Section: General Medicine

Original Research Article

BEYOND HEMATINICS: INVESTIGATING CAUSES AND DIETARY AWARENESS IN REFRACTORY ANAEMIA

Maria Davis[1], *P. K. Sasidharan*[2]

[1]*Assistant Professor, Department of General Medicine, Pushpagiri Institute of Medical Science and Research Centre, Thiruvalla, Kerala, India.*
[2]*Senior Consultant, Internal Medicine & Clinical Hematology, District Cooperative Hospital, Kozhikode, Kerala, India; Professor Emeritus & Former Professor and Head, Department of Medicine and Division of Hematology, Government Medical College, Kozhikode, Kerala, India.*

Received *: 05/01/2026*
Received in revised form *: 09/02/2026*
Accepted *: 26/02/2026*

Corresponding Author:
Dr. Maria Davis,
Assistant Professor, Department of General Medicine, Pushpagiri Institute of Medical Science and Research Centre, Thiruvalla, Kerala, India.
Email: marric9490@gmail.com

DOI: 10.70034/ijmedph.2026.1.392

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 2261-2266

ABSTRACT

Background: Anaemia remains a major public health issue in India, often arising from an imbalance between RBC production and destruction. Nutritional anaemias can present with significant haematological and neurological manifestations, and are commonly overlooked in clinical practice. The objective is to evaluate the clinical profile of patients with refractory nutritional anaemia, identify causes of refractoriness, and promote awareness on the importance of a balanced diet in anaemia management and to see the responses after that.

Materials and Methods: We enrolled 50 consecutive subjects who were referred as refractory nutritional anaemia to PVS Hospital, Kozhikode during a period of one year. It was a hospital based prospective study between January 2020 to June 2021.Clinical evaluation, dietary assessment, and lab tests were conducted. All patients received haematinics and dietary counselling. Outcomes were assessed by symptom relief and hemogram improvement.

Results: 80% had nutritional deficiencies (iron, B12, folate); only 20% had true refractory anaemia. Mixed deficiency anaemia was most common. Fatigue was the most frequent symptom; pallor the most common sign. Significant clinical and haematological improvement was noted with haematinics and balanced diet. Poor dietary intake especially of proteins, fruits, and vegetables was the key contributor. Many cases were wrongly labelled as refractory due to lack of dietary evaluation. Drug-induced deficiencies (e.g., metformin, PPIs) were also observed.

Conclusion: Study showed that refractoriness was often due to unrecognized multiple nutritional deficiencies. Detailed dietary history, clinical examination, and hemogram are more valuable than isolated lab tests. Awareness and correction of dietary habits are essential for effective anaemia management.

Keywords: Refractory nutritional anaemia, Mixed Deficiency, B12, Folic Acid, Iron, Balanced Diet.

INTRODUCTION

Anemia is a disorder characterized by a deficiency in red blood cells or hemoglobin levels, impairing the blood's capacity to transport oxygen. It impacts 22.8% of the worldwide population, with a greater prevalence among newborns and women, especially in poor countries such as India.[1–3] It is clinically noteworthy because of its great prevalence, morbidity, and treatability.[4] Prevalent symptoms encompass fatigue, weakness, and dyspnea. Hemoglobin estimation is the principal diagnostic technique, with normal levels ranging from 12 to 16 g/dL in women and 14 to 18 g/dL in men.[5-7] The WHO estimates that anemia impacts 1.6 billion individuals worldwide, with the highest prevalence observed in preschool children and pregnant women.[8] In India, the prevalence varies from 38% to 82% in women and from 18% to 59% in men.[9] Kerala has a reduced burden, due to its strong public health system and elevated literacy rates.[10–12]

Anemia is frequently attributed to nutritional deficiencies, particularly of iron, folate, and vitamin B12. Approximately 47% of Asian Indians have

