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Original Research Article

Pathological Evaluation of Nutritional Anaemia

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Abstract:

Background: Nutritional anaemia continues to pose a significant public health challenge in developing nations, affecting individuals across all age groups. It is predominantly caused by deficiencies of iron, vitamin B12, and folate and presents with varied hematological patterns.

Aim: To evaluate the morphological patterns of nutritional anaemia with respect to age and gender in a tertiary care hospital.

Materials and Methods: This retrospective observational study included patients diagnosed with nutritional anaemia over a one-year period in 2024. Hematological evaluation was performed using complete blood count and peripheral blood smear examination. Anaemia was classified into microcytic hypochromic, macrocytic, and normocytic normochromic types. Data were analyzed with respect to age, gender, and morphological patterns.

Results: A total of 16,711 cases were analyzed, 7,561 (45.2%) were males and 9,150 (54.8%) were females. Microcytic hypochromic anaemia was the most common morphological pattern (82.6%), followed by macrocytic anaemia (15.1%) and normocytic normochromic anaemia (2.3%). Month-wise analysis showed consistent female predominance and a predominance of microcytic hypochromic anaemia throughout the year.

Conclusion: Nutritional anaemia predominantly affects children and females, with iron deficiency anaemia being the most common morphological type. Peripheral blood smear evaluation serves as an economical and reliable diagnostic tool.

Keywords: Nutritional Anaemia, Iron Deficiency Anaemia, Peripheral Blood Smear.

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Introduction

Anaemia is a widespread global health concern affecting all age groups, with a higher burden observed in low- and middle-income countries. [1,2] In India, anaemia continues to be a major cause of morbidity due to nutritional deficiencies, chronic illnesses, and socio-economic factors. [3,4]

Morphological evaluation of anaemia using peripheral blood smear examination is a simple and cost-effective diagnostic method. [5,6] When combined with red cell indices generated by automated analyzers, it provides valuable insight into the type and probable etiology of anaemia. [7,8]

Recent hospital-based studies have consistently reported microcytic hypochromic anaemia as the most common morphological pattern reflecting iron deficiency. [9,10] The present study was undertaken to evaluate the morphological patterns of anaemia and compare them with findings from other tertiary care studies. [11,12]

Materials and Methods

This retrospective observational study was conducted in the Department of Pathology of a tertiary care hospital. All patients diagnosed with anaemia between January 2024 and December 2024 were included in the study.

A total of 16,711 anaemia cases were analyzed. Peripheral blood smears were prepared and stained using Leishman stain, and red cell indices such as MCV, MCH, and MCHC obtained from automated hematology analyzers were reviewed.

Based on peripheral smear findings and red cell indices, anaemia was classified into microcytic hypochromic, macrocytic, and normocytic normochromic types according to standard criteria described in recent hematological literature.

Cases with incomplete laboratory data were excluded and patient confidentiality was maintained.

Results

A total of 16,711 anaemia cases were evaluated during the study period. Among them, 7,561 (45.2%) were males and 9,150 (54.8%) were females, showing a clear female predominance.

Microcytic hypochromic anaemia was the most common morphological pattern, observed in 13,822 cases (82.6%). Macrocytic anaemia was seen in 2,522 cases (15.1%), while 367 cases (2.3%) showed normocytic normochromic anaemia.

The month-wise analysis demonstrated that microcytic hypochromic anaemia was the predominant morphological type in every month of the study period. Female patients consistently outnumbered male patients throughout the year.

