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A comparative study of the growth status of children with and without SS disease at Ilorin, Kwara State, Nigeria

E. EBOMOYI, M. A. ADEDOYIN* AND F. O. OGUNLESI*

*Departments of Epidemiology & Community Health and *Child Health & Pediatrics, University of Ilorin, Ilorin, Nigeria*

Summary

An anthropometric study was conducted to determine the growth status of 1698 children with and without SS disease. Of the total subjects, 979 (57.7%) were from the University of Ilorin elementary school. Children with SS disease made up 42.3% (719) of the total sample. Children with SS disease had anthropometric values which were lower than the 50th percentile of the Unilorin sample. Of all the parameters assessed, the weight-for-age for children with SS disease was particularly deficient compared with that of the Unilorin pupils and with the Harvard standard. Although subjects were from the same Ilorin urban areas, effort was made to match the socio-economic class of children with SS disease with the Unilorin children. The need for the prompt medical management of children with SS disease and the provision of health counselling services for them were recommended.

Résumé

Une étude anthropométrique a été menée pour déterminer le statut de croissance de 1698 enfants atteints ou non de la maladie associée à SS. Parmi eux, 979 (57.7%) étaient de l'école élémentaire de l'Université d'Ilorin. Les enfants atteints de la maladie associée à SS comptaient 719, soit, 42.3% de l'échantillon total. Les enfants atteints de cette maladie possédaient des valeurs anthropométriques inférieures au 50e percentile de l'échantillon de

l'Unilorin. Parmi tous les paramètres évalués, on constate que le rapport poids-âge des enfants atteints de la maladie était particulièrement défectueux par rapport à celui des élèves de l'Unilorin et à celui de Harvard standard. Bien que les sujets ne soient pas de la même région urbaine d'Ilorin, on a essayé de corréler la classe socio-économique des enfants atteints de la maladie avec les enfants d'Unilorin. Il a été recommandé que les enfants atteints de la maladie reçoivent promptement les soins médicaux appropriés et que l'on s'engage dans des services de conseils médicaux.

Introduction

Sickle cell disease is a recessive hereditary disorder of haemoglobin synthesis. In Nigeria, individuals with sickle cell trait account for 25% of the population, while those with sickle cell disease account for only 2–3% of the population [1–3]. In spite of the extensive research on sickle cell disease there is still no known cure; and with an incidence of 3% in Nigeria a study of the growth status of children with and without SS disease can facilitate the provision of a preventive health programme for the at risk group. Such a health care plan can assist not only in saving many lives but also in relieving much hardship.

An anthropometric study comparing the growth status of children with and without SS disease has not been reported in Kwara State, Nigeria. However, related studies on the subject were conducted in the Caribbean [4,5] and the U.S.A. [6–8]. In an earlier study, Ebomoyi [9] compared the growth patterns of urban and rural Kwara children by measuring the height

Correspondence: Dr E. Ebomoyi, Department of Epidemiology & Community Health, PMB 1515, Ilorin, Nigeria.

and weight, chest, head and mid-upper-arm circumference (MAC) of each participant. The present study compares the growth status of children with and without SS disease by measuring their height and weight, head, and mid-upper-arm circumferences. Using a combination of methods, various anthropometric indices of children with SS diseases were compared with 'normal' children at Ilorin and with the Harvard standard. The Unilorin pupils can aptly be described as controls because the majority of them are born to the 'elite' class and they live in affluent neighbourhoods.

Subjects and methods

This study was carried out at two locations in Ilorin, the capital of Kwara State, Nigeria. All patients with HBSS disease who were being cared for at the Paediatric Sickle Cell Clinic of the University of Ilorin and those from private hospitals in Ilorin were selected for this study. All the children who were currently enrolled at the University of Ilorin elementary school were included in this study as a control group. A total of 183 pupils were in the play class, while 854 were enrolled in the reception and primary classes. At the time of the study, 471 male and 508 female pupils participated in this study from the Unilorin elementary classes. The abstention rate of 5.6% ($n = 58$) was random and could not have affected the results of the study substantially.