vitamin B12 insufficiency, while 33% demonstrate folate deficiency.[13] Iron deficiency is the predominant global cause of anemia, frequently resulting from insufficient consumption, hemorrhage, or malabsorption.[14] Erythropoiesis necessitates proteins, iron, vitamin B12, and folate, among other minerals.[15] Insufficient dietary awareness and inadequate nutritional practices greatly contribute to anemia in India.[16] Vegetarian diets common in India may be deficient in essential nutrients such as B12 and iron.[17] Deficiencies in B12 and folate sometimes occur together, resulting in elevated Mean Corpuscular Volume [MCV] and reduced Red Cell Distribution Width [RDW] in blood analyses.[13] A comprehensive dietary history and physical examination are crucial, with a complete blood count and peripheral smear as primary tests.[18] In cases of unexplained anemia, bone marrow [BM] examinations assist in identifying etiologies such as marrow failure syndromes.[19] Numerous doctors neglect fundamental assessments and concentrate on incidental genetic discoveries, resulting in misdiagnosis.[20] Myelodysplastic syndromes [MDS] can resemble nutritional anemia and are increasingly prevalent with advancing age, characterized by bone marrow malfunction and cytopenias.[21–23]

This study aimed to identify the reasons for treatment refractoriness in nutritional anemias prior to referral, determine the percentage of correctable causes, and assess the prevalence of true refractory anemias, such as Myelodysplastic Syndromes [MDS] or Thalassemia trait, within the study population.

MATERIALS AND METHODS

This prospective cohort study involved 50 patients who visited the General Medicine outpatient department from January 2020 to June 2021 at PVS Hospital, Kozhikode, Kerala. The Institutional Ethics Committee of PVS Hospital accepted the study, as indicated by letter No PVS/EC/02/20-21. Participants diagnosed with refractory anaemia, aged above 12 years and unresponsive to any treatment, were included in the study. Participants with any bone marrow infiltrative disorders, bone marrow failure, or pre-existing organ failure conditions such as persistent infections, Tuberculosis, or rheumatoid arthritis were excluded from the study. Pregnant individuals and those who had undergone any transfusions were also excluded from the trial.

Written consent was obtained from all subjects participating in the study. A semi-structured interview questionnaire strategy was employed to incorporate the patients into the study. The questionnaire gathered data regarding the patient's lifestyle, dietary habits, quantity, and frequency of protein consumption, as well as the frequency of vegetable and fruit intake. The dietary intake of the study participants, regarding protein and the consumption of vegetables and fruits, was categorized into three groups based on the average weekly consumption estimates. Poor indicates consumption of less than three times per week, better signifies more than three times per week, and good denotes at least once daily consumption. A baseline dietary history was obtained at the appointment utilizing a 24-hour dietary recall approach for an average duration of one week.

The patients were classified according to Iron deficiency, B12 deficit, Folic acid deficiency, Combined deficiency, and True Refractory Anemias. Prior to the commencement of the trial, a comprehensive blood profile was conducted, encompassing Vitamin B12 levels, serum ferritin, and serum folic acid assays, alongside the collection of all clinical presentations pertaining to the patients. All patients received counseling on a balanced diet comprising protein, vegetables, and fruits. B12 replacement therapy was administered to all individuals with low B12 levels and to those exhibiting symptoms or indicators of B12 deficiency. All patients received 1000 µg of Hydroxocobalamin (Vitamin B12) intramuscularly for five consecutive days, followed by weekly administration for five weeks, and subsequently once a month. Additionally, they were prescribed folic acid at a dosage of 5 mg per day for a minimum of six months, along with oral iron (as ferrous fumarate) containing 152 mg of iron per tablet for at least six months, contingent upon the deficiency state. A comprehensive dietary plan was also provided, detailing food intake quantities and the administration of oral folic acid and iron tablets. All patients were explicitly instructed to adhere to the dietary recommendations and were reevaluated based on a) symptom improvement, b) improvement in hemogram parameters on a monthly basis. The patients were monitored for a minimum duration of six months to one year, during which comprehensive observations, including symptom improvement and hemogram analysis, were documented.

Diet Plan: A diet plan with a pictorial representation of the proportions and quality of foods they were supposed to take was given for easy understanding, to each subject. Balanced diet, with each meal containing all five components, including one source of calorie (eg: any one cereal) in minimum amounts depending on the caloric requirements, adequate intake of protein (1g/kg/day) (eg: any one of the pulses, yogurt, fish, egg or meat), adequate vegetables (preferably raw or steamed and never over cooked), fresh seasonal fruits and adequate safe drinking water were explained in detail. Vegetables were advised to constitute the major proportion of an individual meal. Water consumption should be adequate so as to produce sufficient urine output (1.5-2 L/day).

Statistical Method: Data was analysed using IBM SPSS version 22. Descriptive analysis was carried out by mean or median for quantitative variables, proportion for categorical variables. Fisher's exact test or Chi square test was used to compare the presence of clinical features.

