

## Weights, Heights and Quetelet's Indices of Children with Sickle-cell Anaemia ( Sicklers)

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### Summary

Emodi KJ, Kaine WN. Weights, Heights and Quetelet's Indices of Children with Sickle-cell Anaemia ( Sicklers). *Nigerian Journal of Paediatrics* 1996; 23 :37. The weights, heights, and Quetelet's indices ( QI ) of 322 sicklers, aged between six and 16 years were compared with those of 319 healthy school children matched for sex, age and social class. The mean weight for the healthy male controls was  $37.27 \pm 9.82$ kg compared with  $26.8 \pm 7.3$ kg for the sicklers. Corresponding mean weights for the female controls and the female sicklers were  $35.90 \pm 8.6$ kg and  $27.09 \pm 8.6$  kg, respectively. These differences in means weights between the controls and the sicklers of both sexes were significant ( $P < 0.01$ ). The mean heights for the male controls and the sicklers were  $152.36 \pm 14.81$ cm and  $134.36 \pm 15.27$ cm respectively, while the corresponding mean heights for the females were  $142.6 \pm 12.26$ cm and  $132.7 \pm 15.6$ cm, respectively. The differences were again significant in both sexes ( $P < 0.01$ ). The mean QI of the male controls was  $15.9 \pm 2.24$  compared with  $14.55 \pm 1.60$  for the sicklers. Corresponding indices for the female controls and for the sicklers were  $15.27 \pm 3.02$  and  $14.56 \pm 1.5$ , respectively and differences in these indices between the two groups in both sexes were similarly significant ( $P < 0.01$ ).

### Introduction

SICKLE-CELL anaemia ( SCA ) has been shown to affect growth.<sup>1-4</sup> The Body Mass Index or Quetelet's Index ( QI ) obtained by dividing the weight (in kilograms) by the square of the height (in metres), has been reported to

be a better index of body size than raw height or weight. In a previous study in Jamaica on the effect of SCA on growth, Ashcroft, Serjeant and Desai<sup>1</sup> only divided the mean weight by height instead of height squared and still obtained a lower fraction in sicklers when compared with controls. QI can also be affected by stunting<sup>5</sup> but in sicklers, there is a shorter mean height as well as a lighter mean weight which results in the smaller QI. To the best of our knowledge, the present study is the first to be carried out here in Nigeria where the incidence of SCA is reported to be the highest in the world.<sup>6</sup>

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### Materials and Methods

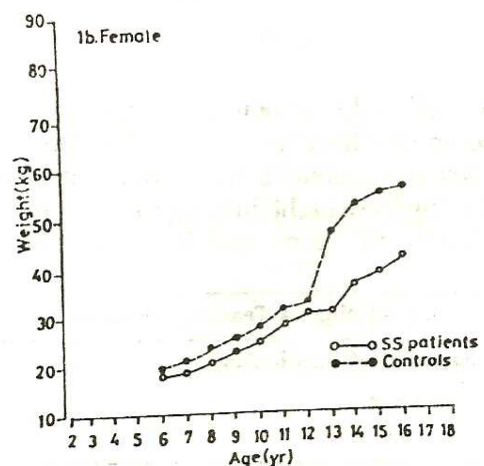
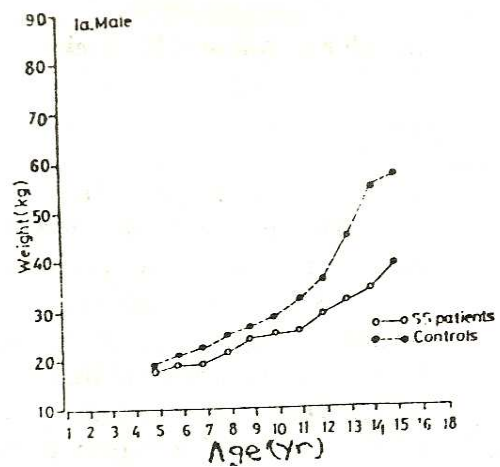
A systematic sampling technique was used over a three-month period to select 322 sicklers, aged between six and 16 years. The patients were among those attending the sickle-cell anaemia clinic of the University of Nigeria Teaching Hospital (UNTH), Enugu. All the patients were in a steady state at the time of the study. Three hundred and nineteen students from an urban primary school and two secondary schools were used as normal controls matched for age, sex and social class according to the method of Barker and Bennet.<sup>7</sup> The sicklers and controls were each weighed in their underwears using well calibrated stadiometer weighing equipment that was also used in measuring the height while the child was standing erect without shoes. In addition, the heels were placed together with the back in contact with an upright wall. The head was held in such a way that the subject was looking forward with the lower border of the eye sockets in the same horizontal plane as the external auditory meatus. The child was then requested to straighten the back and neck. The Quetelet's Index (QI) was obtained using the following formula:  $QI = \frac{\text{Weight in kilogram}}{(\text{Height in metres})^2}$