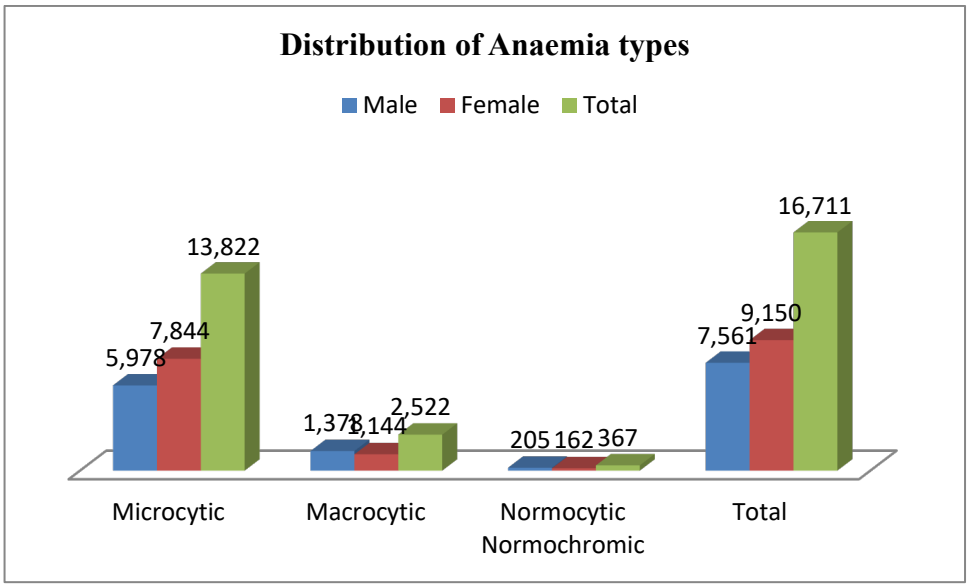

Chart 1: Distribution of Anaemia types

Chart 1: Distribution of Anaemia Types (January–December): shows that microcytic hypochromic anaemia was the predominant morphological type in both males and females, accounting for over 80% of all cases. Macrocytic anaemia forms the second most common category, while normocytic normochromic anaemia constitutes a small proportion. Female patients outnumber males across all anaemia types, highlighting a consistent female predominance.

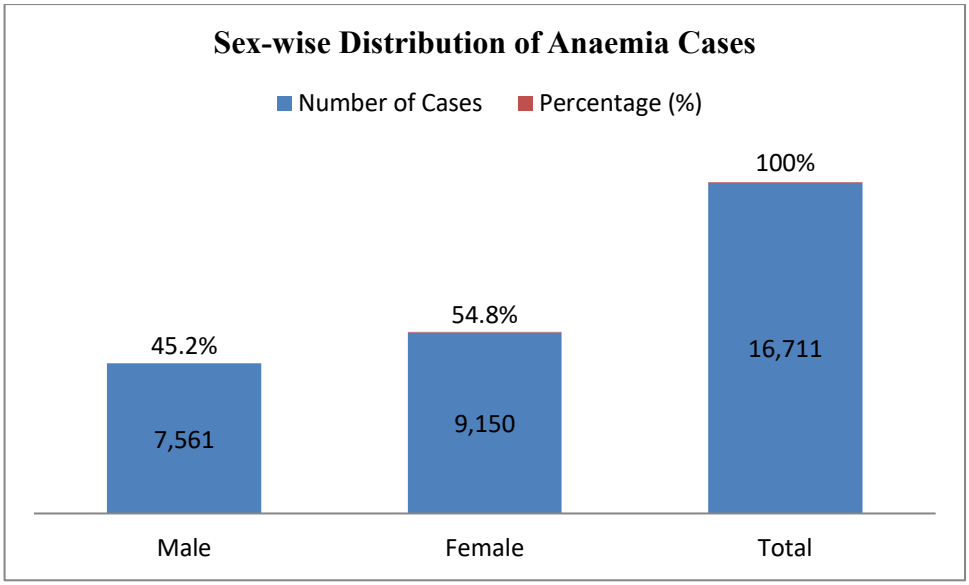

Chart 2: Sex-wise Distribution of Anaemia Cases

Chart 2: Sex-wise Distribution of Anaemia Cases: shows a higher prevalence of anaemia among females compared to males. This female predominance may be attributed to physiological factors such as menstruation, pregnancy, and increased nutritional demands, along with socio-economic and dietary influences.

Table 1: Month-wise Distribution of Anaemia Cases

	Microcytic hypochromic anaemia		Macrocytic anaemia		Normocytic normochromic anaemia		Overall Anaemia cases		
Month	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Total**
January	441	759	123	117	18	12	582	888	1,470
February	609	706	121	104	19	18	749	828	1,577
March	458	658	105	93	13	8	576	759	1,335
April	490	707	115	93	9	10	614	810	1,424
May	510	603	117	94	14	11	641	708	1,349
June	492	513	110	95	18	15	620	623	1,243
July	505	596	128	102	18	13	651	711	1,362
August	504	704	104	86	16	17	624	807	1,431
September	469	550	110	75	25	15	604	640	1,244
October	570	641	109	90	18	14	697	745	1,442
November	510	687	115	95	17	18	642	800	1,442
December	420	720	121	100	20	11	561	831	1,392
Total	**5,978**	**7,844**	**1,378**	**1,144**	**205**	**162**	**7,561**	**9,150**	**16,711**

Table 1: Month-wise Distribution of Anaemia Cases: Microcytic hypochromic anaemia was the predominant type across all months, with consistently higher cases in females, while macrocytic anaemia constituted a smaller proportion and normocytic normochromic anaemia accounted for the least number of cases, contributing overall to 16,711 anaemia cases during the study period.