RESULTS AND DISCUSSION

Clinical Profile Of Patients: The study included 50 consecutive patients who satisfied all the inclusion criteria. Among the 50 individuals with refractory anaemia in the present study, 40 patients are classified into refractory nutritional anaemia and 10 were having true refractory anaemia. Among refractory nutritional anaemia 52% had combined deficiency of Vitamin B12, Folic Acid and Iron, 16% had B12 and folic acid deficiency and only 12% had apparently an iron deficiency state alone. Among true refractory anaemia 8 of them (80%) were diagnosed with Myelodysplastic Syndrome, and 2 (20%) with Thalassemia trait. There are no similar studies in the literature for comparison, except for some case reports.

Mean age of patients with True refractory anaemia was significantly higher than those with Refractory nutritional anaemia with p value <.001.

Majority of the Refractory nutritional anaemia were females while males were more among the true refractory anaemia patients. The difference was statistically significant too with p value .001.

In the study we noticed that nutritional anaemia was seen in all the social classes. Altogether 70% of the patients were from middle class and there were 10% from upper socioeconomic status class only 8% were from a lower socioeconomic status. This tells very clearly that lack of awareness is the real cause for nutritional anaemia and was even the cause for refractoriness to treatment, highlighting the need to create awareness on balanced diet to all sections of people and then empowering the marginalised sections for its consumption. Studies have shown that low- and middle-income countries exhibit a high prevalence of anaemia [24,25].

Majority of the patients in the nutritional anaemia category were of normal Body Mass Index [BMI], overweight or obese category. Among the 40 patients with nutritional anaemia only three were underweight again highlighting the lack of balanced diet. Twenty out of 40 with nutritional anaemia were either overweight or obese. But there was no significant difference between the groups (p value 0.78). We observed 42-50% of the study participants who had either true refractory or refractory nutritional anaemia belonged to normal weight category, while 27-40% of the patients were even overweight.

The association of anaemia and body mass index (BMI) has been controversial. Studies have shown the occurrence of anaemia in both undernourished and over-nourished and there is no co-relation with haemoglobin concentration [26] . One thing is clear that it is not starvation or undernutrition that predisposes to nutritional anaemia, but lack of balanced diet that is the major concern. This is especially true in Kerala setting where health indices are comparable to that of developed nations. Anaemia thus appears to be not an issue of undernutrition alone, but often lack of awareness about balanced diet containing all the required items for haematopoiesis. The present study clearly showed the ignorance of balanced diet even among educated and rich people.

Baseline Characteristics Of Two Groups

Pallor was present in all the study participants irrespective of the group. Fatigue was the commonest symptom observed in 95% and 100% while anorexia in 77.5% and 70% respectively in the refractory nutritional anaemia and true refractory anaemia groups. Prochaska et.al in 2017 showed that lower Hb counts in anaemic patients are often associated with increased in fatigue and reduced energy metabolism.[27]

Among symptoms, irritability was present exclusively in Refractory nutritional anaemia patients (57.5%) and the difference was statistically significant with p value .001. Among examination findings Nail changes, Romberg's sign and dark circles were present exclusively in Refractory nutritional anaemia patients (57.5%, 47.5% and 40% respectively). The difference was statistically significant too with p values .001, .008 and .02 respectively. Other symptoms and signs were prevalent similarly in both groups.

Dietary patterns in terms of vegetarian diet and intake of milk, protein, fruits, and vegetables was similar in both groups with p values .09, .18, .20 & .42 respectively. Among haematological parameters Hb, PCV, TC, platelet count and RDW was higher in refractory nutritional anaemia patients and all differences were statistically significant except of RDW. MCV and ESR was higher in True refractory anaemia patients

Serum Ferritin, B12 and folic acid levels of the subjects

Serum ferritin and serum B12 level were significantly lower in refractory nutritional anaemia patients compared to true refractory anaemia patients.

Profile Of Refractory Nutritional Anemia

Clinical Features

Symptoms like giddiness, dyspnoea on exertion, Angina, palpitation, paraesthesia, and numbness were more prevalent in those following vegetarian diet compared to those consuming non-vegetarian diet. Fatigue, giddiness, dyspnoea on exertion, Angina, paraesthesia, and memory impairment were more prevalent in those patients with decreased protein consumption. Similar findings were seen like giddiness, dyspnoea on exertion and angina were more prevalent in those patients with low vegetables and fruits consumption. Only 2.5% of the participants had good consumption of fruits and vegetables. Protein is an important factor which determines the prevalence of nutritional anaemia in people and just 5% of them had a good protein intake.

