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Anaemia a Clue for Prospective Risk for Hypothyroidism among Women of Different Age Groups

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ABSTRACT

Anaemia persists to be a foremost public health nutritional problem in India, and has obstructive health and economic consequence. Aging is associated with disturbances in iron metabolism and storage. During the last decade, remarkable progress has been made toward understanding their cellular and molecular mechanisms in aging and age-associated diseases. This study designed to spotlight the prevalence of anaemia among women of three different age groups in Chennai. The samples collected from women of three different age groups (Young aged: 18-25, Middle aged: 26-45 and Post menopausal: 46-60). Total hematological profiling, iron binding assay, Total iron binding capacity assay were done. Higher magnitude of anaemia was observed in post menopausal women (48%) than middle aged (19.35%) women and young aged (25%) women. The anaemic condition is the primary sign of hypothyroidism therefore to indicate the affiliation between anaemia and hypothyroidism, level of thyroid hormones were estimated. The occurrences of anaemic condition in these different age groups were moderately found.

Keywords: Anaemia, iron deficiency, hemoglobin, serum iron, hypothyroidism, thyroid hormones, ELISA.

INTRODUCTION

Blood is a constantly circulating fluid providing the body with nutrition, oxygen, and waste removal. The composed of blood cells: Red blood cells (which carry oxygen to the tissues), White blood cells (which fight infections) and Platelets (smaller cells that help blood to clot). Hemoglobin (Hb) is a complex molecules and it is the most important component of red blood cells. Each red blood cell contains 280 million hemoglobin molecules. It composed of protein (globulin) and a molecule (heme) which binds to iron. The ability of hemoglobin to take up oxygen molecules in the lungs and then release them in the tissues is regulated by several factors both within the hemoglobin molecule itself and through external chemical factors.

Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status. The World Health Organization (WHO) has defined anemia as blood concentration of hemoglobin < 130 g/L for men and < 120 g/L for women.

Anaemia is the most prevalent nutritional public health problem across the world affecting about half of pre-school age children and pregnant women in developing countries while in India, it affects almost all ages and physiological groups, such as pre-school children, adolescent girls, pregnant women and lactating mothers, because of the increased demand for iron during pre-school life and adolescent age and additional demand during pregnancy and lactation (Arlappa .N *et al.*, 2014).

Iron plays a vital role in oxygen transport and storage, oxidative metabolism, cellular proliferation and many other physiological processes. It has a key property that allows it to co- ordinate electron donors and to participate in red-ox processes. This property also accounts for its potential to cause toxic effects through the generation of free radicals (Sean Lynch, 2007).

Iron deficiency anemia is the most common malnutrition among the adolescent population. Iron requirements are increased during adolescence, reaching a maximum due to rapid pubertal growth. The prevalence of anemia in the developing countries is found to be three to four times higher than in the developed countries (Lamba R *et al.,* 2014).

Dr. Thomson and colleagues hypothesized anemia is linked to poor nutrition in postmenopausal women, according to a recent observational study of the Women's Health Initiative (WHI). They hypothesized that a greater number of dietary inadequacies of these nutrients would be associated with a greater risk for incident and persistent anemia.

In the elderly, anemia is often mild and asymptomatic and rarely requires hospitalization. However, untreated anemia can be detrimental, because it is associated with increased mortality, poor health, fatigue, and functional dependence and can lead to cardiovascular and neurological complications (Lodovico Balducci, 2003).

Thyroid hormones stimulate directly or indirectly growth of erythroid colonies through erythropoietin. Anemia is often the first sign of hypothyroidism. Hypothyroidism can cause a wide variety of anemic disorders. Numerous mechanisms are involved in the pathogenesis of these anemia's that can be microcytic, macrocytic and normocytic (Mehmet *et al.,* 2012).

METHODOLOGY

Sample collection:

About 5ml of blood samples collected in EDTA vacutainer from 96 women from Slum area, Nungambakkam, Chennai of three different age groups such as Young aged (18-25), Middle aged (26-45) and Post menopausal (46-60) with the prior intimation of the study.

Hematological Profiling: Complete blood cell count was analyzed using Automated Hematology Analyzer MDC-400. Hematology Analyzer works on the principal of electronic impedance technique. Smear study was performed to find the morphological classification using Leishman's staining method.

Biochemical Analysis:

Serum Iron Assay: Iron bound to Transferrin is released in acidic medium and the ferric ions are reduced to ferrous ions. The ferrous ions react with ferrozine to form a violet colour complex. The intensity of the complex formed is directly proportional the amount of iron in the sample. The sample was mixed with iron buffer reagent and iron colour reagent, incubated for 5 minutes in room temperature. The iron standard was taken to prepare standard and blank is prepared with distilled water. The absorbance read at 570nm.

