

**UTILITY OF AUTOMATION IN ASSESSMENT OF HAEMATOLOGICAL PROFILE AND TYPING OF ANAEMIA IN PRE-SCHOOL CHILDREN - A TERTIARY CENTRE STUDY**Vinukumar V<sup>1</sup>, Kalaranjini K. V<sup>2</sup>, B. Krishnaswamy<sup>3</sup>, Sheela Vasudevan<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: BACKGROUND:** According to the current WHO estimates most of world's population may be Iron deficient and at least one third have anemia because of Iron deficiency. The current study gives emphasis on utility of Complete blood count for screening as well as to find out the type of anemia at no additional cost. **AIMS:** To study the hematological profile and to type the anemia in children aged between 1-5 yrs. **SETTINGS AND DESIGN:** Descriptive study **MATERIAL AND METHODS:** A total number of 112 cases attending Rajah Muthiah Medical College Hospital Pediatrics outpatient department during the period of July 2007- July 2009 were included in the present study and were divided into 4 groups. Venous blood samples were collected by venipuncture into containers with di-potassium EDTA. All samples were analyzed for hematological parameters. (Erythrocyte count, Hemoglobin, Hematocrit, Mean corpuscular volume, Mean corpuscular Hemoglobin concentration and Red cell Distribution width) **STATISTICAL ANALYSIS USED:** None **RESULTS:** A total of 112 cases were included in the study, among which, 30 were in Group I, 30 were in Group II, 26 were in Group III and 26 were in Group IV. The prevalence of anemia was found to be 73.2%. Children in Group II (2-3 yrs.) were most affected (90%) followed by children in Group I (1-2 yrs.) (73.3%) with male predominance. Classification of anemia was done using MCV and RDW and found that 58.9% came under Microcytic Heterogeneous type due to iron deficiency. **CONCLUSION:** A significant correlation exists between hemoglobin, Hematocrit, MCV, MCH and RDW. Hemoglobin concentration below 11.5 gm/dl in pre-school age group was found to be an effective screening test for selecting patients for further evaluation. Correlation between MCV and RDW was found to be effective in categorization of anemia even before peripheral smear examination and biochemical investigations.

**KEYWORDS:** Anemia, Hemoglobin, Mean Corpuscular Volume, Red Cell Distribution Width.

**INTRODUCTION:** Nutrition and health are the most important contributory factors for human resources development in the country<sup>1</sup>. But still under nourishment continues to be a major public health issue and cause substantial proportion of all child deaths, more so in developing country like ours. Rural India needs more attention as 72.9% of India's population resides in rural area. Moreover this is the population who rarely receive proper nutrition due to various socioeconomic causes.<sup>2</sup>

Anemia is one of the common problems encountered in clinical medicine. However anemia is not a disease but rather the expression of an underlying disorder or disease. Anemia is functionally defined as a decrease in the competence of blood to carry oxygen to tissues, thereby causing tissue hypoxia.<sup>3</sup> Anemia is defined as a low hemoglobin concentration or RBC mass compared to the age specific norms<sup>4</sup>.

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According to the current WHO estimates most of world's population may be Iron deficient and at least one third have anemia because of Iron deficiency.<sup>5</sup> Anemia in children is a commonest health problem in developing countries and a frequent laboratory abnormality encountered in children.<sup>5,6</sup> As many as 80% of children in developing countries and 20% in US will be anemic at some point by age 18 yrs.<sup>6</sup>

The most vulnerable group regarding health and nutritional status are the pre-school children living in rural as well as slum areas, who are victims of undernourishment.<sup>2</sup> Preschool denotes children aged 1-5 yrs.<sup>7</sup> Pre-school age is when brain development and physical growth is at its maximum acceleration, hence its importance.<sup>2</sup>

Anemia in infancy and early childhood is associated with behavioral and cognitive delays, including impaired learning, decreased social achievement, and low scores on tests of mental and motor development. Most children with anemia are asymptomatic and have abnormal hemoglobin or Hematocrit level on routine screening. Infrequently, a child with anemia may have pallor, fatigue and jaundice but may or may not be critically ill.<sup>3</sup>

Given the detrimental long term effects and high prevalence of nutritional deficiency, its prevention in early childhood is an important public health issue. Iron deficiency is currently the most wide spread micronutrient deficiency with an estimated prevalence of 43%.<sup>4</sup>

Among infants the following characteristics confer special risks: low socioeconomic status, consumption of cow's milk before six months of age, low birth weight and prematurity.<sup>8</sup>

The Complete blood count is a test frequently done on children presenting to pediatric OPD, usually for consultation and the same can be utilized to screen for Iron Deficiency Anemia at no additional cost.

