ORIGINAL ARTICLE

Screening by Point of Care Testing: A Critical View for Community Health Service to Evaluate Anemia in Women

Madhura TK [1], Ajit Bhale[2] and Vishnu Kankute[3]

[1] Department of Biochemistry, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bangalore Karnataka - 562110, [2]Departmentt of Biochemistry, SBH Government Medical College, Dhule – 424001, [3]Department of Biochemistry, Government Medical College, Aurangabad – 431001, Maharashtra, India.

Abstract:

Background: Anemia is a public health issue that affects people in both developed and developing countries. Given the global significance of this disease, several countries are implementing measures to minimise anaemia, particularly among the individuals most vulnerable to its fatal effects: pregnant women and young children. Attempts have been made over the last three decades to establish estimates of the prevalence of anaemia at various levels, utilising a variety of methodologies, including the deployment of point-of-care testing. *Aim and Objective:* To estimate the prevalence of anaemia in women by POCT screening method; a camp based study in residents of DRDO, Pune. *Material and Methods*: 110 women of different age group participated in a medical camp conducted at DIAT-DRDO, Pune. 3 ml of venous blood was obtained in a EDTA vacuitainer. Estimation of hemoglobin rendered using portable photometer Hemocue (Hb 201 system). Statistical analysis: Collected data was analyzed by Tukeys multiple posthoc procedures, ANOVA and Karl Pearson's correlation coefficient method. *Results:* 56 percent of women had levels of Hb well below 12g / dL and 44 percent of women had levels of Hb that were common. Highest prevalence was observed among the anaemic women in the 21–30-year age group. Therefore, the peak reproductive community has been more affected. *Conclusion:* The undiagnosed cases can continue for decades along with low haemoglobin values, affecting oxygenation of the tissue. Thus, at the first clinic visit, specifically female (housewives) residents of the peripheral area, uneducated with ignorant attitude must be screened on a compulsory basis.

Keywords: Point of care testing (POCT), Screening, Anemia, Hemoglobin (Hb), Iron deficiency anemia (IDA), Prevalence, Awareness.

Introduction:

Anaemia is described as a reduction in the total number of red blood cells (RBCs) or haemoglobin in the blood, resulting in a reduction in the blood's ability to transport oxygen. The burden of anaemia in world accounts to 25 percent [1]. It has an impact on people's health, physical productivity, and performance. In developing nations, this can be avoided by providing prompt treatment to restore personal health and increase national production by 20% [2]. In India, anaemia affects 90.1 percent of teenage girls, with 7.1 percent having severe anaemia [3]. In India, the prevalence of iron deficiency anaemia increased from 56.5 percent in 2005-2006 to 53.0 percent in 2015-2016 [4]. In women, anaemia can be a contributing factor in maternal and neonatal mortality [5]. Anemia affects nearly half of women of reproductive age and 26% of males in the 15-59 age group [6]. Iron deficiency anaemia affects 600 million people in South-East Asia, primarily teenage girls, women of reproductive age, and young children. According to a single-center study conducted in a rural environment in India, the illness affects 87 percent of the population [7]. According to the National Family Health Survey (NFHS-V), women aged 15 to 49 years old in urban and rural areas have 53.8 percent and 58.5 percent anaemia, respectively. Furthermore, in both urban and rural settings, girls aged 15 to 19 years have 56.5 percent and 60.2 percent anaemia, respectively [8]. Anaemia is a symptom of poor nutrition as well as bad health. The most serious health effects of anaemia, such as an increased risk of

maternal and newborn death, have been documented. Maternal deaths accounted for 113 per 100,000 live births in 2016-18, according to the Sample Registration System [9]. Furthermore, iron deficiency anaemia, as the name implies, is a frequent type of anaemia in which the blood lacks enough red blood cells to deliver oxygen and is caused by an iron deficit [1]. The harmful consequences of IDA on children's cognitive and physical development, as well as their physical performance [10]. Hb concentration is the most accurate indicator of anaemia at the population level, compared to clinical diagnostics, which are subjective and so have greater potential for error. Hb levels may be measured easily and cheaply. Many causative factors of anaemia exists other than iron deficiency. Anaemia's aetiology should be approached with caution. The major purpose of the anaemia evaluation is to offer information to decision-makers about the kind of measures that should be implemented to prevent and monitor anaemia. This means that, in addition to determining the Hb content, the reasons of anaemia must be determined.

