

GROWTH OF TRIBAL CHILDREN WITH SICKLE CELL ANAEMIA- A STUDY FROM SOUTH INDIA

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ABSTRACT

BACKGROUND

Sickle cell anaemia is a multisystem disease associated with end-organ damage, which can adversely affect the growth and development of children. There is no enough data on the effect of this disease on the growth and development of children.

MATERIALS AND METHODS

A community-based cross-sectional study was conducted in tribal children with and without sickle cell anaemia (HbSS and non-SS). Mean values of height, weight, head circumference, chest circumference, BMI and US/LS ratio were calculated for the age group of 1-5, 6-10 and 11-15 years. Mid upper arm circumference was studied for 1-5 age group.

RESULTS

Out of 254 children, 138 were males and 116 females. There was no significant difference in mean anthropometric parameters in the age group of 1-5 years and 11-15 years. Mean weight, height and BMI of children in 6-10 years were 19.01 kg, 114.51 cm and 14.38 respectively for HbSS and 22.06 kg, 124.77 cm and 14.07 respectively for non-SS. Mean MAUC in 1-5 years were 13.93 cm for SS group and 13.78 cm in non-SS group.

CONCLUSION

Sickle cell anaemia is not causing significant adverse effect on the growth of children; but it has a transient negative effect on the growth of primary school going children.

KEYWORDS

Children, Tribal, Growth, Sickle Cell Anaemia.

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BACKGROUND

Sickle Cell Disease (SCD) is a heterogeneous group of inherited blood disorders characterised by predominance of sickle haemoglobin (HbS). It include conditions where one beta globin allele is sickle cell mutation (HbS) and the other beta globin allele is another mutation such as HbC, Hbβ+/β0, HbD or HbO resulting HbSS, HbSβ0, HbSβ+, HbSC, HbSD or HbSO phenotypes.¹ The most severe form of SCD is commonly referred to as Sickle Cell Anaemia (SCA) where both the beta globin alleles show sickle cell mutation resulting in HbSS.² In SCA, HbS is usually >90% of total haemoglobin; whereas in SCD, HbS could be >50%.¹ SCA is one of the most common monogenetic diseases in the world

with recent estimates suggesting that more than 3,12,000 infants are born with HbSS each year.³

In Kerala, 1.5% of the population is represented by tribes, of which 36.5% resides in Wayanad.^{4,5} A high gene frequency of haemoglobin S among various tribal communities in Wayanad has been identified.⁵ Clinical severity of SCA is low in patients from northern districts of Kerala.⁴ Feroz M and K P Aravindan has demonstrated high levels of HbF in these patients from Wayanad and they have also correlated this high HbF with absence of irreversible sickle cells in the peripheral smear of these patients.⁵ This maybe the reason for the milder phenotype of this disease in this population. A reasonable amount of literature has indicated that the SCD patients experience adverse effect upon the physical growth and development.³ Studies have shown that American black children with sickle cell disease were shorter with lower weights and thinner body build than normal children.⁶ Studies from other states of India also showed an adverse effect of SCA on the growth of children.^{7,8}

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Aims and Objectives

However, there is no enough data from Kerala to confirm this view. In the context of milder phenotype of the disease in sickle cell population of Kerala, it is relevant to study the effect of SCA on growth and development of children, because a small intervention in nutrition and primary healthcare of these children can improve the morbidity and even mortality related to this disease. So, we conducted a study in Wayanad district, which has maximum density of sickle cell anaemia in Kerala.

MATERIALS AND METHODS

A community-based cross-sectional study was conducted in children of age 1 to 15 years in Muttill Vivekananda Hospital, Wayanad district, which is a hospital dedicated for the welfare of tribal population. Tribal promoters and anganwadi workers mobilised these children to the hospital. Medical checkup was done in these children and medicines were provided for illnesses detected during the checkup. Children with bony deformities of any aetiology and children having other systemic illnesses likely to cause growth retardation were excluded from the study. Informed consent was taken from parents of all children and Institutional Ethics Committee clearance was obtained from Government Medical College, Kozhikode. Out of 658 children attended, 254 tribal children with known haemoglobin electrophoresis pattern were selected by purposive sampling method. Haemoglobin electrophoresis by cellulose acetate electrophoresis at pH 8.9 was carried out in these children previously by Muttill Vivekananda Hospital as part of the patient care.