Table 2: Age group distribution of Anaemia Cases

Age group	Microcytic anaemia	Macrocytic anaemia	Normocytic Normochromic anaemia	Total
1–14	4148	644	45	4837
15–40	2362	571	138	3071
41–60	2911	348	61	3320
≥60	4401	959	123	5483
Total	13822	2522	367	16,711

Table 2: Age group distribution of Anaemia Cases: indicates that microcytic anaemia is the most common morphological type across all age groups. The highest number of cases is observed in ≥60 years and 1–14 years age groups, suggesting increased vulnerability at the extremes of age. Macrocytic anaemia is more frequently seen in adults and the elderly, possibly reflecting vitamin B12 and folate deficiencies.

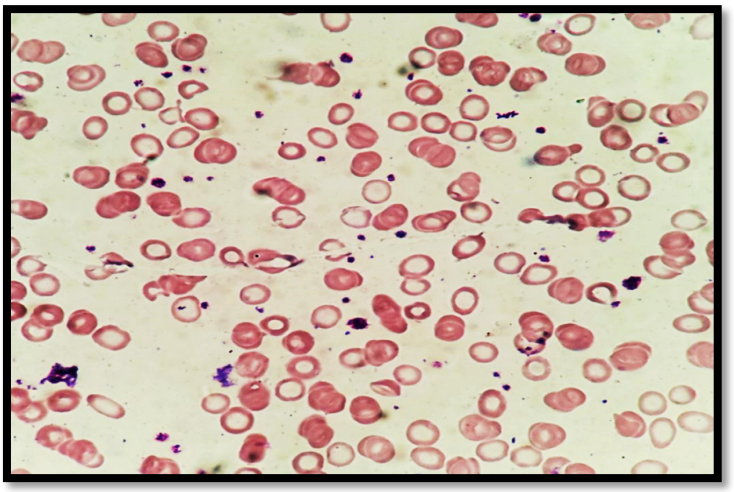

Figure 1: (40x: Leishman stain) Peripheral smear showing microcytic hypochromic (small) red blood cells.

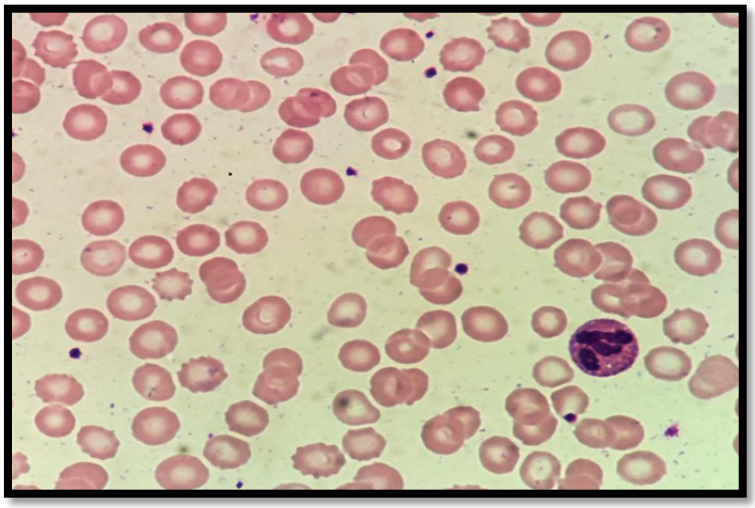

Figure 2: (40x: Leishman stain) Peripheral smear showing normocytic normochromic (normal, same size) red blood cells.