The student's t test was used for statistical analysis of the data.

### Results

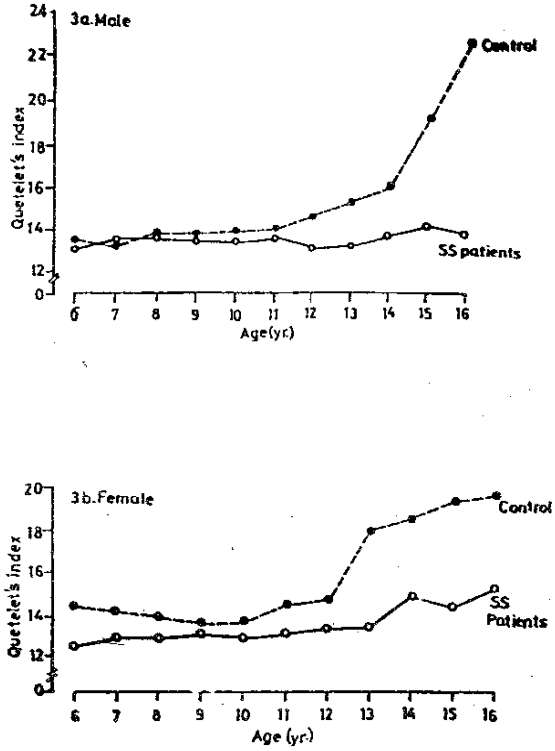
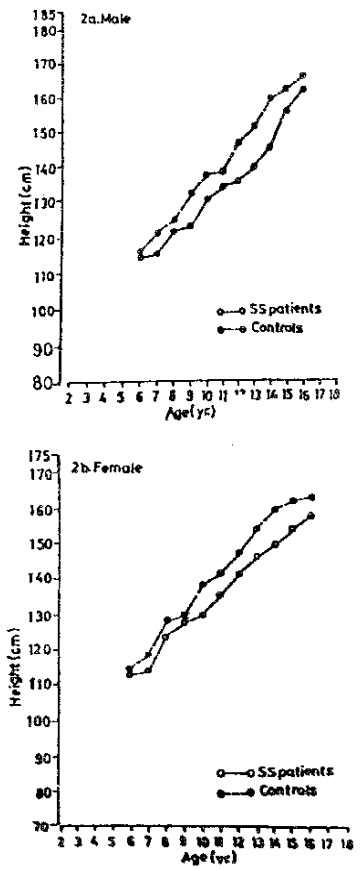
The mean weights of the male and female sicklers were  $26.8 \pm 7.3\text{kg}$  and  $27.09 \pm 8.6\text{kg}$  respectively; these weights were significantly lower ( $P < 0.01$ ) than the  $37.27 \pm 9.82\text{kg}$  and  $35.90 \pm 8.6\text{kg}$  for the male and female controls respectively. The difference increased progressively with age in both sexes (figs 1a

and 1b), but was more marked in the males. The pubertal growth spurt also occurred earlier in the control group. The spurt started at 13 years of age for males and 12 years for females. Female sicklers showed a one-year delay for the growth spurt which in the males started at 15 years of age with a magnitude that was not as marked as in the controls.