Basic weariness, exhaustion, shortness of breath, or resistance to activity are common symptoms as anaemia progresses slowly. At times of high performance, anaemia caused by blood loss has more severe consequences, such as weariness, dizziness, fainting, increased thirst, or heart failure. Anemia must be severe before a person becomes noticeably pale [11].

Anemia is caused by a variety of variables, the most common of which are nutritional and viral. Iron deficiency is the most common cause of anaemia among nutrition variables. Poor nutrition can increase iron insufficiency, especially when it's combined with folic acid, vitamin A, or vitamin B12 deficiency. The most common causes of anaemia mediated by water are malnutrition and water-borne or water-mediated illnesses. Anemia is common in India due to low food consumption, low iron intake (less than 20 mg/day), and low folic acid intake (less than 70 micrograms/day); poor iron bioavailability (3-4% only) in an Indian diet high in phytates, phenolic compounds, and fibre promotes poor iron absorption [12,13].

In growth during pregnancy, there is a demand for vitamins A and B12, folate, riboflavin, and copper.

Anemia caused by gastrointestinal bleeding, significant monthly blood loss (gynaecological reasons), or parasitic illnesses such hookworms, ascaris, and schistosomiasis, as well as malaria, affects 300-500 million individuals in endemic countries [12]. Hookworm infections afflict around 44 million pregnant women, and schistosomiasis affects 20 million people. Cancer, TB, and HIV can all lower Hb levels in the blood.

Haemoglobinopathies speed up the decomposition process. Aplastic anaemia, anaemia of renal failure, and anaemia of endocrine diseases are all examples of impaired RBC production caused by pure red cell aplasia. Other factors that affect erythroblast proliferation and maturation include myelophthisic anaemia, myelodysplastic disease, chronic inflammation, and congenital dyserythropoietic anemias.

Objective:

To evaluate hemoglobin in women residing at Girinagar, Pune by POCT by cross sectional study.

Material and Methods:

110 women participated voluntarily in a medical camp of “well women’s clinic” at Girinagar, Pune. The participants were of different age group and pre-registered a week before.

Consent was provided by all the participants and involved in the study voluntarily with their full will.

The present study data has been obtained from a medical camp conducted at DIAT-DRDO, Girinagar, Pune - 25. Hence, Ethical Clearance is not applicable. Hemoglobin quantification rendered using portable photometer Hemocue (Hb 201 system). The hemocatic haemoglobin device consists of disposable micro-cuvettes containing a dry reagent and a photometer built for a single function. the working principle is the formation of modified azide-methemoglobin in the cuvette. Sodium deoxycholate disintegrates the

membranes of the erythrocytes, releasing the haemoglobin. Sodium nitrite transforms the iron in the pyrrole rings of haemoglobin from the ferrous to the ferric state into met hemoglobin, which then combines to form azide-methemoglobin with azide. The photometer reads the turbidity at 570 nm and 880 nm [14]. Under aseptic precautions, the capillary sample was collected from the lancet with a penetration depth of 1.5 to 2 mm (to ensure sufficient blood flow) on the fleshy portion of the non-dominant hand side of the middle or ring finger, assisted by the operator after gentle massage with light pressure maintenance to achieve a strong penetration. They cleaned away the first two drops of blood, using a clean lint-free sterile gauze pad. As it produces incorrect effects, thinning and clotting of the blood must be prevented. Within 30 to 45 seconds following the puncture, a strong capillary flow is observed. The third drop in blood used to measure hemoglobin. there are various factors influencing the Hb measurement [15,16].

