Original Research Article

Body mass index based anemic status among children who are attending the pediatrics ward of southern part of Chennai - A prospective study

D. Aishwarya[1], Saranya S[1*]

[1]Junior Resident, Department of Pediatrics, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India

[*]Corresponding author email: **saranyaselvaraj7@gmail.com**

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Abstract

Introduction: Anemia can increase the risk of maternal and child mortality, impair cognitive and physical development in children, and endanger physical performance in adults. Obesity is a growing global health problem; the prevalence of this condition has increased dramatically in recent years. Generally, it can be claimed that16-31% of children are suffering from obesity nowadays. One of the major causes of obesity is the rapid changes in lifestyles and dietary patterns namely, from traditional to new diets, a drastic shift which heralded large amounts of fat, sugar, and oil.

The aim of the study: The presents study was undertaken to investigate the prevalence of anemia and interrelationship of anemia with BMI among the children population.

Materials and methods: The study was conducted in 100 children in who were willing to participate in the study at Sree Balaji Medical College and Hospital, Chennai. Children were categorized into 4 group. Group I Normal weight subjects, group II underweight, group III overweight and group IV obese children. All the 100 children were age and sex-matched. Both the gender was in taken for the study. Parameters such as height, weight, BMI, Hb, serum ferritin were analyzed using standard techniques and results were analyzed accordingly.

Results: Male children were more in the total population (65) when compared to female children (35). Group III (n=30) were more in our study population.The mean hemoglobin count was found to be less in Group II when compared with Group -1, Group-III, Group-IV. Serum ferritin level was found to be less in Group II when compared with Group -1, Group-III, Group-IV.

Conclusion: This study suggests that the higher levels of total and central obesity should be taken into account when assessing the children's body iron status and should be treated before providing dietary recommendations to correct anemia.

Key words

Obesity, Anemia, Hb, Serum Ferritin, Body Mass Index.

Introduction

Iron deficiency is the most common and widespread nutritional disorder in the world. It is estimated that 30% of the global population suffers from iron-deficiency anemia and most of them live in developing countries [1]. Anaemia is known to affect people belonging to all age-groups, Particularly women of childbearing age and children. World Health Organization (WHO) definitions for anemia are as follows: in children's from 6 months to 5 years, anemia is defined as a Hb level<11g/dl, and in children between 5–11 years Hb < 11.5g/dl [2]. Obesity has been reported to be associated with anemia in adults in some countries which may be due to up-regulated hepcidin expression thereby hampering iron absorption. Therefore, obesity could potentially add to the burden of anemia. The most significant contributor to the onset of anemia is iron deficiency [3]. The other causes of anemia are heavy blood loss, parasitic infections, acute and chronic infections, micronutrient deficiency and hemoglobinopathies [4]. Anemia among women causes many serious health problems and is pervasive in developing countries [5]. Anemia can result in adverse pregnancy outcomes, and severe anemia can lead to maternal death. Anemia can result in decreased muscular strength, weakness, lowered physical activity, fall injury, diminished physical and mental capacity, increased frailty risk, increased morbidity from infectious diseases, perinatal and neonatal mortality, inadequate iron stores for the new born, premature delivery, low birth weight and impaired cognitive performance,motor development and scholastic achievement in children [6]. It is estimated that 75% of anemia is related to iron deficiency, followed by folate and vitamin B12 deficiencies. Almost all the studies at national and local level have focused predominantly on a pregnant and lactating female and children. Some studies showed that obese people are almost two times more likely to be diagnosed with iron deficiency anemia and are significantly higher among obese than normal weight people [7]. Studies also introduced the most common age of this problem as 12-16 years old. In addition, obese girls usually grow faster, thus they reach puberty at an earlier age than the rest of the girls. Therefore, the possibility of saving iron is reduced [8].