Blood Parametres With Diet

Out of 40 patients with refractory nutritional anaemia, 29 were nonvegetarian and 11 were vegetarians. Serum folic acid and haemoglobin were found to be significantly different in patients who follow non vegetarian diet. Vegetarians being at a risk of nutritional deficiency compared to non-

vegetarians has been a controversial topic for an exceptionally long time. At the same time, studies have shown a number of health benefits following a vegetarian diet, but the fact is that they are at a high risk of deficiency of some nutrients.[28-30]

Between the two groups of low and 'better & good' groups of protein intake there was no significant difference in serum ferritin and folic acid level, but serum B12 level was significantly higher in those consumed better and good amount of protein with p value 0.04.

Those consuming better and good amounts of protein and vegetables and fruits had significantly higher hemoglobin values compared to the poor consumers with p value 0.001.

Serum ferritin, B12 level and folic acid at baseline with vegetables and fruits intake among Refractory nutritional anaemia patients was studied and there was significant difference in serum ferritin, B12 and folic acid levels in those consumed better and good number of vegetables and fruits with p value .008, .04 and .001 respectively.

The general practice is that vegetables are used only when pulses or nonvegetarian items are not available. In other words, people tend to avoid vegetables as they are given a similar role as nonvegetarian items as a dish or curry only.

Effects Of Drugs

We observed that patients who had a long history of Proton Pump Inhibitors [PPI] intake was found to have a lower serum ferritin level compared to patients who did not have any history of PPI intake (p value 0.79). Long term usage of PPI is considered safe, but extended use of PPI is known to cause refractory iron deficiency anaemia. Studies have shown the inverse relation between long term usage of PPI and serum ferritin level.[31] It was also observed that people with long term use of metformin had a low serum Vitamin B12 levels compared to patients without metformin use though it was statistically significant (p value 0.04). Long term use of metformin is known to induce vitamin B12 deficiency due to the malabsorption of vitamin B12 in intestine.[32] Our study also reported a lower vitamin B12 level in patients who had a history metformin usage.

Improvement in symptoms, signs and haematological parameters

Balanced diet along with haematinics could improve the symptoms and signs in all patients in the refractory nutritional anaemia group, but it was not observed in the true refractory anaemia group. We observed that there was 100% improvement in the symptoms and signs in the refractory nutritional anaemia group after intervention. This is because, we motivated, educated and insisted on consuming a balanced diet along with haematinics in all study subjects. Without a balanced diet, the availability of all the micronutrients would be low. If any one of the components required for haemoglobin synthesis is missing, we may get manifestations of all the deficiencies, several refractory anaemias we had seen in the Medicine OP were refractory because of ignoring this reality. All the parameters showed a significant improvement post intervention in the refractory nutritional anaemia group. The Hb, PCV, MCV, TC, RDW all improved following proper diet and haematinics. Even in the people with true refractory anaemia the Hb and PCV showed a significant increase after dietary modification, but other parameters remained the same post intervention. These findings strengthen the relationship between lack of balanced diet and disease manifestations.

Table 1: Symptom relief in Refractory Nutritional Anemia after intervention

	Pre Treatment (n = 40)	Post Treatment (n = 40)	p value
Symptoms			
Pica	12 (30.0)	0 (0)	<.001
Fatigue	38 (95.0)	0 (0)	<.001
Anorexia	31 (77.5)	0 (0)	<.001
Headache	10 (25.0)	0 (0)	.002
Giddiness	20 (50.0)	0 (0)	<.001
Dyspnoea on exertion	13 (32.5)	0 (0)	<.001
Angina	9 (22.5)	0 (0)	.003
Palpitation	11 (27.5)	0 (0)	.001
Paraesthesia	17 (42.5)	0 (0)	<.001
Numbness	14 (35.0)	0 (0)	<.001
Memory Impairment	17 (42.5)	0 (0)	<.001
Irritability	23 (57.5)	0 (0)	<.001
Examination finding			
Pallor	40 (100)	0 (0)	<.001
Angular Stomatitis	34 (85.0)	0 (0)	<.001
Glossitis	28 (70.0)	0 (0)	<.001
Nail Changes	23 (57.5)	0 (0)	<.001
Romberg"s sign	19 (47.5)	0 (0)	<.001
Dark Circles	16 (40.0)	0 (0)	<.001
Congestive Cardiac Failure	2 (5.0)	0 (0)	.16

All the symptoms and examination findings showed improvement in the refractory nutritional anaemia patients post intervention. The improvement was statistically significant too with p values <.05 for all except congestive cardiac failure [Table 1].