Anthropometric measurements of these children were taken by a single investigator. Height, weight and Mid Upper Arm Circumference (MUAC) were recorded according to the National Health and Nutrition Examination Survey 2009 revised guidelines of CDC Atlanta.⁹ Height is recorded by using stadiometer with an accuracy of ±0.1 cm. Weight is recorded with a normal bathroom standing scale (Detecto scales) with an accuracy of ±100 gms. Both the equipments were calibrated before the commencement of data collection. The lower body segment is measured from upper edge of pubic symphysis to the floor and upper body segment is calculated by subtracting lower body segment

from the height. Head Circumference (HC), Chest Circumference (CC) and MUAC were recorded using fibre glass measuring tape with an accuracy of ±0.1 cm. BMI is calculated by the formula, weight in kg and height in m².

Based on the Hb electrophoresis pattern, these children were grouped into two, HbSS group and non-HbSS (HbAA and HbAS). There was no sickle thal (HbSβ0) patient detected in our study.

Mean values of height, weight, HC, CC, BMI, US/LS ratio of children in the age group of 1-5, 6-10 and 11-15 were calculated separately for both the groups. MUAC was studied only in children between 1 and 5 years. Statistical significance of the data was analysed by paired t-test. P value <0.05 was considered significant.

Inclusion Criteria

Children between 1 and 15 years of age with known haemoglobin electrophoresis pattern, attending Muttill Vivekananda Hospital, Wayanad.

Exclusion Criteria

1. Children with bony deformities of any aetiology.
2. Children with other systemic illnesses.

RESULTS

In the present study, there were 254 tribal children between 1 and 15 years with known electrophoresis pattern, of which 96 were included in SS group and 158 in non-SS group. Gender distribution, age pattern and growth pattern are shown in table 1, 2 and 3, respectively. Pattern of MUAC is shown in Table 4.

Category	Total Number	Male	Female
SS	96	57 (59.4 %)	39 (40.7%)
Non-SS	158	81 (51.3 %)	77 (48.8%)

Table 1. Gender Distribution of SS and Non-SS Groups (n=254)

Age	SS (n=96)	Non-SS (n=158)
>1-≤5	15 (15.7%)	28 (17.8%)
>5-≤10	44 (45.9%)	95 (60.2%)
>10-≤15	37 (38.6%)	35 (22.2%)

Table 2. Age Pattern of SS and Non-SS (n=254)

Variables	>1-≤5 Years (n=43)			>5-≤10 Years (n=139)			>10-≤15 Years (n=72)		
	SS (n=15)	Non-SS (n=28)	P value	SS (n=44)	Non-SS (n=95)	P value	SS (n=37)	Non-SS (n=35)	P value
Weight (kg)	12.43	11.25	0.1524	19.01	22.06	0.0001	30.73	28.63	0.1422
Height (cm)	92.95	88.08	0.1466	114.51	124.77	0.0000	139.55	138.97	0.7406
HC (cm)	47.74	46.94	0.1885	49.56	50.35	0.0164	51.22	51.37	0.7094
CC (cm)	49.50	48.54	0.2998	55.50	56.99	0.0207	61.83	65.70	0.0025
US/LS ratio	1.11	1.179	0.1439	0.98	0.97	0.7955	0.89	0.90	0.8532
BMI (kg/m ²)	14.33	14.42	0.8575	14.37	14.06	0.2502	15.60	14.70	0.0159

Table 3. Growth Parameters of SS and Non-SS Groups (n=254)

Age	SS (n=15)	Non-SS (n=28)	P value
≥1-<5	13.93	13.78	0.6513

Table 4. Mean Mid Upper Arm Circumference in cm (n=43)

No significant difference is observed in the mid arm circumference in 1-5 age group.