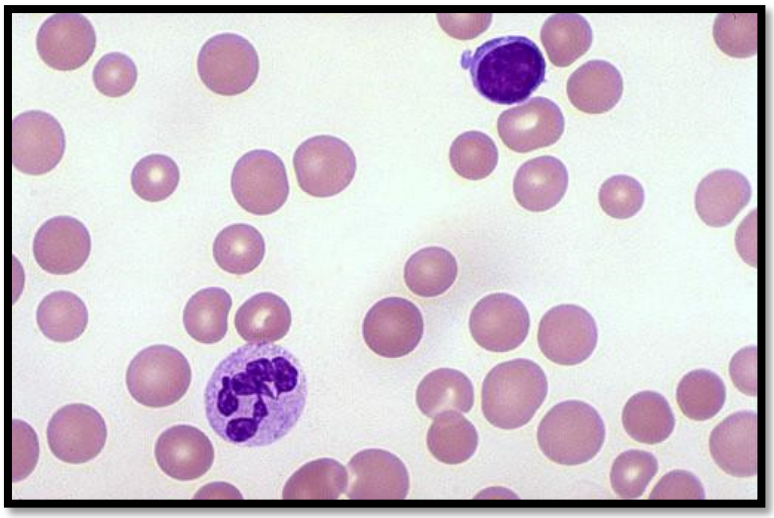

Figure 3: (100x: Leishman stain) Peripheral smear showing macrocytic (large) red blood cells.

Discussion

Nutritional anaemia continues to be a major global health concern, particularly in developing countries. In India, nutritional deficiencies, socioeconomic factors, and chronic illnesses contribute significantly to the disease burden. In the present study, a total of 16,711 anaemia cases were evaluated, with a female predominance (54.8%) compared to males (45.2%).

The present study demonstrated that microcytic hypochromic anaemia (82.6%) was the most common morphological pattern. Similar observations have been reported in earlier studies conducted in India where iron deficiency anaemia remains the leading cause of anaemia. Studies by Kumar et al., Sharma et al., and Patel et al. also reported microcytic hypochromic anaemia as the predominant morphological type. [9,10,11] This similarity reflects the high prevalence of nutritional iron deficiency in the population.

In the present study, macrocytic anaemia constituted 15.1% of cases, which is comparable with findings reported in previous studies evaluating vitamin B12 and folate deficiency. Macrocytic anaemia is often associated with nutritional deficiencies, malabsorption syndromes, and chronic illnesses. Similar proportions have been reported by Sharma et al. and Patel et al., indicating that megaloblastic anaemia also contributes significantly to the anaemia burden.

Normocytic normochromic anaemia accounted for 2.3% cases in the present study, which is lower compared to microcytic anaemia. Normocytic anaemia is commonly associated with chronic diseases, infections, and inflammatory conditions. Previous studies have also reported relatively lower proportions of normocytic anaemia when compared with microcytic anaemia.

The present study also demonstrated a female predominance (54.8%), which is consistent with previous epidemiological studies conducted in India. Females are more prone to anaemia due to menstrual blood loss, pregnancy, nutritional deficiencies, and increased physiological iron requirements. Similar observations have been reported by Sharma et al., Patel et al., and Rao & Kulkarni in their respective studies. [10,11,17]

Overall, the findings of the present study correlate well with previously published literature and confirm that iron deficiency anaemia remains the most common morphological pattern in the Indian population, followed by macrocytic anaemia.

Table 3: Comparison of morphological patterns of Anaemia with other Studies:

Study	Year	Sample Size	Microcytic (%)	Macrocytic (%)	Normocytic (%)
Sharma et al. [10]	2021	1,240	80.6	14.8	4.6
Kumar et al. [9]	2022	520	78.4	17.1	4.5
Patel et al. [8]	2023	860	76.9	18.2	4.9
Present study	2024	16,711	82.6	15.1	2.3

Table 3: Comparison of morphological patterns of Anaemia with other Studies: The comparison shows that microcytic hypochromic anaemia is the predominant morphological pattern across all studies, including the present study (82.6%), reflecting the persistent burden of iron deficiency anaemia in the population. The proportion of macrocytic anaemia is relatively similar among studies, while normocytic normochromic anaemia accounts for a smaller percentage of cases.

Table 4: Comparison of Sex Distribution of Anaemia Cases:

Study	Year	Male (%)	Female (%)
Sharma et al. [10]	2021	47.1	52.9
Patel et al. [11]	2023	44.6	55.4
Rao & Kulkarni [17]	2021	46.3	53.7
Present study	2024	45.2	54.8

Table 4: Comparison of Sex Distribution of Anaemia Cases: The gender distribution in the present study demonstrates female predominance (54.8%), which is comparable with findings reported by previous studies. This observation highlights the higher susceptibility of females to anaemia due to nutritional deficiency, menstrual blood loss and increased physiological iron requirements.