Table 2: Change in Hematologic parameters in Refractory Nutritional Anaemia patients after intervention

Parameter	Pre Treatment (n=40)	Post Treatment (n=40)	p value
Hb (gm/dl)	8.0 (1.5)	13.2 (0.89)	<.001
PCV (%)	25.5 (6.0)	42.7 (2.2)	<.001
MCV (fl)	75.0 (16.1)	82.4 (3.1)	.004
TC (/mm³)	6201.8 (2515.6)	7257.4 (1240.8)	.02
Platelets (/mm³)	290100 (160731)	270900 (51255.4)	.41
ESR (mm in first hour)	36.8 (12.1)	36.4 (11.2)	.88
RDW	17.0 (3.6)	13.3 (0.7)	<.001

Hemoglobin, PCV, MCV, TC & RDW showed significant improvement post intervention in refractory nutritional anemia group. There was no significant change in platelet count and ESR post intervention. [Table 2]

CONCLUSION

Eighty percent of the refractory anemias were attributable only to dietary deficits. Only 20% had true refractory anemia, attributable to MDS or thalassemia trait. The coexistence of various nutritional deficits, particularly reduced protein consumption, was the predominant cause of therapy refractoriness in nutritional anemias. Nutritional anemias were more prevalent in females. Strict vegetarians had an elevated risk of deficits in vitamin B12, iron, and folic acid. Subjects receiving an improved diet exhibited reduced symptoms and less clinical signs. The primary cause of nutritional anaemias was a lack of information regarding a balanced diet, as most individuals belonged to the middle and upper classes. Determining the causes and variables contributing to anaemia requires a comprehensive dietary history, medication history, physical examination, and hemogram, rather than depending on a solitary laboratory test or investigation. Supporting data from food history, combined with clinical manifestations such as psychiatric problems, Romberg's sign, and skin hyperpigmentation, led to the diagnosis of nutritional anemia in most cases, which was corroborated by treatment improvement. In certain cases, resistance to therapy was attributed to extended usage of PPIs and/or Metformin. Patients on Metformin exhibited reduced B12 levels, while those on PPIs demonstrated diminished serum ferritin levels.

Recommendations

Maintaining a heightened index of clinical suspicion and familiarizing oneself with the clinical manifestations of nutritional deficits is essential for recognizing nutritional anemias. Laboratory examinations are ancillary; nonetheless, they may not independently suffice for diagnosis. Prior to classifying anaemias as genuine refractory anemia or myelodysplastic syndromes, it is essential to exclude combination deficiencies of vitamin B12, folic acid, with or without iron deficiency, as well as protein shortage. Always obtain a comprehensive dietary history accompanied by a thorough physical examination; if clinical symptoms are compelling, normal blood tests do not exclude the likelihood of nutritional deficiencies. An essential necessity exists to promote awareness of balanced diets among all demographics.

REFERENCES

1. Kishore S, Singh M, Jain B, Verma N, Gawande K, Kishore S, et al. A study to assess prevalence of anaemia among beneficiaries of Anaemia Mukt Bharat Campaign in Uttarakhand. J Fam Med Prim Care. 2020;9(3):1691–4. https://pmc.ncbi.nlm.nih.gov/articles/PMC7266259/
2. Gardner W, Kassebaum N. Global, Regional, and National Prevalence of Anemia and Its Causes in 204 Countries and Territories, 1990–2019. Curr Dev Nutr. 2020;4(Suppl 2):830. https://pmc.ncbi.nlm.nih.gov/articles/PMC7258674/
3. Li Q, Liang F, Liang W, Shi W, Han Y. Prevalence of Anemia and Its Associated Risk Factors Among 6-Months-Old Infants in Beijing. Front Pediatr. 2019;7:286. https://pubmed.ncbi.nlm.nih.gov/31355169/
4. Stoltzfus RJ, Heidkamp R, Kenkel D, