SJIF Impact Factor: 6.711

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 8.
Issue: 11
Page N. 10-14
Year: 2024

Original Article www.wjahr.com

COMPARATIVE STUDY OF HAEMOGLOBIN AND HAEMATOCRIT LEVELS TO THE SEX, AGE, WEIGHT AND HEIGHT OF SCHOOL CHILDREN IN NNEWI, ANAMBRA STATE, NIGERIA

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Article Received date: 03 September 2024 **Article Revised date:** 24 September 2024 **Article Accepted date:** 13 October 2024

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ABSTRACT
Haemoglobin and Haematocrit determinations are routine laboratory tests whose values depend on many factors, including the age and sex of an individual. The decrease in these values leads to anaemia. Children are prone to infection due to their lifestyles and maturing immunity. The aim of this study was to determine the haemoglobin and haematocrit values in healthy school children living in Nnewi, Anambra state; aged ranged from 7 to 18 years and relate the values with their age, height and weight. A total of 1,200 primary and secondary school children, made up of 580 males and 620 females were used for this study. Their Blood samples were collected in Ethylene diamine tetra-amino acid (EDTA) bottle for haemoglobin and haematocrit estimation using Cyanmethaemoglobin and Microhaematocrit methods respectively. The height of the school children was taken with a meter tape placed on the wall without their shoes and recorded in meter, while their weight was taken with a weight scale and recorded in kilogram. The result shows that haemoglobin and haematocrit levels increase in both males and females as they attained a mean weight of 44kg and a mean height of 1.55m. Significant sex difference merges at 15years, with males having higher height, weight, haemoglobin and haematocrit levels than the females.

KEYWORDS: School children, Haemoglobin, Haematocrit, Nnewi Height and weight.

INTRODUCTION
Haemoglobin and haematocrit concentrations of the blood are widely used as an aid in assessment of the state of health of an indidvidual. The concentration varies substantially according to age, sex, and race/ethnicity as well as altitude. The haemoglobin concentration in normal infants declines after birth to reach the physiological nadir at approximately eight weeks of age (normal range 9.0–14.0g/dl). The causes of the decline include accelerated red cell loss around the time of delivery, reduced survival of neonatal red cells (approximately 90 days to 120 days) and erythropoietin deficiency as a result of negative feedback from increased oxygenation after the normal neonatal circulation is established.[1] The fall in haemoglobin reactivates erythropoietin production, and the normal feedback mechanism that persists for the remainder of life is established.[1] At birth, the total haemoglobin (Hb) level, red blood cell (RBC) count and haematocrit are shown to be higher than at any other period of life.[1] The levels of these parameters decrease during the next few months after birth, some more steeply than others, with the cells becoming hypochromic with the development of "physiologic" iron deficiency anemia. The haemoglobin content and the red cells then gradually rise to adult levels by the age of puberty. Male and female have different mean haemoglobin levels in health in venous blood. Females have mean levels approximately 12% lower than male.[2] It is probably a direct effect of sex hormones, both estrogen and androgens, on erythropoiesis. Developmental changes occur leading to maturation, The mechanisms or causes of developmental change are genetic factors and environmental factors. Genetic factors are responsible for cellular changes like overall growth, changes in proportion of body and brain parts[3], vision and dietary needs. Growth is related to

changes in size, number, or dimensions at the level of cells, organs and individuals, as measured by weight, length, bone age, and metabolic balance (body calcium and nitrogen retention).[4,5] Environmental factors affecting development are diet and disease exposure, as well as social, emotional, and cognitive experiences.[5] Children are vulnerable to malnutrition and infectious diseases.[6] Malnutrition is a large problem in developing nations, and has an important impact on young children's weight, height and health.[7] The relationship of haemoglobin and haematocrit levels to height and weight are important, since these parameters may directly or indirectly be influenced by nutritional factors.

MATERIALS AND METHOD

Ethical approval and a written consent were obtained for this study. A total of 1,200 children were used and 2mls of blood sample was collected from each child and added into sample bottles containing Ethylene Diamine-tetra-acetic acid (EDTA). Haemoglobin was carried out using the Cyanmethaemoglobin method and reported in gram per deciliter (g/dl), while the haemtocrit level was also carried out using the microhaematocrit method and was reported in percentage (%). Height measurement was taken from the children without their shoes using a meter tape placed on the wall and reported in meter. The weight of the children was taken with a weight scale with the children putting on their uniform. The uniform was estimated to weigh 0.2kg and was subtracted before the real weight was recorded. Statistical package for the social sciences (SPSS) application with chi-square test was used. The relationships between the continuous variables were examined using Pearson's linear correlation test at the level of $P \leq 0.05$.