Materials and methods

The study was conducted between the year 2016-2017 in 100 children in who are willing to participate in the study at Sree Balaji medical college and hospital, Chennai. Children were categorized into 4 group. Group-I normal weight subjects, Group –II underweight, group III overweight, group IV obese children. All the 100 children were age, and sex-matched. Both the gender is taken for the study. Parameters such as height, weight, BMI, Hb, serum ferritin are analyzed using standard techniques and results were analyzed accordingly. Oral consent got from the parents of study for the collecting blood sample. The need and purpose of the study were explained in detail. The anthropometric assessment included weight, height, and WC. Weight was measured with the use of digital scales (med scape GC-98 model) with a precision of 0.1 and height was measured with the use of SECA height gauge with an accuracy of 0.5 cm in a standing position without shoes and keeping the shoulders in a relaxed position. WC was measured using a non-elastic tape with an accuracy of 0.1cm at the midpoint of the lower end of the rib cage and top of the iliac crest in a standing position. Body Mass Index (BMI) was calculated weight (kg)/height $(m)^2$. BMI was

considered as a criterion to assess total obesity and WC to assess central or abdominal obesity. The assessment of obesity with BMI index using the CDC2000 reference. International Obesity Task Force (IOTF-2000) has proposed the standards for adult obesity in Asia and India as follows: A cut-off point of 18.5 kg/m^2 is used to define thinness or acute undernutrition and a BMI of 23 kg/m^2 indicates overweight. A BMI of over 25 kg/m^2 refers to obesity. Simultaneously, IV blood sample was obtained from cubital vein to measure serum Ferritin, Hb. Results are analyzed accordingly.

Statistical analysis

The data analysis was carried out using the SYSTAT version 12. Statistical significance of the difference in mean values between groups was assessed using independent samples t-test. The relationship between hemoglobin concentration, serum Ferritin, and BMI was examined by calculating the Pearson's correlation coefficient (r) and the significance of correlation (p).

Results

Children were categorized into 4 group. Group-I normal weight subjects, Group –II underweight, group III overweight, group IV obese children. All the 100 children were age, and sex-matched. Both the gender are the intake for the study. Parameters such as height, weight, BMI, Hb, serum ferritin are analyzed. The age group of children was between 3-10 years. Male children were more in the total population (65) when compared to female children (35). Group III (n=30) were more in our study population.Height was measured in cm in Group –I (32.56±2.8), Group –II (28.93±6.9), Group –III (23.89±4.20), Group –IV (21.45±0.6) of p-value (<0.509) which was found to be less statistically significant.

Weight was measured in kgs Group –I (33.82±0.2), Group –II (29.34±0.7), Group –III (35.85±3.9), Group –IV (39.23±3.1) of p-value (<0.203) which was found to be statistically less significant. BMI (kg/m^2) Group –I (16.01±3.3), Group –II, (14.89±3.0), Group –III (21.98±1.6), Group –IV (26.99±9.0) of p-value (<0.001**) which was found to be more statistically significant. Hb (gm/dl) level in Group –I (15.4±2.0), Group –II (11..77±1.03), Group –III (14.67±2.04), Group –IV (14.98±2.8) of p-value (<0.001**) which was found to be more statistically significant. Serum Ferritin level (ng/ml) Group –I (23.08±3.9), Group –II (14.84±3.2), Group –III (21.77±4.5), Group –IV (19.23±4.5) of p-value (<0.001**) which was found to be more statistically significant. The mean hemoglobin count was found to be less in Group II when compared with Group -1, Group-III, Group-IV. Serum ferritin level was found to be less in Group II when compared with Group -1, Group-III, Group-IV (Table – 1).

Table – 1: Anthropomorphic, measurements, Hb count, serum ferritin level in children to show the prevalence of anemia in comparison with BMI.

PARAMETERS	Group –I Normal Weight Children (n=25)	Group –II Underweight Children (n=25)	Group –III Over Weight Children (n=30)	Group -IV Obese Children (n=20)	P value
Height(CM)	32.56±2.8	28.93±6.9	23.89±4.20	21.45±0.6	<0.509*
Weight (KG)	33.82±0.2	29.34±0.7	35.85±3.9	39.23±3.1	<0.203**
BMI (kg/m^2)	16.01±3.3	14.89±3.0	21.98±1.6	26.99±9.0	<0.001**
Hb (gm/dl)	15.4±2.0	11.77±1.03	14.67±2.04	14.98±2.8	<0.001**
S. Ferritin level (ng/ml)	23.08±3.9	14.84±3.2	21.77±4.5	19.23±4.5	<0.001**

P<0.05 considered being statistically significant, P value <0.001 was considered to be more significant.

