



## PREVALENCE OF NUTRITIONAL ANEMIA IN MUMBAI, 3- YEAR STUDY DONE IN INDIAN REFERENCE LABORATORY

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**ABSTRACT** **Introduction:** - Anemia is major health problem which affects children, women of reproductive age groups to a significant extent. This study was done to study prevalence of anemia in Mumbai across different age groups.

### Aims And Objectives: -

To study prevalence of nutritional anemia in Mumbai with respect to age group & gender

To compare prevalence of vitamin B12 deficiency anemia with iron deficiency anemia

To establish correlation between RBC indices with serum Iron & Serum B12 levels

**Method:** - We did a retrospective analysis of serum iron profile, CBC, Vitamin B12, Folic acid data obtained in referral laboratory in Mumbai over a span of 3 years (2019-2021). Population studied belonged to Mumbai metropolitan region.

CBC was analyzed on DXH Coulter. Serum Iron, serum ferritin, TIBC, Vitamin B12 & serum folic acid were analyzed on Cobas analyzers.

We compared & correlated results according to gender & age

**Results:** - Prevalence of low serum Iron & serum ferritin was seen in females as compared to males ( $P < 0.001$ ). However low levels of vitamin B12 was significantly seen in males as compared to females ( $P < 0.001$ ). Low serum iron, Ferritin, MCH, MCV and high TIBC were significantly associated with low Hemoglobin ( $P < 0.001$ )

**KEYWORDS :** Macrocytic & microcytic anemia, nutrition & RBC indices, ferritin, iron, vitamin B12

### INTRODUCTION

Nutritional anemia is seen across all group, but it is more frequently seen in reproductive age group in females. It is estimated that iron deficiency anemia is the eighth leading cause of disease in girls in developing countries<sup>[1]</sup>. In south-east Asia, roughly prevalence of iron deficiency anemia is roughly 50-70%<sup>[2,3]</sup>. WHO defines nutritional anemia as "Condition which results due to deficiency of one or more nutrients in the blood causing drop in hemoglobin content of blood"<sup>[4]</sup>. Data from national health survey IV showed that more than 50% of woman in India are anemic & its prevalence in Maharashtra is 48%<sup>[5,6]</sup>. Apart from iron deficiency anemia, folic acid, vitamin B12 deficiencies, chronic inflammation, parasitic infestation also contributes to the etiology of Nutritional anemia.

Women of reproductive age group are at higher risk of developing nutritional anemia. Its risk is significantly increased in infants, pregnant women & in lactating mothers. Anemia affects productive as well as reproductive abilities in women. Hence it has got enormous consequences, if not treated at right time. In pregnancy anemia causes intra-uterine growth retardation (IUGR), still-birth, low birth weight babies & neonatal death. Around 47% maternal deaths in rural India are attributed to excessive bleeding and anemia resulting from poor nutritional practices.<sup>[7]</sup> Low socioeconomic status & illiteracy prevents women from obtaining antenatal care, even if good healthcare services are available. Thus good antenatal care, institutional delivery & proper utilization of health service will definitely improve maternal health.<sup>[8]</sup>

In spite of routine iron supplementation is provided during antenatal visits, iron deficiency anemia is still a major concern for pregnant females in developing countries for past 30 years<sup>[9]</sup>.

Megaloblastic anemia is second most common cause of nutritional anemia in pregnancy. It is caused most commonly by folate & vitamin B12 deficiency. Laboratory evaluation of iron deficiency anemia reveals microcytic, hypochromic anemia with low plasma iron, high total iron binding capacity & low-level ferritin. Megaloblastic anemia predominantly shows macrocytic blood picture, occasional hypersegmented neutrophils with low folic acid or vitamin B12 levels.

### Study Design

This retrospective study was conducted over period of three years from 2019-2021. Total 2593 test results were selected in referral laboratory in Mumbai. Population belonged to city of Mumbai.

### Investigations

Complete blood count (CBC)

Serum Iron, Total iron binding capacity, Serum ferritin. (Iron studies)

Vitamin B12 & Folic acid levels

Patient data of three years was analyzed. We studied incidence & prevalence of nutritional anemia across different age groups. We divided them into 18-30 years, 31-50 years & above 50 years.

We also compared values in female's v/s values in males We tried to establish significant association between low hemoglobin & other parameters which are used to evaluate anemia.

### MATERIALS & METHODS

Retrospective analysis of serum iron profile, CBC, Vitamin B12, Folic acid was performed on data obtained from patient evaluated for anemia in referral laboratory in Mumbai over a span of 3 years (2019-2021). Population studied belonged to Mumbai metropolitan region.