Total Iron Binding Capacity (TIBC):

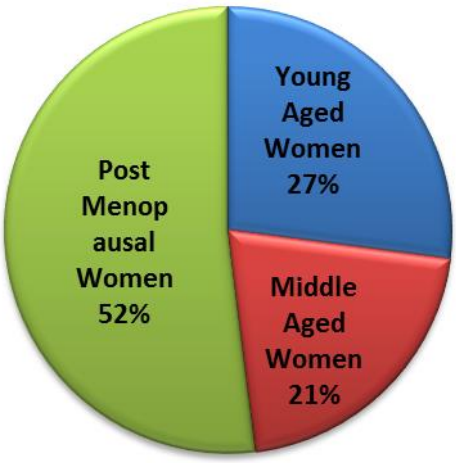
The serum is treated with excess of ferrous ion to saturate the iron binding site on transferrin. The excess ferrous ion is absorbed and precipitated and the iron content in the supernatant. The sample is mixed well and incubated at room temperature. The supernatant obtained from the centrifugation is used to estimate TIBC.

Thyroid Hormone Measurements: Thyroid Stimulating Hormone (TSH), Triiodothyronine hormone (T3) and Thyroxine Hormone (T4) levels were measured using Enzyme Linked Immunosorbent Assay (ELISA) for quantitative determination of hormones concentration in serum using the methods of Helenius, *et al.,* 1986.

RESULT

In this study, blood samples were collected from 96 women with three varieties of age groups young age group, middle age group and post menopausal group. The samples were initially subjected to hematological profiling. Higher magnitude of anaemia was observed in post menopausal women (48%) than middle aged (19.35%) women and young aged (25%) women in Figure: 1.

Figure-1: Comparision on Anaemic Rate (%) of Different Age Group Women.

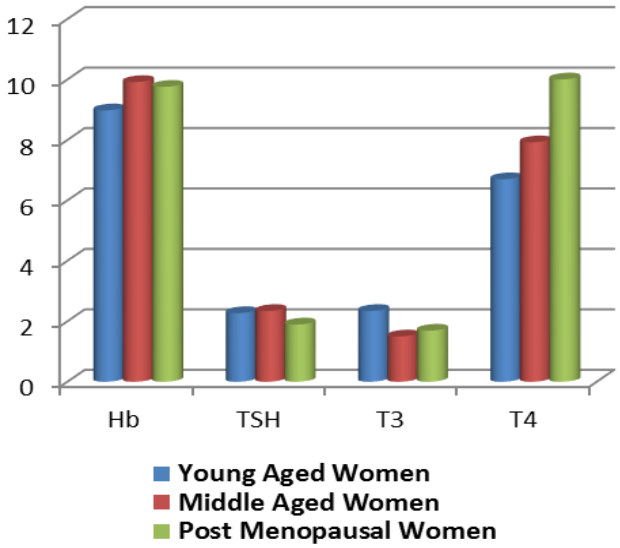


In all three age groups the red blood cells of anaemic women were found to be closer to the normal range of about 3.80-5.80 millions/mm3. In haematocrit and Mean corpuscular volume (MCV), the anaemic samples showed low hemoglobin level had very low haematocrit value and MCV. Platelet count was found to be low in anaemic samples and white blood cells were found to be normal in all cases.

From 96 samples, anaemic samples were selected and subjected to biochemical analysis such as Serum Iron and Total Iron Binding Capacity (TIBC). From the analysis, Iron and TIBC were confirmed Iron Deficiency anaemia among 10 samples in young age, 6 samples in middle age and 12 samples in post menopausal women were found out of 96 samples.

Iron Deficiency anaemic samples were further analyzed for Serum iron, Total iron binding capacity and thyroid profile (TSH, T3 & T4) shown in Table-1 & Figure-2.

Figure-2. Comparison of Hemoglobin, TSH, T3 & T4 between Young Aged, Middle Aged & Post-Menopausal Women.



DISCUSSION

Anaemia has many causes with Iron Deficiency being the primary pathology in women. Moreover, anaemia was typically asymptomatic in its early stages. Patients may develop fatigue, headache, weakness and other non-specific symptoms. Iron deficiency may also have long-term consequences on the health of the people.

In this study, the prevalence of anaemia in young aged, middle aged and post menopausal women was analyzed in association with the thyroid levels. Based on the complete blood count analysis and thyroid analyses of anaemic samples, TIBC, Iron and smear study confirmed that 25% young aged, 19.35% middle aged and 48% post menopausal women samples found to be Iron deficiency anaemia.

Three levels of severity of anaemia are distinguished as mild anaemia 10.0-10.9gms/dl, moderate anaemia 7.0-9.9gms/dl and severe anaemia less than 7.0gms/dl (Centres for Disease Control and prevention, 1998).

From the above classification of severity of anaemia based on their haemoglobin level, the estimated anaemic samples are found to be mild anaemic and moderate anaemic in all aspects of age groups. Iron Deficiency anaemia was observed in post menopausal women (48%), middle aged (19.35%) women and young aged (25%) women.

High prevalence of anaemia among young women may affect adversely on the outcome of their pregnancies, once they entered into marital life, because nutritional status of young women, particularly, iron status during pregnancy is inextricably linked to the birth weight of child and subsequently to child survival. The higher prevalence of anaemia among post menopausal women than the younger and middle aged women in the present study could be attributed to the differences in the hemoglobin level and specifically in Thyroid profile (T3, T4 and TIBC).