For diagnosis of HBSS, blood was taken by either venipuncture or pricking of the thumb, and haemoglobin electrophoresis was performed by the technique described by Zak *et al.* [10]. The children who were currently enlisted for treatment as cases of sickle cell disease were all eligible for the anthropometric assessment.

We inquired about the occupation and the combined annual income of the participants' parents. This information was used to match the subjects with HBSS disease and the Unilorin (control) subjects by their socio-economic status. The matching ratio was approximately 1:2 among the patients and the control subjects respectively. Socio-economic status (SES) was used because it influences environmental hazards and lifestyles. Additionally, SES is an important determinant of disease and it was required to match the cases of HBSS

and the control subjects thereby making them comparable [11–13].

Consent forms were sent to the parents of the pupils and only those who returned them with parental consent were allowed to participate in the study; all the pupils were allowed to participate.

Five research assistants with post-basic nursing training were recruited and given a month in-service training at the Epidemiology and Community Health Laboratory of the University of Ilorin on the technique for taking weight, MAC, height and head circumference measurements. A nutritional component of primary health care was also taught to facilitate patient education, and referral of children found to be suffering from growth retardation. These research assistants, including the investigators, took all the measurements both at the Unilorin primary school and at the various specialist and private hospitals in Ilorin.

A school was selected in the inner city to pre-test and assess the effectiveness of the research assistance. Various anthropometric values were repeated by the field workers to ascertain inter- and intra-observer variations. The children were weighed wearing very light clothing without shoes. The height, weight, head and left mid-upper-arm circumferences of children with and without SS disease, aged 2–13 years were measured as described by Jelliffe [14]. Establishing a precise age for the children with HBSS disease was no problem as accurate medical records were kept for the children since the diagnoses of their disease. Parents of children with HBSS disease whose children were under 5 years of age were interviewed. Those over 6 years old provided information on the socio-economic status of their parents. At the reception classes, age was stated and confirmed by class teachers.

Percentages, means and standard deviations for the group of children with HBSS disease were compared with those of the control subjects. Student's *t*-tests (two-tailed) were used to compare mean height, weight, head and mid-upper-arm circumferences.

Results

The age distribution of the subjects revealed that 17.3% of control subjects, and 14.6% of

subjects with SS disease were under five. In the age group of 5–9, the control subjects were 29.6% and the patients with SS disease 19.8% of the sample. Additionally, the control subjects in the age group of 10–13 were 10.7% and the subjects with SS disease 7.9% of the total sample. Children with SS disease made up 42.3% of the subjects, there were 383 male and 336 female children. The 'normal' children attending Unilorin elementary school consisted of 471 male and 508 female pupils.

As shown in Fig. 1a and b, the 50th percentile of weight-for-age for both males and females with SS diseases lies below the 50th percentile of both the Harvard standard and the Unilorin 50th percentile. The preponderance of the weights for both Unilorin pupils and children with SS disease were below 99% of the Harvard standard. This trend is more pronounced in the latter group where both the males and females weighed less than 94.8% of the Harvard standard. Statistically significant differences existed between weights for Unilorin male pupils and their counterparts with SS disease ($t = 24.81$, $P < 0.001$). The 50th percentile of height-for-age of the male and female children with SS disease also lies below the 50th percentile of both the Harvard standard and the Unilorin sample (Fig. 1c and d). However, the 50th percentile of height-for-age of the Unilorin female children of the sample lies above the 50th percentile of the Harvard standard. Compared with their Unilorin counterparts, male children with SS disease were statistically

shorter ($t = 7.93$, $P < 0.01$). Again, female Unilorin children were statistically taller than children of the same age with SS disease ($t = 7.40$, $P < 0.01$).

