS, the values for median height, weight and head circumference of Singapore children fell generally between the 25th and 50th percentiles of the American children. A similar but more exaggerated trend was also observed for height and weight by age more than 20 years ago by Chang et al.[7]. However, when the 50th percentiles of weight for height for the two studies were compared, it was found that the curves were almost similar, indicating that for the same height, both Singaporean and American children were likely to attain the same weight (Figs 13–14).

These facts reinforced the findings of Eveleth and Tanner that Asiatics, even those who were growing up under the best circumstances, were less tall at all ages than affluent people of European and African descent. This could be due to differ-

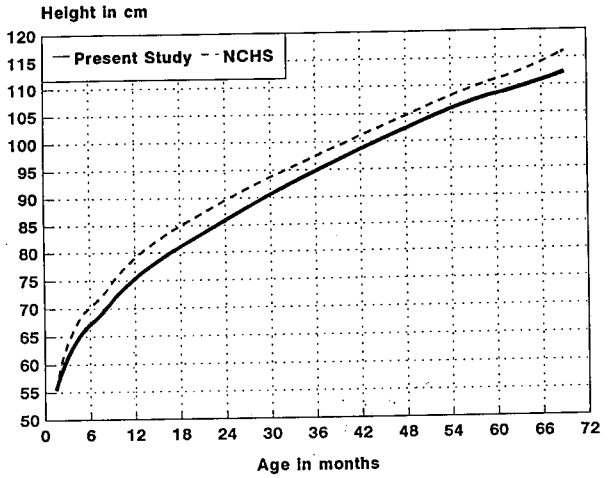

Figure 7. Comparison of height between present study and

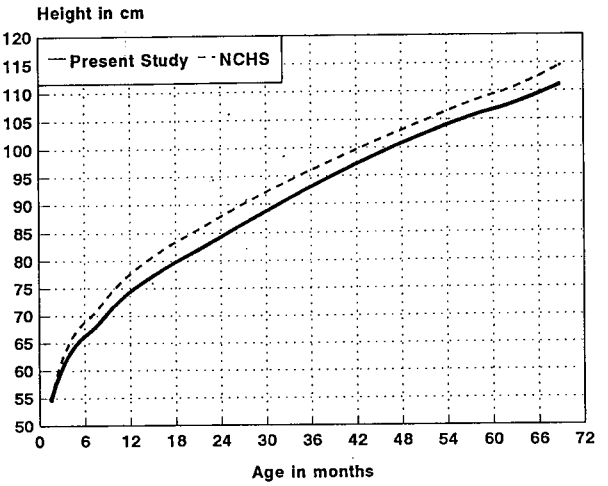

Figure 8. Comparison of height between present study and

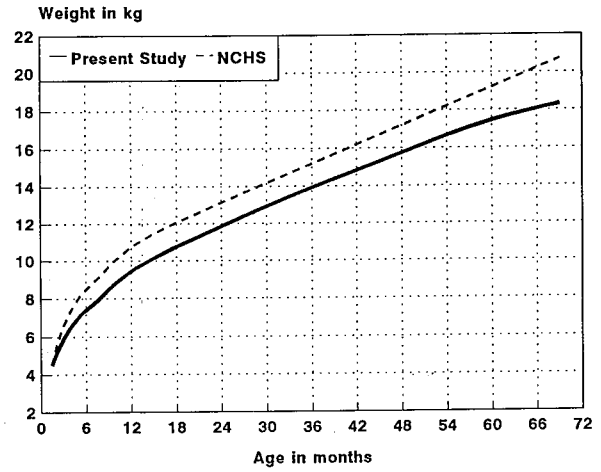

Figure 9. Comparison of weight between present study and NCHS (boys).

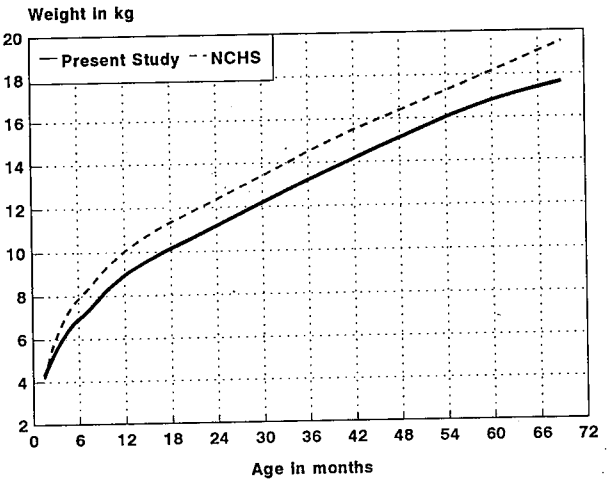

Figure 10. Comparison of weight between present study and NCHS (girls).

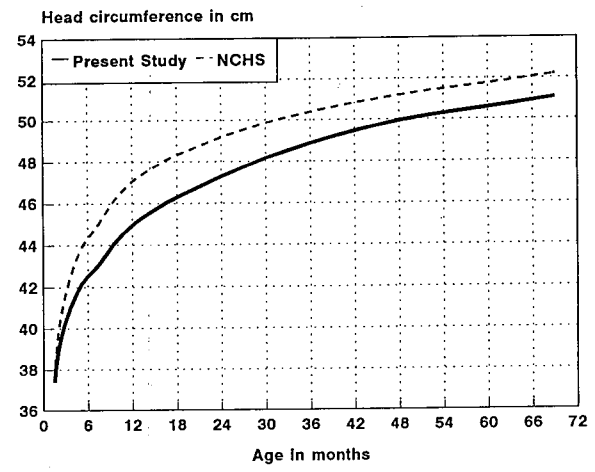

Figure 11. Comparison of head comparison between present study and NCHS (boys).