Several physiological factors influences the variability in reported hemoglobin values. The physiological factors affecting POCT results are capillary blood has higher Hb than venous blood, especially in women and in men with severe iron depletion (median +0.67 g/dL or +6.7 g/L for iron-depleted women to -0.1 g/dL or -1 g/L for iron-repleted men). Venous blood has a slightly higher Hb than arterial blood. Finger-stick sampling shows close proximity to venous Hb values, while ear-stick sampling tends to give higher results.

Results:

Collected data was analyzed by Tukeys multiple posthoc procedures, ANOVA and Karl Pearson's correlation coefficient method. The majority of participants belong to 31-40 years of age group accounting to 35.45%of total participants. (Table 1). The status of anemia was classified as <12g/dL and > 12 g/dL considering the lower limit of normal Hb in women as 12-14 g/dL. [1].The prevalence of anemia in the participant group accounts to 56.36% with major contribution by women aged 21-30 years. (Table 2). The mean Hb is lowest in women aged ≥41 years of 11.49 g/dL which is statistically significant. (Table 3).

Tukey's test is done to identify means that are significantly different from each other. Statistically significant difference in mean has been found in age group between 31- 40 years and ≥41 years old. (Table 4). The Karl Pearson's correlation coefficient measures the strength of a linear association between two variables. The co-efficient value of -0.38 lies in the average association between age and Hb (Table 5).

Table No.1: Distribution of study samples by age groups

Age groups	No	%
≤ 20	18	16.36
21-30	34	30.91
31-40	39	35.45
≥ 41	19	17.27
Total	110	100.00
Mean ± SD age	30.79 ± 8.51	

Table No. 2: Comparison of age groups with status of different variables

Variables	Haemoglobin	
Age Groups (%)	> 12g/dL	< 12g/dL
≤ 20	5 (10.42%)	13 (20.97%)
21-30	9 (18.75%)	25 (40.32%)
31-40	21 (43.75%)	18 (29.03%)
≥41	13 (27.08%)	6 (9.68%)
Total	48 (43.64%)	62 (56.36%)
Chi-square = 12.3123 p = 0.0063		

Table No. 3: Comparison of age groups with Hb by one way ANOVA

Age groups	Haemoglobin	
	Mean	Standard Deviation
≤ 20	12.26	0.84
21-30	12.43	0.73
31-40	11.88	0.55
≥ 41	11.49	0.66
Total	12.04	0.75
F value = 9.2237, p value = 0.0001 (p<0.05)		

Table No. 4: Comparison of age groups with Hb values by Tukeys multiple posthoc procedures

Variable	Mean Hb	12.256	12.432	11.877	11.495
Age groups	≤ 20	-	-	-	-
	21-30	P = 0.808	-	-	-
	31-40	P = 0.211	p = 0.004	-	-
	≥ 41	P = 0.005	P = 0.000	P = 0.190	-

Table No. 5: Correlations among age and Hemoglobin values by Karl Pearson's correlation coefficient method

Variables	Age
Age	-
Hb	-0.3845*

*Indicates correlations are significant at 5% level of significance.

Discussion:

There have been numerous attempts over the last three decades to generate estimates of the prevalence of anaemia at various levels, including at the global level, but no systematic analysis of all the data collected and published with the goal of generating regional and global estimates has ever been conducted. Given the public health importance of anaemia, it is startling that several countries lack national prevalence data.

Food-based techniques to increasing iron intake through food fortification and dietary variety are successful, long-term strategies for preventing IDA in the general population.

The majority of the 110 participants were between the ages of 31 and 40. Hemoglobin levels in India are typically between 12 and 14 g/dL. Hb levels were substantially below 12g/dL in 56 percent of women, while 44 percent of women had normal Hb levels. Highest prevalence was observed among the anaemic women in the 21–30-year age group. Therefore, the peak reproductive community has been more affected. The findings obtained were therefore statistically relevant evaluated by several posthoc procedures by ANNOVA and Tukeys in one way.