Analysis of complete blood count (CBC)

CBC was analyzed on DXH coulter (5 and 7 part)

Analysis of Iron studies, Vitamin B12 & Folic acid

Serum Iron & TIBC were analyzed on biochemistry module of Cobas analyzer.

Ferritin, Vitamin B12 & Folic acid were analyzed on immunology module of Cobas Analyzer

Biological reference range

Following reference range was used from Dacie & Lewis practical hematology book, 12<sup>th</sup> edition, 2016

Parameter	Biological Reference Range
Haemoglobin (>18 years)	14-18 gm/dl (Male), 12-16 gm/dl (Females)
MCH (>18 years)	27-34 pg
MCV (>18 years)	82-101fL

Serum Iron	33-193 µg/dL
Serum Ferritin	13.25-110.6 ng/mL
TIBC	250-450 %
Vitamin B12	197-771pg/ml
Folic acid	3-17 ng/ml

**Statistical Analysis Methods**

Descriptive and inferential statistical analysis has been used in this study. Chi-square test was used to determine level of significance. (P<0.05) was considered statistically significant.

**RESULTS**

Total 2593 patients were included in study for period of 3 years (2019-2021). All adults above 18 years of age were included in this study. Out of which 1819 (70.15%) were females & 774 (29.85%) were males. Overall 618 adults belonged to 18-30 age group (23.84%), 1058 belonged to 31-50 age group (40.80%) & 917 were above 50 years (35.36%) (Table 1)

**Table 1: - Age & Gender-wise Distribution Of Anemia**

	Frequency	Percentage
Gender		
Female	1819	70.15
Male	774	29.85
Age group(in Years)		
18 – 30	618	23.84
31 – 50	1058	40.80
>50	917	35.36

Ferritin was low in 1007 patients (50.96%), it was normal in 969 (49.04%) patients. Folic acid was reduced in 27 (15.88%) patients & it was normal in 143 (84.12%) of patients. Low hemoglobin was predominantly seen in 2442 (94.18%) of patients & it was normal in 151 (5.82%) of patients. Serum iron was reduced in 1249 (53.93%) of patients and it was normal in 1067 (46.07%) of patients. Vitamin B12 was low in 576 (32.41%) of patients and it was normal in 1201 (67.59%) patients. TIBC was low in 494 (20.23%), it was normal in 1416 (57.99%) & raised in 532 (21.79%) patients. MCH was reduced in 1773 (69.02%) patients, it was normal in 530 (20.63%) patients. MCV was reduced in 1601 (62.32%) patients & it was raised in 357 (13.90%) patients. (Table: -2)

**Table: - 2 Frequency Of Different Anemia Parameters**

	Frequency	Percentage
Ferritin		
Low	1007	50.96
Normal	969	49.04
Folic Acid		
Low	27	15.88
Normal	143	84.12
Haemoglobin (Hb)		
Low	2442	94.18
Normal	151	5.82
Iron		
Low	1249	53.93
Normal	1067	46.07
Vitamin B12		
Low	576	32.41
Normal	1201	67.59
TIBC		
Low	494	20.23
Normal	1416	57.99
High	532	21.79
MCH		
Low	1773	69.02
Normal	530	20.63
High	266	10.35
MCV		
Low	1601	62.32
Normal	611	23.78
High	357	13.90

We studied all these parameters with regards to different age groups. We divided age group into 18-30 years, 31-50 years and more than 50 years.

Serum ferritin & serum iron was reduced significantly in 31-50 age group. (P<0.0001). However, MCH & MCV were significantly lowered in 18-30

age group (P<0.001). Increase in TIBC levels were also predominantly seen in 18-30 age group (P<0.0001). Thus it can be concluded that 18-30 & 31-50 age groups were commonly affected in microcytic hypochromic anemia. MCV was significantly raised in age group more than 50 years (P<0.0001). This shows that macrocytic anemia was commonly associated in people more than 50 years of age. (Table 3)