RESULT

The results of the haemoglobin (Hb), haematocrit concentration, height and weights determined in 1,200 healthy school children were presented in figures 1, 11 and 111, 1V and V.

Figure 1 showed that at the ages of 7 and 8years, the height of the boys were higher than the girls until the age of 10 years when both the boys and girls had the same height. Significant difference ($p < 0.05$) was seen from the age of 15 to 18 years in the heights of the boys and girls. The weight of the boys and girls increased with their age as shown in Figure11. Their values showed no significant difference ($P<0.05$), until the age of 15 years when the boys weighed more than the girls. The Haemoglobin and Haematocrit values showed no significant differences until the boys and girls attained 14years and pronounced more at ages 16 to 18years. (Figures111 and 1V).

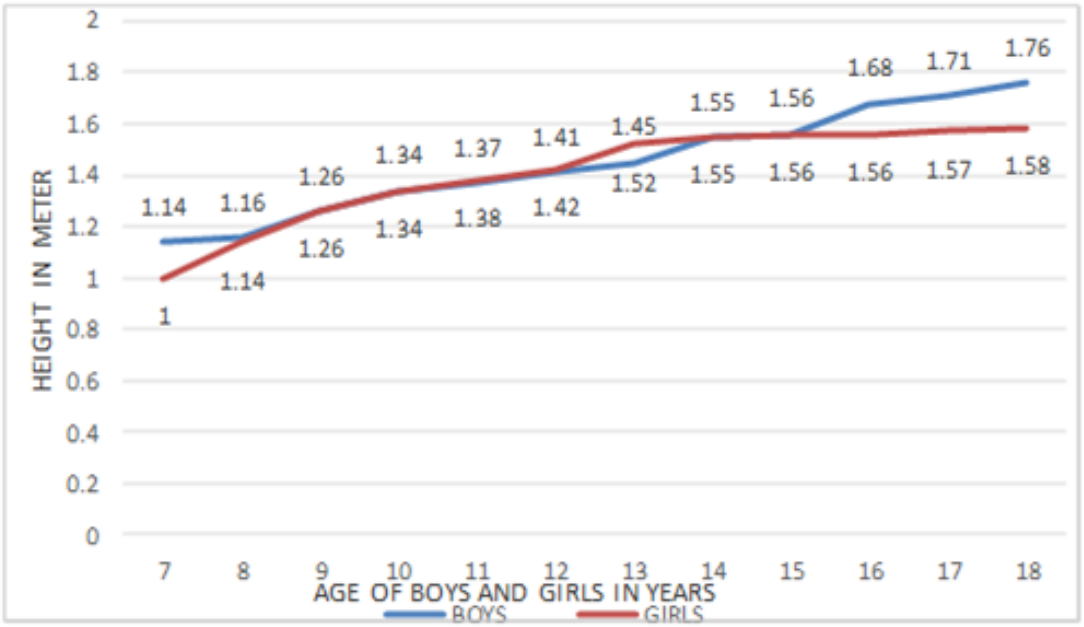

FIGURE 1: Mean height against the age of the children aged 7-18 years.

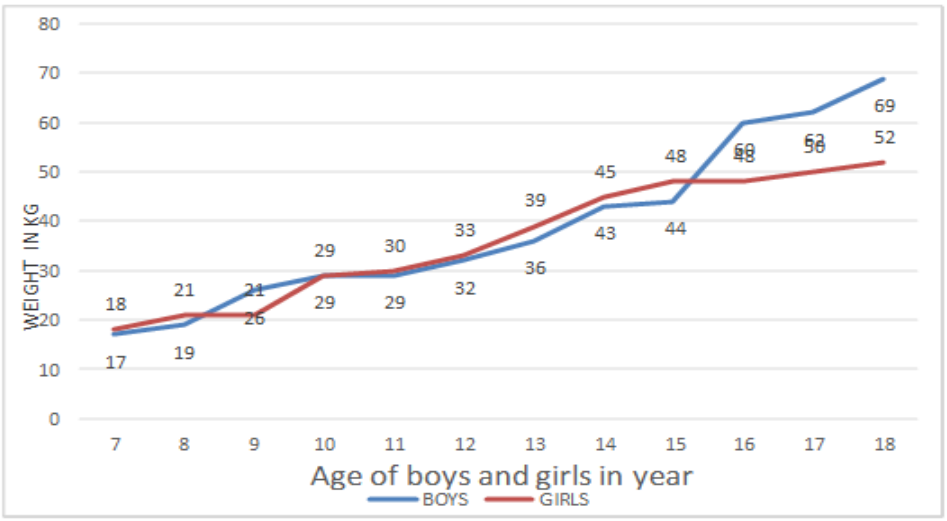

FIGURE 11: Mean weight against the age of the children aged 7-18 yea.