Table 5: Comparison of Predominant Anaemia Type Reported in Recent Studies:

Study	Setting	Predominant Type	Percentage
Varghese et al. [12]	Tertiary care	Microcytic	79.6
Talukdar et al. [13]	Geriatric patients	Microcytic	74.2
Jayant & Thakur [14]	Hospital-based	Microcytic	77.8
Present study	Tertiary care	Microcytic	82.6

Table 5: Comparison of Predominant Anaemia Type Reported in Recent Studies: The consistently higher prevalence of microcytic anaemia across studies confirms iron deficiency as the dominant etiology of anaemia in tertiary care hospitals.

Conclusion

Nutritional anaemia remains a major healthcare burden affecting diverse age groups. Iron deficiency anaemia remains the most common type, particularly among children and females. Peripheral blood smear examination combined with red cell indices remains a reliable and cost-effective approach for morphological classification of anaemia. Early diagnosis can facilitate timely management and reduce morbidity. The high prevalence of microcytic anaemia highlights the need for early screening and nutritional intervention programs.

References

1. Pasricha SR, Colman K, Centeno-Tablante E, Garcia-Casal MN, Peña-Rosas JP. Anaemia: a comprehensive global estimate. Nat Rev Dis Primers. 2021;7(1):67-78.
2. Kassebaum NJ. The global burden of anaemia. Blood. 2021;137(5):587-596.
3. Bain BJ. Diagnosis from the blood smear. Br J Haematol. 2020;190(3):323-337.
4. Gulati G, Song J, Florea AD, Gong J. Purpose and criteria for blood smear scan, blood smear examination, and blood smear review. Lab Hematol. 2020;26(2):65-71.
5. Buttarello M. Quality specification in automated blood cell counts. Am J Clin Pathol. 2021;155(1):25-37.
6. Briggs C. Quality counts: new parameters in blood cell counting. Int J Lab Hematol. 2022;44(2):178-185.
7. Tefferi A. Anaemia in adults: a contemporary approach to diagnosis. Mayo Clin Proc. 2020;95(9):1984-1996.
8. Patel S, Shah K, Mehta R. Morphological evaluation of anaemia using peripheral blood smear and red cell indices. J Lab Physicians. 2023;15(2):134-139.
9. Kumar A, Kumar D, Ahmad I, Tripurari. A prospective study of morphological pattern of anaemia at a tertiary care centre. Int J Health Clin Res. 2022;5(1):265-266.
10. Sharma P, Singh T, Gupta N. Spectrum of anaemia based on morphological classification in a tertiary care hospital. Indian J Hematol Blood Transfus. 2021;37(3):412-417.
11. Patel DK, Bhalodia DM, Chauhan DS, Jasani DJ. Correlation between morphological typing of anaemia and red cell indices with peripheral smear findings. Int J Med Pharm Res. 2023;4(4):123-129.
12. Varghese AM, Sankar S, Jayalakshmy PL. Efficacy of RBC histogram in the diagnosis of morphological types of anaemia compared with peripheral smear. Int J Res Med Sci. 2023;11(5):1653-1659.
13. Talukdar M, Samaddar A, Lahiri S. RBC indices and morphological pattern of anaemia in geriatric patients. Med J Dr D Y Patil Vidyapeeth. 2023;16(Suppl 2):S189-S194.
14. Jayant K, Thakur V. Assessment of peripheral blood film findings among anaemia patients. Int J Clin Diagn Pathol. 2022;5(1):1-3.
15. Ghosh K. Nutritional anaemia: current concepts and future perspectives. Indian J Med Res. 2022;156(3):389-397.
16. Toteja GS, Singh P. Anaemia in India: epidemiological trends and challenges. Indian J Med Res. 2021;154(4):536-544.
17. Rao S, Kulkarni M. Retrospective analysis of anaemia patterns in a tertiary care hospital. J

Family Med Prim Care. 2021;10(9):3385-3390.
18. Singh N, Verma R, Gupta S. Clinico-hematological profile of macrocytic anaemia in adults. Asian J Transfus Sci. 2020;14(2):140-145.