An integrated strategy to correcting anaemia is sometimes required due to the multifaceted nature of this disorder. To effectively combat it, we must first identify and address the contributing elements. In areas where iron insufficiency is the most common cause, susceptible groups, such as pregnant women and small children, generally supplement their iron consumption with iron supplements. After anaemia has been diagnosed, hematopoietic supplementation with vitamin B12 (cyanocobalamin) and folic acid is indicated. These minerals, such as copper and zinc, as well as vitamin C, have an impact on iron metabolism.

Conclusion:

The benefits of early detection through screening of asymptomatic persons are demonstrated through screening of those at high risk in a clinical setting.

Clinicians should also be vigilant in evaluating anemia's suggestive clinical manifestations and discovering the underlying aetiology. In reproductive age groups, early detection of anaemia is critical for better mother and foetal outcomes.

Undiagnosed instances might go unnoticed for decades, with low haemoglobin levels compromising tissue oxygenation. As a result, at the first clinic visit, all residents of the peripheral region, particularly female (house wives) people who are uneducated and have an ignorant attitude, must be screened.

Conflict of Interest - Nil
Sources of Support - Nil

References

1. Harsh Mohan. Textbook of Pathology.7th edition. New Delhi, India: Jaypee brothers Medical Publishers (P) Ltd; ©2015. Chapter 10. Anaemia P268-271.
2. Smith RE. The clinical and economic burden of anaemia. *The American Journal of Managed Care* 2010; 16: S59-66.
3. G. S. Toteja, Padam Singh, B. S. Dhillon, B. N. Saxena, F U Ahmed, R P Singh et al. Prevalence of anaemia among pregnant women and adolescent girls in 16 districts of India. *Food and Nutrition Bulletin* 2006; 27(4):311-315.
4. National Health Policy 2017. New Delhi: Ministry of Health and Family Welfare, Government of India; 2017.

5. Ezzati M, Lopus AD, Dogers A, Vander HS, Murray C. Selected major risk factors and global and regional burden of disease. *Lancet* 2002; 360(9343):1347-1360.
6. John L Beard 1 , Michael K Hendricks, Eva M Perez, Laura E Murray-Kolb, Astrid Berg, Lynne Vernon-Feagans et al. Maternal iron deficiency anaemia affects postpartum emotions and cognition. *The Journal of Nutrition* 2005; 135(2):267-272.
7. Anjaneya Prasad V, Anjani Kumar C, Neelima V, Sai Prasanth R. Study of magnitude of anaemic problem in rural tertiary care centre in outpatient department. *International Journal of Research in Medical Sciences* 2018; 6(11):3499-3503.
8. National Family Health Survey (NFHS-V), 2019-21.
9. Sample Registration System (SRS) report of Registrar General of India (RGI) 2016-18.
10. Iron deficiency anaemia: assessment, prevention and control. A guide for programme managers. Geneva, World Health Organization 2001; 1-7.
11. Janz, TG, Johnson RL, Rubenstein SD. Anaemia in the emergency department: evaluation and treatment. *Emergency medicine practice* 15 (11):1–15.
12. National Nutrition Monitoring Bureau: Micronutrient Survey. National Institute of Nutrition, Hyderabad, 2002.
13. Toteja GS, Singh P, Dhillon BS, Saxena BN, Ahmed FU, Singh RP et al. Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India. *Food and Nutrition Bulletin* 2006; 27(4):311-315.
14. Vanzetti G. An azide-methemoglobin method for hemoglobin determination in blood. *The Journal of Laboratory and Clinical Medicine* 1966; 67(1):116-126.
15. Cable RG, Steele WR, Melmed RS, Johnson B, Mast AE, Carey PM et al, The difference between fingerstick and venous hemoglobin and hematocrit varies by sex and iron stores. *Transfusion* 2012;52(5):1031-1040.
16. WHO. Hemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization 2011.

***Address for correspondence**: Dr. Ajit P. Bhale, Associate Professor, Department of Biochemistry, SBH Government Medical College, Dhule - 424001. Maharashtra. Email: b7ajit1@gmail.com, Mobile: +91 9890489181.*

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