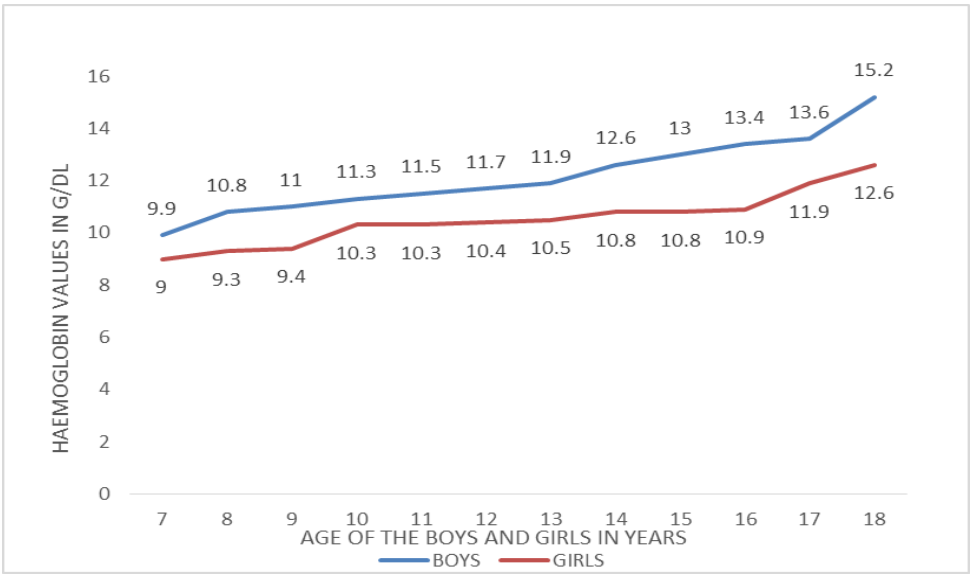

FIGURE 111: Haemoglobin values against the age of the children aged 7-18 years.

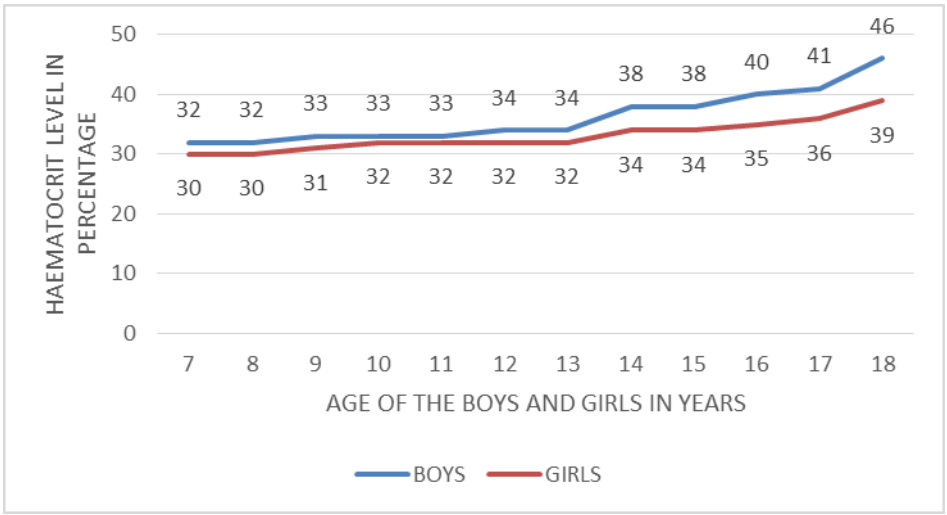

FIGURE 1V: Haematocrit values against the age of the children aged 7-18 years.

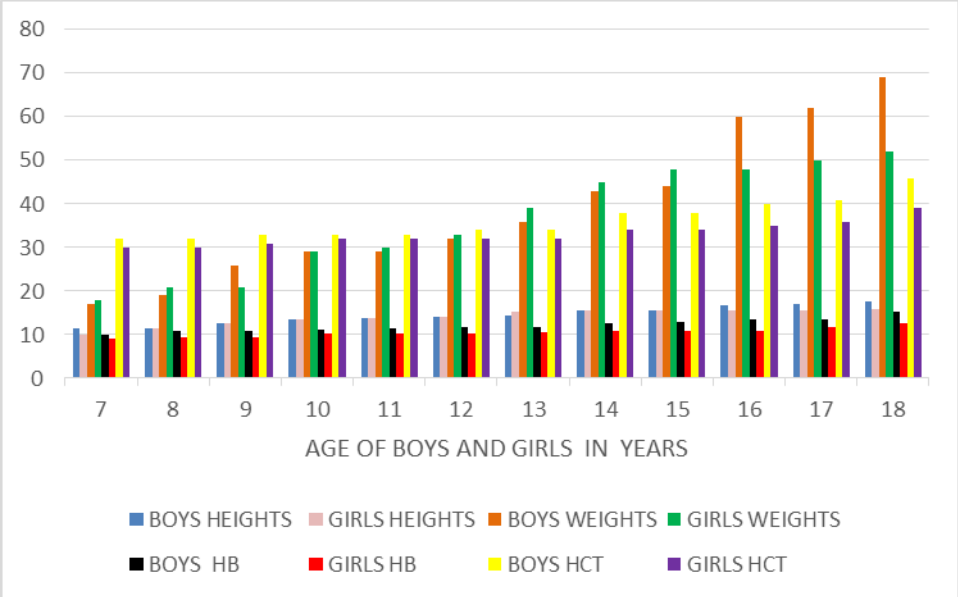

FIGURE V: Mean haemoglobin, haematocrit, height and weight of boys and girls in relationship to their age.

DISCUSSION

Haemoglobin and Haematocrit values of boys and girls aged 7 to 18years attending primary and secondary schools in Nnewi metropolis, Anambra state was carried out, and the values obtained were related to their height and weight. The values were intended to be used as a reference range for children residing and attending clinics and hospitals in Nnewi. The study showed that from the age of 7 years, the boys were taller than the girls until the age of 10 and 14 years, where the girls were seen taller than the boys, which was statistically not significant. A significant difference (<0.05) was observed from the age of 15years which correspond fairly to the beginning of menstruation in girls and this physiological change affects the growth rate of girls. Considering the weight of the children, from the outcome of the result, the girls weighed more than the boys until the age of 15years, this could be due to the accumulation of fat in the body which comes from the hormone dislocation which occurs with the onset of sexual maturity and part from over-eating which is stimulated by rapid physical growth, the fat in the girls is responsible for about 21-29% of total weight as indicated by.[7,8] From the age of 16 to 18 years, the boys weighed heavier than the girls which can be attributed to hormonal changes, muscle building in boys. There were significant difference (<0.05) observed between the height and weight of both boys and girls from the age of 16 years. The haemoglobin and haematocrit between the boys and the girls also differed significantly from the age of 14 years, the boys having higher values than the girls. The low haemoglobin and haematocrit in the girls when compared with the boys, may be as a result of rise in oestrogen as they attain puberty and womanhood causing suppression of erythropoiesis in girls, and could also be as a result of steady increase in the body mass index that can correlate nutritional status and variation in growth and development.[9] The higher haemoglobin in the boys can be attributed to the adaptive response to greater oxygen requirements due to the rapid increase in lean body mass and increase production of testosterone hormone. A study observed that in males, the achievement of adult testosterone concentration is associated with an increase in erythropoiesis and haemoglobin concentration.[10] There was a positive correlation between haemoglobin and haematocrit values showing uphill linear relationship to age, height and weight, indicating that these values increases with age.

CONCLUSION

This study clearly shows difference in height, weight, haemoglobin and haemocrit values between the ages of the girls and boys (aged 7-18years) studied. The parameters increase with increase in age. Sexual differences were also demonstrated with the older boys heavier and taller than the girls. The haemogloin and haematocrit values reveals that the boys have higher values than the girls.

Compliance with ethical standard

Acknowledgments: The authors wish to thank all the parents that gave their consent for the children/wards to participate in this study, the headmasters/mistresses and the principals whose schools were used for the study. Special thanks to the Head of Haematology department for using the laboratory for the analysis.

Disclosure of conflict of interest: There is no conflict of interest or any financial support related to this study.

Ethical Approval: The approval for this study was sought and obtained from the Ethical committee, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra state, Nigeria.

Statement of informed consent: Informed consent was obtained from the parents of the children.

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