Age-associated decline in hematologic variables has been the subject of extensive investigation in animal models (Ahluwalia, N. *et al.*, 2000 & Xu,

Table-1. Relationship between Anaemic rate, Thyroid profile, Iron and TIBC among Young aged women, Middle aged women and Post-menopausal women.

S.NO	GROUPS	ANAEMIC RATE (%)	Hb g/dl	Serum iron	TIBC	TSH	T3	T4
				µg/dl	µg/dl			
1	YOUNG AGED WOMEN	25	10.9	31	423	0.79	1.6	4.76
			8.3	30	411	3.16	0.4	4.5
			8.1	33	402	1.36	1.4	6.11
			9.4	55	300	0.41	1.2	9.37
			9.9	60	375	1.95	1.3	7.35
			10.6	45	267	0.99	1.7	9.54
			7.4	28	422	5.38	0.5	3.38
			10.3	76	345	3.42	1.1	10.5
			10.6	56	259	1.25	1.1	7.3
			4.3	25	405	4.01	0.4	4.2
2	MIDDLE AGED WOMEN	19.35	9.3	34	403	2.36	2.3	7.47
			9.9	29	418	0.23	2.2	11.5
			10.1	99	362	1.95	1.1	8.97
			10.9	104	286	2.59	1.7	9.29
			10.7	86	265	3.06	1.2	6.63
			8.6	33	429	3.86	0.5	3.68
3	POST MENOPAUSAL WOMEN	48	9.3	34	406	3.42	1.3	8
			9.1	27	417	4.26	2	3.38
			10.6	76	259	0.55	2.2	5.98
			9.5	33	413	6.49	1.6	7.82
			10.4	76	342	0.79	1.4	9.84
			10.4	43	343	0.88	1.2	7.82
			9.8	56	323	0.45	1.1	8.09
			10.3	67	256	0.37	2	33.8
			10.2	56	344	1.39	1.7	7.35
			8.7	23	423	0.25	2	11.3
			9.7	97	397	1.3	2.5	8.11
			9.1	57	367	2.6	1.3	8.56

J. *et al.,* 2008) and humans (Seaverson, E.L. *et al.,* 2007, Gaskell, H. *et al.,* 2008 & Price, E.A. *et al.,* 2011). A number of studies have shown that aging is associated with an erythropoietic decline as well as a reduced reserve capacity in the hematopoietic system (Saitoh, T. *et al.,* 1999, Balducci, L. *et al.,* 2005 & Eisenstaedt, R. *et al.,* 2006). However, an early study reported by Boggs and Patrene (1986) and Atul Kumar Oja (2013) using B6D2 F1 female mice argued that an expanded plasma volume in aged animals substantially contributed to the decrease in hematocrit, whereas circulating red cell mass remained unchanged in aged animals, suggesting an age-related "dilutional" anemia.

A major concern arises from iron chelation therapy against the aging process is that compounds available to date cannot specifically target individual organs or systems. This may dramatically limit the use of iron chelators in elderly persons, in particular when considering the finding that altered iron status is characterized by adequate iron stores and low hematologic variables in both rodent and human studies (Xu . J. *et al.,* 2012).

Samples which showed abnormal thyroid levels belong to Iron Deficiency anaemia which is confirmed by Complete blood count, Smear study, Iron and TIBC. In this comparative study of three different groups of women, reported that 53% of the 96 patients shown hypothyroidism with anaemia.

On the based anemia severity is associated with the hypothyroidism degree. Hypocellular structure of the bone marrow gives rise to thought that thyroid hormones play a role in hematopoiesis. The most frequent reason of this is the bone marrow repression due to thyroid hormone deficiency as well as lack of erythropoietin production arising from the reduction in need of O_2.

Erythrocyte life cycle in hypothyroidism is normal, and there is hypoproliferative erythropoiesis. Thyroid hormones also increase 2-3 DPG (diphosphoglycerate) levels assisting in the transmission of oxygen into the tissues. Anemia is defined in 20-60% of the patients with hypothyroidism (Christ-Crain M. *et al.,* 2013). Several clinical studies confirmed an age-dependent decrease of thyroid function including iodine uptake and thyroid hormone production (Müller. B *et al.,* 2001). However, it should be underlined that direct age-related changes need to be distinguished from the actual alterations induced by thyroid diseases or non-thyroidal illness.

Severe Iron deficiency could lower thyroperoxidase activity and interfere with thyroid hormone synthesis and from our study, we concluded that Iron Deficiency anaemia have a significant role in thyroid hormones

CONCLUSION

Anaemia is a severe public health problem among post menopausal, young aged and middle aged women of different physiological groups in Chennai. Therefore, there is a need to strengthen the iron rich diet and proper healthy life style to avoid nutritional anaemia. The presence of anaemia in thyroid disease is associated with thyroid hormone. Therefore, thyroid hormones have a significant influence on erythropoiesis and the molecular mechanism by which thyroid hormones influence hematopoiesis may provide a basis for therapeutic intervention in thyroid diseases.

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