The present study is on hematological parameters and its utility in categorization of anemia among preschool children attending Rajah Muthiah Medical College and Hospital hailing from rural community in and around Chidambaram.

**MATERIAL AND METHODS:** A total number of 112 cases attending Rajah Muthiah Medical College and Hospital Pediatrics outpatient department during the period of July 2007 - July 2009 were included in the present study and was cleared by Institutional Ethics Committee.

The above registered children were divided into 4 groups.

Group I	:	1-2 yrs.
Group II	:	2-3 yrs.
Group III	:	3-4 yrs.
Group IV	:	4-5 yrs.

Blood was withdrawn from an ante cubital vein by means of dry sterile 5 ml, disposable plastic syringe with a needle of 20 gauge after preparing the cubital fossa with a sterile swab. Two ml of blood was withdrawn, slowly. Immediately blood is transferred to sterile glass bottle with dipotassium EDTA as anticoagulant and was analyzed in an automated cell counter as shown in fig 1(MODEL & COMPANY: MYTHIC 18, ORPHEE SA, C2 DIAGNOSTICS, FRANCE)for complete blood counts (Erythrocyte count, Hemoglobin, Hematocrit, Mean corpuscular volume, Mean corpuscular Hemoglobin concentration, Red cell Distribution width, Reticulocyte count and platelet count).

**INCLUSION CRITERIA:**

- Randomly selected children attending pediatric outpatient department aged 1 yr. to 5 yrs. during study period.

**EXCLUSION CRITERIA:**

Children with

- acute infections
- communicable diseases like HIV, Tuberculosis Hepatitis
- Other major and chronic illness.
- on iron supplements
- History of recent blood transfusion
- Known cases of hemoglobinopathies.

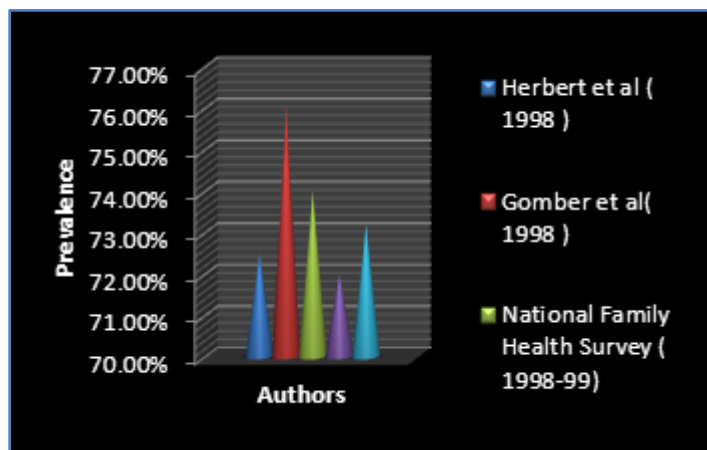
**RESULTS:** 112 Preschool children were included in the study and categorized into Group I: 1-2 yrs. (30 cases); Group II: 2-3 yrs. (30 cases); Group III: 3-4 yrs. (26 cases) and Group IV: 4-5 yrs. (26 cases). 82/112 cases were found to be anemic as per WHO definition. Among them 22 (26.9%), 26(31.7%), 18(21.9%) and 16(19.5%) were in I, II, III and IV Groups respectively. Out of 82 anemic pre-school children, 47(57.31%) were found to be males and 35(42.68%) were found to be females. Thus male to female ratio in the present study was found to be 1.3:1. 23 out of 112(20.5%) pre-school children had RBC count less than 3.6 million per cu.mm and 89 out of 112(79.5%) pre-school children had RBC count within 3.6 to 5.5 million per cu.mm. 60 cases(53.6%) had Hematocrit less than 33%. Hemoglobin value of pre-school children was less than 11.5g/dl in 82/112 cases (73.2%) and it was greater than or equal to 11.5g/dl in 30/112 cases(26.8%). Among pre-school children, mild degree of anemia (9-11gm/dl) seen in 37.5% of cases, moderate degree of anemia (7.0-9.0 gm/dl) seen in 22.3% of cases and 10.7% of cases were severely anemic (less than or equal to 7.0). 82/112 (13.2%) had MCV below 80fl, 15/112(13.4%) had MCV within the normal range and 15/112(13.4%) had MCV more than 100 fl. 69/112(61.6%) pre-school children had MCH below 25.9 pg., 37/112(33.03%) had MCH within normal range (26.0-34.9 pg.) and 6/112 (5.4%) had MCH more than 35.0 pg. 61/112(54.5%) pre-school children had MCHC below 30.9 g/dl, 49/112(43.8%) had MCHC within normal range (31.0-36.0g/dl) and 2/112(1.8%) had MCH more than 36.1g/dl. 73.2 % of preschool children had decreased MCV (<80 fl). Classification of anemia was made on the basis of Mean Corpuscular Volume (MCV) and Red cell Distribution Width (RDW) with number of cases in each group (Table 1).