Discussion

Anemia that's most common in people of African heritage (about 1 out of every 500 African-American children is born with it). It affects hemoglobin, a protein in red blood cells that helps carry oxygen throughout the body. RBCs with normal hemoglobin move easily through the bloodstream because of their rounded shape and flexibility [9]. Sickle cell disease makes RBCs sticky, stiff, and more fragile, and they form into a curved, sickle shape. Instead of moving through the bloodstream easily, sickle cells can clog blood vessels.Pallor has poor sensitivity for predicting mild anemia but correlates well with severe anemia. One study showed that physical examination findings of pallor of the conjunctivae, tongue, palm, nail beds are 93 percent sensitive and 57 percent specific for the diagnosis of anemia in patients with a Hb level of less than 5 g per dL (50 g per L) [10]. The sensitivity decreases to 66 percent when the Hb level is 5 to 8 g per dL (50 to 80 g per L) [11]. Chronic anemia may be associated with glossitis, a flow murmur and growth delay, although these conditions are rare in developed countries. According to the WHO classification of anaemia as a problem of public health significance at community levels, the prevalence of anaemia which was >40% was considered to be a severe public health problem, that which was between 20.0 to 39.9% to be a moderate public health problem, that which was between 5.0 to 19.9% to be mild public health problem and that which was <4.9% not to be a public health problem [12]. The prevalence of anemia among the study population was greater than 40%, it was considered as a severe public health problem. The present study thus brings out the fact that the problem of anemia was related to a wider population than the traditionally considered groups of the children categories under body mass index.The prevalence of iron deficiency varies greatly according to the host factors like age, gender, physiological causes, pathological causes, nutritional factors, environmental factors and socioeconomic conditions. Concerning the relationship between age and Hb concentration, the present study showed that age was directly and highly correlated with Hb concentration [13]. The incidence of anemia increases with the age and are highest among the period of increasing growth and adolescents. Similar to study on Iraqi adolescents females a negative correlation was found with age and BMI, however, none of the association was statistically significant. The present study also points to the fact that most of the girls of higher age group were closure to the lower levels of hemoglobin (<12 gm%). Iron deficiency is characterized by microcytosis with an elevated RBC distribution width. Because the anemia is mild and the history and laboratory values are consistent with iron deficiency, it is appropriate to treat presumptively with oral iron therapy and repeat testing in one month. Treatment for mild anemia is 3 to 6 mg of elemental iron per kg per day. Once-daily dosing results in similar improvement as two- or three-times-daily dosing and does not significantly increase adverse effects. In a child who otherwise appears well and has had a recent viral infection, transient erythroblastopenia of childhood (TEC) should be considered [14]. This condition usually occurs in children six months to three years of age after a viral infection or exposure to toxic agents. It is the result of an immune reaction against erythroid progenitor cells. In patients with TEC, the initial reticulocyte count is zero but slowly increases as the patient recovers, which typically occurs within two months of onset. child's age, ill appearance, and lack of viral symptoms make TEC less likely. Older children and adolescents are also at risk of anemia. The combination of a growth spurt and the onset of menstruation leaves adolescent girls at particularly high risk of iron deficiency anemia [15].

Conclusion

As anemia is one of the major public health problems in India, a comprehensive plan to overcome is important. National guidelines can be followed for the prevention and management of anemia. Various strategies to prevent anemia

are by improving dietary intake, by providing iron folate-rich foods and a food item that promotes iron absorption, providing awareness to the public by conducting health and nutrition education programmes and screening for early detection of anemia among children. The main limitation of our study is that we used anemia as an indicator which only represents a part of the complex assessment of iron status.

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