**Table 3: - Distribution Of Nutritional Anemia Parameters Across Different Age Groups**

	Age group						P value
	18 – 30		31 – 50		>50		
	Frequenc y	Percent age	Frequenc y	Percent age	Frequenc y	Percent age	
Ferritin							
Low	275	56.47	505	58.25	228	36.60	<0.0001
Normal	212	43.53	362	41.75	395	63.40	
Folic Acid							
Low	9	18.37	12	22.64	6	8.82	0.7504
Normal	40	81.63	41	77.36	62	91.18	
Haemoglobin (Hb)							
Low	568	91.91	1002	94.71	872	95.09	0.0209
Normal	50	8.09	56	5.29	45	4.91	
Iron							
Low	302	56.87	555	57.87	392	47.46	<0.0001
Normal	229	43.13	404	42.13	434	52.54	
Vitamin B12							
Low	153	32.83	277	35.70	146	27.29	0.0059
Normal	313	67.17	499	64.30	389	72.71	
TIBC							
Low	73	12.92	134	13.40	287	32.73	<0.0001
Normal	321	56.81	600	60.00	495	56.44	
High	171	30.27	266	26.60	95	10.83	
MCH							
Low	457	75.04	780	74.29	536	58.90	<0.0001
Normal	99	16.26	155	14.76	276	30.33	
High	53	8.70	115	10.95	98	10.77	
MCV							
Low	424	69.62	719	68.48	458	50.33	<0.0001
Normal	115	18.88	187	17.81	309	33.96	
High	70	11.49	144	13.71	143	15.71	

We compared these parameters with respect to gender. We concluded that, serum iron, ferritin, MCH, MCV were significantly lowered & TIBC was significantly raised in females as compared to males. We also observed that, MCV was raised & Vitamin B12 was reduced in males as compared to females. This shows that microcytic hypochromic anemia due to iron deficiency is more common in females as compared males, but males have more prevalence of macrocytic anemia due to vitamin B12 & Folic acid deficiency. (Table 4)

**Table 4: - Distribution Of Nutritional Anemia Parameters Across Gender**

	Gender				P value
	Female		Male		
	Frequenc y	Percentag e	Frequenc y	Percentag e	
Ferritin					
Low	799	55.91	208	38.03	<0.0001
Normal	630	44.09	339	61.97	
Folic Acid					
Low	14	12.50	13	22.41	0.0946
Normal	98	87.50	45	77.59	
Haemoglobin (Hb)					
Low	1712	94.12	730	94.32	0.8442
Normal	107	5.88	44	5.68	
Iron					
Low	973	58.72	276	41.88	<0.0001
Normal	684	41.28	383	58.12	
Vitamin B12					
Low	334	26.16	242	48.40	<0.0001
Normal	943	73.84	258	51.60	
TIBC					
Low	231	13.40	263	36.63	<0.001
Normal	1039	60.27	377	52.51	

High	454	26.33	78	10.86	
MCH					
Low	1405	77.80	368	48.23	<0.0001
Normal	308	17.05	222	29.10	
High	93	5.15	173	22.67	
MCV					
Low	1280	70.87	321	42.07	<0.0001
Normal	393	21.76	218	28.57	
High	133	7.36	224	29.36	

We also observed significant association between low hemoglobin with low serum Iron, low serum ferritin, low MCH Low MCV & normal TIBC (P<0.0001) (Table: -5)

**Table 5: - Hemoglobin Comparison**

	Haemoglobin (Hb)				P value
	Low		Normal		
	Frequency	Percentage	Frequency	Percentage	
Ferritin					
Low	999	53.48	8	7.41	<0.0001
Normal	869	46.52	100	92.59	
Folic Acid					
Low	23	14.74	4	28.57	0.1764
Normal	133	85.26	10	71.43	
Iron					
Low	1245	56.82	4	3.20	<0.0001
Normal	946	43.18	121	96.80	
Vitamin B12					
Low	550	32.86	26	25.24	0.1092
Normal	1124	67.14	77	74.76	
TIBC					
Low	491	21.21	3	2.36	<0.0001
Normal	1298	56.07	118	92.91	
High	526	22.72	6	4.72	
MCH					
Low	1735	71.58	38	26.21	<0.0001
Normal	425	17.53	105	72.41	
High	264	10.89	2	1.38	
MCV					
Low	1577	65.06	24	16.55	<0.0001
Normal	497	20.50	114	78.62	
High	350	14.44	7	4.83	

We also compared RBC indices MCV and MCH with ferritin, iron Vitamin B12 & folic acid. We found out that low MCV was significantly associated with low ferritin & low iron (P<0.0001). High MCV was significantly associated with low Vitamin B12 levels. However, we could not find significant association of MCV & Folic acid. (Table-6)

For MCH, we observed that, low MCH has significant association with low Iron & low ferritin levels (P<0.0001), however there was no significant association with folic acid levels (Table-7).