S. No	TYPES OF ANAEMIA	NO OF CASES
1.	Microcytic Heterogeneous	68
2.	Microcytic Homogeneous	14
3.	Normocytic Homogeneous	14
4.	Normocytic Heterogeneous	06
5.	Macrocytic Heterogeneous	10

**Table 1: Classification of anemia with number of cases**

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**DISCUSSION:** Anemia in preschool age group was defined and classified using WHO criteria (Hb less than 11 g/dl).<sup>9</sup> In the present study, prevalence of anemia was found to be 73.2% which was in concordance with the studies conducted by Villalpando et al,<sup>10</sup> National Family Health Survey<sup>11</sup> 1998-99, Herbert et al<sup>12</sup> and Gomber et al<sup>13</sup> as shown in Fig 1.



**Fig. 1: Comparison of prevalence of anemia**

Preschool children in Group II (2-3 yrs.) were most affected by anemia (90%) followed by children in Group I (1-2 yrs.) (73.3%), which was in concordance with studies conducted by Mudrakohli et al<sup>14</sup> Osorio et al<sup>15</sup> and Susan et al.<sup>16</sup> Males were found to be more anemic when compared to females (1.3:1). Similar result was obtained by studies conducted by Gomber et al.<sup>13</sup> Degree of anemia was classified as mild (9-<11.0 gm/dl), moderate (7-<9.0 gm/dl) and severe (< 7gm/dl). Mild degree of anemia was most prevalent (40.2%) in the present study followed by moderate (22.3%) and severe anemia (10.7%). The findings were in accordance with studies conducted by Gomber et al<sup>13</sup> and Chakraborty et al.<sup>17</sup> Comparison of MCV and RDW were done and found out that 73.2% of children had decreased MCV (<80 fl) and 58.9% had increased RDW, which correlated with studies conducted by Pattan et al,<sup>18</sup> Oski et al<sup>19</sup> and Martin et al.<sup>20</sup>

Classification of anemia was made on the basis of Mean Corpuscular Volume (MCV) and Red Cell Distribution Width (RDW) which was proposed by Bessman et al.<sup>21</sup> Anemia are classified into six types - Microcytic Heterogeneous, Microcytic Homogeneous, Normocytic Homogeneous, Normocytic Heterogeneous, Macrocytic Homogeneous and Macrocytic Heterogeneous. The results of the present study with possible etiology were included in Table 2.

S. No	TYPES OF ANAEMIA	NO. OF CASES	POSSIBLE AETIOLOGY
1.	Microcytic Heterogeneous	68	Iron deficiency anemia
2.	Microcytic Homogeneous	14	Chronic disease
3.	Normocytic Homogeneous	14	Blood loss
4.	Normocytic Heterogeneous	06	Early iron deficiency
5.	Macrocytic Heterogeneous	10	Vitamin B <sub>12</sub> / Folate deficiency

**Table 2: Classification of anemia with number of cases and possible etiology**

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**CONCLUSION:** One of the major areas for improvement in primary health care is prevention of nutritional deficiency because it has been associated with delay in psychomotor development especially in preschool age. Appropriate screening and subsequent diagnostic testing will allow most cases of anemia to be diagnosed at the earliest. Basal blood parameters are mandatory before treating children with anemia to avoid unwanted side effects. In the present study, a significant correlation exists between Erythrocyte count, Hemoglobin, Hematocrit, MCV, MCH and RDW. MCV and RDW alone can be utilized for classifying Anemia even before doing peripheral smear or biochemical investigations.

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