As with the mean weights, the mean heights of the male ( $134.36 \pm 15.27\text{cm}$ ) and female ( $132.7 \pm 15.6\text{cm}$ ) sicklers were significantly lower ( $P < 0.05$ ) than those of the male ( $152.36 \pm 14.81\text{cm}$ ) and female ( $142.6 \pm 12.26\text{cm}$ ) controls (figs 2a and 2b). The difference in the height decreased after 15 years of age for both sexes. This was after showing a slight but definite increase in difference in the males. There was a later pubertal growth spurt among female sicklers. Among the males, there was a reduction in the difference of the height between the two groups at 16 years of age. For both sexes, the weight was affected more than the height in the sicklers than in the controls.

The mean QIs were  $15.9 \pm 2.24$  for male controls and  $15.27 \pm 3.02$  for female controls and these were greater ( $P < 0.01$ ) than the respective values in the male sicklers ( $14.55 \pm 1.6$ ) and the female sicklers ( $14.56 \pm 1.5$ ). There was a narrow range of QI for all the patients, especially for the males. After the age of 12 years, the mean QI for the controls became progressively larger (figs 3a and 3b). There was also a rapid increase in the difference after 14 years in control males (figs 3a) and 12 years in control females (fig 3b).



### Discussion

The present study has shown evidence of some impairment of growth of sicklers when compared to sex and social class-matched controls. The weights of the children showed a deficit that increased with age. The Jamaican cohort study<sup>8</sup> has also documented a noticeable deficit in weight as early as below the age of one year. The weights of the patients in the present study compared with that of Lesi<sup>3</sup> in Lagos, have shown that our results were just below those of Lesi's elite groups for both sexes. Our present study has also confirmed the results of other studies that showed males to be more affected than females with respect to weight.<sup>9</sup>

The heights of our patients also showed a deficit which increased with age compared with those of the controls; the difference in the heights became less after puberty. It should be observed that this deficit had already been present at six years of age. Other studies have also shown an increasing deficit with increasing age up to a certain age,<sup>10</sup> thus confirming that the mean height of patients with SCA is reduced in childhood.<sup>10,11</sup>

The Quetelet's Index or Body Mass Index is said to be a better index of body size than raw heights or weights. It also has the best correlation with body fat.<sup>12</sup> The present study has shown a larger mean QI in controls compared with that in the sicklers; there is a shorter mean height as well as a lighter mean weight, but the greater deficit in weight resulted in a smaller QI. The narrow range of QIs seen in the sicklers indicate the paucity of muscle mass as well as body fat. There was no rise of QI in male sicklers at puberty as was seen in the controls, while for the females, the rise

was not as marked and only at 14 and 16 years did it reach 15 which fell just within the normal range of 15 to 18 as reported by Etta and Singh.<sup>5</sup>

When Ashcroft, Serjeant and Desai<sup>4</sup> divided mean weight by height alone instead of height squared, the fraction obtained was still less among the sicklers than among the controls. Platt, Rosenstock and Espeland<sup>10</sup> showed that by the age of 22 years, the height curve of males with SCA approached that of the controls and that in fact, female sicklers were actually taller than the controls. This trend of adult patients with SCA to be taller than those of general population has also been documented by Serjeant *et al.*<sup>13</sup> In the present study, the difference in height was much less after 15 years than earlier.

The main reason for the poor growth, especially in weight gain could be said to be due to chronic ill health, increased susceptibility to infection<sup>14</sup> and the high metabolic rate and energy wastage of these patients.<sup>15</sup> The chronic anaemic state of these patients cannot really contribute to poor growth as seen in other children with chronic anaemia due to nutritional deficiencies, because there is a marked shift of the oxygen dissociation curve to the right in sicklers, which maintains near normal peripheral oxygen delivery.<sup>13</sup> The use of siblings as controls would have been ideal for environmental, social class as well as hereditary factors but in that case, sex and age matching would have been inadequate. A longitudinal study would also reveal with greater accuracy the growth pattern of these patients.



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