DISCUSSION

There are 35 different tribal communities in Kerala. A good number of them are residing in Wayanad district. According to the 2011 census, total size of tribal population was 4,84,839.⁴ They are commonly affected with communicable diseases especially water borne diseases and also genetic abnormalities like sickle cell anaemia and G6PD deficiency.¹⁰ A significantly high gene frequency for sickle cell has been detected in the tribal population of Wayanad.^{5,11}

Among the tribal communities all over India, prevalence of underweight, stunting and wasting were 55%, 54% and 28%, respectively, according to NFHS-3 data.¹² However, prevalence of under nutrition was much less in tribal children in Kerala.¹³ A tribal survey in Kerala conducted by National Nutrition Monitoring Bureau showed a prevalence of 43% underweight, 54% stunting and 15% wasting.¹⁴ In our study, all the children above the age of one year with and without SCA were having significant under nutrition. A recent study in Wayanad, which compared tribal children with nontribal children, also showed higher prevalence of under nutrition among tribal children.¹³ Scarcity of food, infant and young child feeding practices and recurrent or chronic illnesses maybe the important factors responsible for this.

Generally, children with SCA in Kerala have a benign to relatively severe clinical manifestations. Evidence of milder course of disease in tribal children with SCA in Wayanad has been reported previously.⁴ There are reports from other parts of India also indicating milder disease of SCA in tribal population associated with high prevalence of alpha thalassaemia.¹⁵

M. B. Mukherjee, et al has demonstrated growth retardation in his study on children with SCA in Nagpur District of Maharashtra.⁷

In the present study, there was no difference in the mean weight and height between children included in HbSS and non-SS group of 1-5 and 11-15 years. In population outside India, growth delay in SCA starts in early childhood and becomes more apparent during adolescence.¹⁶ This pattern of growth delay is not seen in our study, which may be due to the less severe nature of SCA in this population. Moreover, the mean weight and mean height of both SS and non-SS children of age group 11-15 years were observed to be similar in the present study, which implies that SCA is not delaying the pubertal growth spurt.

In 6-10-year-aged children of HbSS group, the mean weight, height, head circumference and chest circumference were significantly low (p value <0.05) when compared to non-HbSS group. The diet and the clinical spectrum of these children were not analysed in the present study; however, the likely increased outdoor activities of this age group and

the resultant risk for frequent vaso-occlusive crisis would have contributed to this transient effect on growth of these children.

In the present study, there was no statistically significant difference in US/LS ratio between HbSS and non-SS children of all the 3 age groups. A study in children with sickle cell disease by M.B. Mukherjee and R.R. Gangakhedkar also showed normal US/LS ratio as compared to normal children with comparable sex and age.¹⁷

Apart from weight for height, MUAC is the anthropometric index most often used in the identification of malnourished children.^{18,19} MUAC is the proxy of an individual's nutritional status, which reflects indirectly the catabolism of lean tissue and fat, which occurred during undernourishment.^{20,21} It is a rapid method of assessing nutritional status without any extensive training, supervision or materials. There are studies from other parts of India and also from African populations showing lower MUAC in children with SCA.^{7,17} In the present study, there was no difference in the mean MUAC of children below 5 years between HbSS and non-SS groups. This disparity could be explained by less severe expression of the disease in this region and also by the fact that growth delay may not become apparent during early childhood in SCA.

The Body Mass Index (BMI) is a measure of adiposity of an individual and is found to be a good indicator of nutritional status. Absolute and relative changes in the amount of lipid, protein, water and minerals leads to change in body composition from infancy to adolescence; however, this physiological changes may not be the same for children with sickle cell anaemia.^{22,23} In SCA, hypoxaemia and tissue hypoperfusion can affect almost all systems of the human body causing retardation of growth and development, which can reflect in impairment of various anthropometric measurements including body fat.²⁴ A low BMI in children with SCA has been demonstrated by many studies.²⁵ In contrast to this, the mean BMI in HbSS children of all the age groups were not reduced significantly when compared to non-SS group, which could be explained by the milder form of SCA in this part of country.

CONCLUSION

Sickle cell anaemia is not causing significant adverse effect on the growth of children; but it has a transient effect on the growth of primary school going children. Further studies are needed to address the severity of disease and its effect on growth and development of children.

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