**Table 6: - MCV Comparison**

	MCV				P value
	Low		Normal		
	Frequency	Percentage	Frequency	Percentage	
Ferritin					
Low	941	66.98	58	14.54	2.98 <0.0001
Normal	464	33.02	341	85.46	163 97.02
Folic Acid					
Low	8	8.99	9	21.43	8 28.57 0.0228
Normal	81	91.01	33	78.57	20 71.43
Iron					
Low	1074	71.74	132	24.67	40 14.44 <0.0001
Normal	423	28.26	403	75.33	237 85.56
Vitamin B12					
Low	261	22.66	114	31.23	201 77.61 <0.0001
Normal	891	77.34	251	68.77	58 22.39

**Table 7: - MCH Comparison**

	MCH						P value
	Low		Normal		High		
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Ferritin							
Low	977	63.98	26	8.10	1	0.81	<0.0001
Normal	550	36.02	295	91.90	123	99.19	
Folic Acid							
Low	11	10.78	7	18.92	7	35.00	0.0205
Normal	91	89.22	30	81.08	13	65.00	
Iron							
Low	1142	69.17	79	17.48	25	12.14	<0.0001
Normal	509	30.83	373	82.52	181	87.86	
Vitamin B12							
Low	295	23.45	106	33.76	175	85.78	0.0226
Normal	963	76.55	208	66.24	29	14.22	

Statistically significant findings of current study: -

- Significant prevalence of microcytic hypochromic type of anemia in 18-30 & 31-50 age group. (overall)
- Microcytic anemia has more prevalence in females as compared to males.
- Macrocytic anemia has more prevalence in males as compared to females
- Low haemoglobin has statistically significant correlation with low serum Iron, low serum ferritin, low MCV & low MCH
- Low MCV has significant association with low serum iron & serum ferritin & high MCV has significant association with low vitamin B12
- Low MCH has significant association with low serum iron & serum ferritin.

**DISCUSSION**

Nutrition is an important aspect in our lives. Nutrition is essential for physical, mental development, maintaining efficiency, well-being and having healthy life in all stages of human development appropriate for the age and stage of the life. - starting from prenatal period including infancy, childhood, adolescent, adults till elderly.

Identifying the presence, etiology and severity of anemia is crucial.

Laboratory measurements are important for a proper diagnosis of nutritional anemia. They are most informative when multiple measures of nutritional status like ferritin, serum iron studies, vitamin B12, folic acid that can be correlated with hemoglobin levels, RBC indices and evaluated in the context of nutritional and medical history. Extensive work has been done to identify the burden of the disease and address the problem in various parts of the country based on various parameters like age, gender, ethnicity, geographic distribution, socioeconomic status, cultural practices, etc. Several policies and guidelines have been deployed by the government from time to time to tackle nutritional anemia which is still a serious public health issue.

In study done by Lilare et al<sup>[10]</sup>, prevalence of nutritional anemia among females belonging to 15-49 years age groups was 49.5%. In study done by Dey et al, prevalence of anemia among reproductive age groups in females was 49.5%.<sup>[11]</sup> Patavegar et al conducted study in rural areas of Maharashtra. They found out that prevalence of anemia among reproductive age group was 51.92%<sup>[12]</sup> Pande et al conducted similar study in slum areas of Indore city and found out that prevalence of anemia was 61%<sup>[13]</sup>. These findings were correlating with our study which showed that prevalence of anemia among reproductive age group was significantly higher in females as compared to males (P<0.0001). In addition to this it can be also derived that prevalence of anemia varies from study population & study area.<sup>[13]</sup>

Lilare et al<sup>[10]</sup> found out that anemia was more common in 15-25 age group, but association of anemia and age groups was not statistically significant (P=0.171). Patvegar et al<sup>[12]</sup> also concluded that there was no significant correlation between anemia & different age groups However in our study we have observed significant association of hypochromic microcytic anemia with 18-30 & 31-50 age group (P<0.0001). Ahmad N et al did a study on pregnant woman & concluded that anemia was most common in <20 years of age (88.7%)<sup>[14]</sup>

**CONCLUSION:-**

From our study it is concluded that, anemia is still a major health issue

in metropolitan city like Mumbai. Prevalence of microcytic hypochromic anemia was more commonly seen in reproductive age group in females as compared to males. However, prevalence of macrocytic anemia was more commonly seen in males as compared to females.

Though various studies published previously have shown the prevalence of nutritional anemia to be higher in rural and underdeveloped areas, our data suggests higher prevalence even in urban population.

This emphasizes the need for early diagnosis and intervention by increasing awareness, nutrition education, anemia prophylaxis in the vulnerable population, increasing outreach of anemia control programs effective screening and evaluation of anemia not only in rural but also in urban and metropolitan areas like Mumbai.

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