Presented in Fig. 2a and b is the 50th percentile of MAC-for-age for both males and females of the study sample compared with the Harvard standard. About 89.4% of the Unilorin male children had MAC over the 50th percentile of the Harvard standard. Male Unilorin children had statistically larger MAC measurements than comparable children with SS disease ($t = 14.32$, $P < 0.001$). Among the Unilorin female children, the mean mid-upper-arm circumferences for all ages was above the 50th percentile of the Harvard standard. The Unilorin female elementary school pupils had larger arm circumferences than their counterparts with SS disease ($t = 15.17$, $P < 0.001$). During weaning the head circumference is larger than the chest circumference, but with children experiencing abnormal growth patterns the chest may appear larger than the head. These anthropometric changes occur dramatically in children under three [15]. As a result, the head circumference was not compared with the Harvard standard, instead, the 50th percentiles of the Unilorin male and female sample were compared with the 50th percentiles of their counterparts with SS disease. As illustrated in Fig. 2c and d, marked differences could be observed in the growth pattern of head circumference of the two groups of subjects after 6 years of age. The
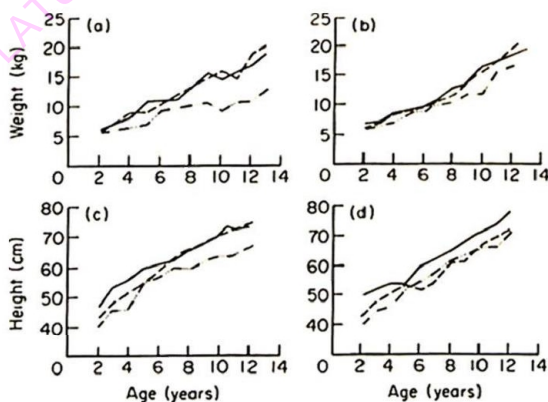

Fig. 1. Comparison of the 50th percentiles of the Unilorin children (——) with the 50th percentiles of children with SS disease (—·—) and with the 50th percentiles of the Harvard standard (- - -). Weight-for-age, male (a), female (b). Height-for-age, male (c), female (d).
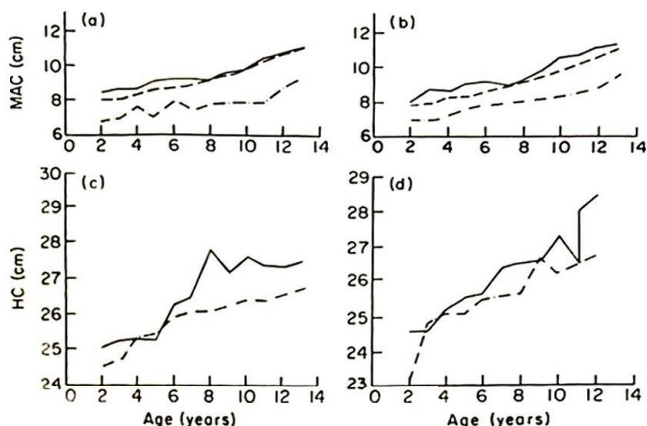
Fig. 2. Comparison of the 50th percentiles of the Unilorin children (——) with the 50th percentiles of children with SS disease (—·—) and with the 50th percentiles of the Harvard standard (- - -). MAC-for-age, male (a), female (b). Head circumference-for-age (HC), male (c), female (d).

difference in the size of head circumference among Unilorin female pupils and their counterparts with SS disease was significant ($t = 2.32$, $P < 0.05$).

Presented in Fig. 3 is the index of weight/height-for-age of Unilorin pupils compared with those of the Harvard standard and children with SS disease.

In most cases male children with HBSS had lower values than controls, whereas female children with sickle cell anaemia had values comparable to the Unilorin and Harvard standard until after the age of five when lower values were observed, possibly indicating that leanness is a characteristic feature of patients suffering from sickle cell anaemia.

Discussion

Although we confirmed that none of the Unilorin children had HBSS, it was not determined whether any of them had been heterozygous, AS. Even if a few of them had sickle cell trait, many investigators [4,5,7] have reported that no statistically significant differences were found in the height and weights between normal subjects (HbA/HbA) and those with sickle cell trait (SCT). Also, effort was made to match the socio-economic status of the two groups of subjects.