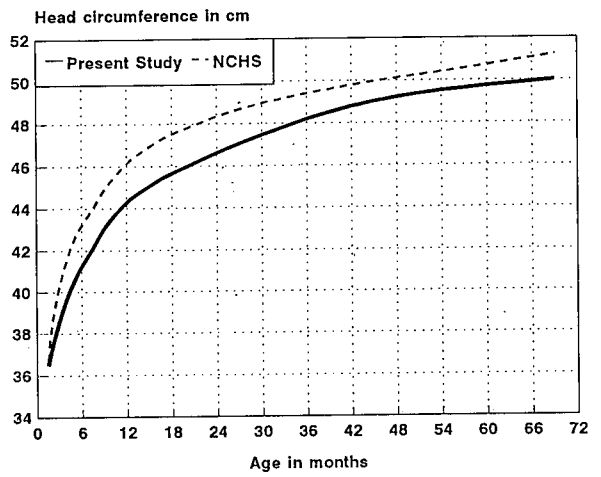

Figure 12. Comparison of head circumference between present study and NCHS (girls).

ences in gene pools and environment and their interaction[6]. It was likely that Singaporean children were reaching their full growth potential as inferred by the comparison of the median weight for height curves. This finding clearly demonstrates that the use of Western growth charts as growth standards in Asiatic populations may not be appropriate, and local growth charts should be used whenever they are available.

Conclusion

In summary, the above study had demonstrated that the pre-school children in Singapore have grown taller, heavier and have larger head circumference when compared to their counterparts more than 15 years ago.

When compared to American children of the same age

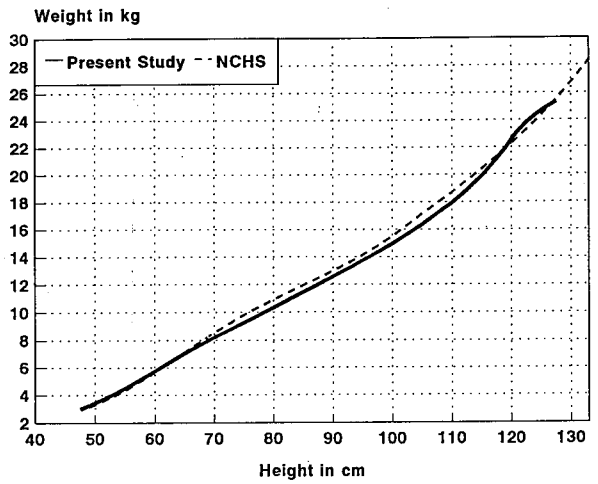

Figure 13. Comparison of weight for height between present study and NCHS (boys).

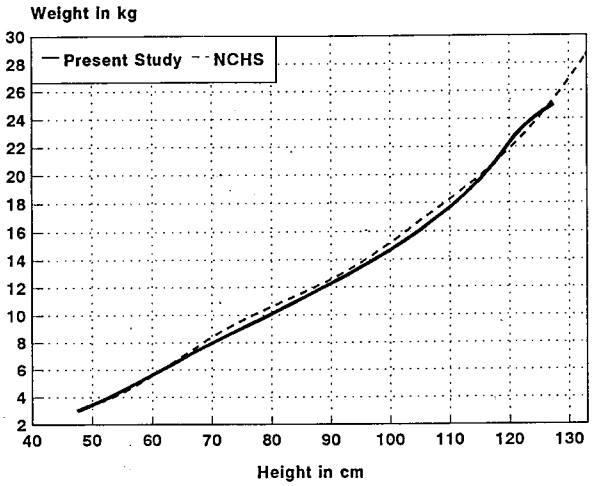

Figure 14. Comparison of weight for height between present study and NCHS (girls).

using the NCHS's curves, it was discovered that the local parameters were consistently lower than those of the NCHS. Our children, however, had attained the same weight for similar height when compared with American children.

Based on the above findings, the percentile charts derived from the present study had been selected for use in place of the NCHS/CDC/WHO's curves for growth monitoring and screening purposes in Singapore.

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新加坡學齡前期兒童生長的長期趨勢

摘要

作者在 1988 年選擇了多於 13,500 年齡在 0—6 歲的兒童進行了人體測量研究。按年齡身高，年齡體重，身高體重和年齡頭圍繪製百分比曲線圖。當與 1972 年早期研究相比較，新加坡學齡前期兒童身高增加 4.4%，體重增加 10.9%，頭圍增加 4.1%。當用年齡身高、年齡體重和年齡頭圍中數與國家健康統計中心 (NCHS 1978) 曲線圖相比較，新加坡學齡前期兒童一般比美國同齡兒童矮些，輕些和頭圍小些。但身高體重中數與同齡的美國兒童類似。這些結果指出了新加坡兒童生長的長期趨勢。