From the weight, height and MAC of subjects measured, the Unilorin children serving as 'controls' had better anthropometric values than their counterparts with SS disease. Specifically, the Unilorin male children were statistically heavier than male children with SS disease ($t = 24.81$, $P < 0.001$). Also, the female Unilorin pupils had statistically heavier weight measurements than their age-cohorts with HBSS ($t = 12.80$, $P < 0.001$). This observation
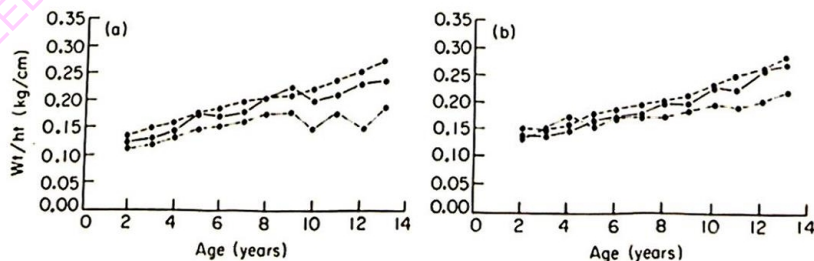

Fig. 3. Weight/height, by age, of children with SS disease (—·—) compared with Unilorin pupils (——) and with the Harvard standard (- - -). (a) Males, (b) females.

agrees with the findings of Ashcroft, Serjeant & Desai [5]. The Unilorin children were statistically taller than their comparable age-group with HBSS and compared favourably with the Harvard standard. Gaston [16] theorized that in spite of adequate appetite, the growth of most children with SS disease was less than optimal, it generally paralleled the third percentile for height-for-weight. Serjeant [17] asserted that most children with SS disease experience retardation of growth with an appreciable change in their stature. Even with the use of the arm circumference as an age-independent public health index for detecting growth deficits, the results of the statistical analysis revealed that Unilorin children had larger MAC's than their counterparts with HBSS ($P < 0.01$).

Generally, anthropometric figures on height, weight and MAC measurements in developing countries show lower values when compared with the North American and European standards. Marked differences can be observed between affluent and impoverished classes [18–21]. It is quite common to observe that measurements on African children of school age who are born to the elite class, living in affluent neighbourhoods, more often than not have weights and heights which are either similar or greater than standards derived from American and British children [22–24]. Over 80% of the male Unilorin children had MAC measurements which were above the 50th percentile of the Harvard standard (Fig. 2a and b). All of the female Unilorin children had MAC measurements which were larger than the 50th percentile of the Harvard standard. However, all of the children with SS disease had MAC measurements which were lower than the 50th percentile of the Harvard standard.

The head circumference is another age-independent anthropometric measurement which is useful in measuring the growth status of a child. However, this index is most useful for children under 3 years of age [15]. As a result, the head circumference was not compared with the Harvard standard. Instead the 50th percentile of these anthropometric measurements for the Unilorin pupils and children with SS disease were compared. Unilorin male children had larger head circumferences than their counterparts with HBSS ($t = 2.32$, $P < 0.01$), and female children also had far larger head circum-ferences than female children with SS disease ($t = 2.60$, $P < 0.01$).

An age-independent weight/height ratio was reported to be quite sensitive and appropriate for detecting the growth status of children. This index for the two groups of subjects had confirmed that children with SS disease in most cases had lower values than the Unilorin pupils and the Harvard standard. This suggests that patients suffering from HBSS were emaciated, and short as a group. This observation was confirmed by Ashcroft, Serjeant & Desai [5], they maintained that with the use of weight/height in detecting growth deficits, children with HBSS had a substantially lower ratio than those of 'controls' of the same age.

The growth status of children with SS disease from 2–13 years of age has been compared with their 'normal' age group and with the Harvard standard. From this study, children with HBSS as a group were shorter, weighed less and were of thinner body stature. Quite consistently, they had anthropometric values which were lower than the Harvard standard. From this study, it seems prudent that primary health care workers should promptly refer patients with features of SS disease for treatment in tertiary and diagnostic centres. Such patients should also be provided with health counselling and career guidance to enable them to live economically productive lives.

Acknowledgments

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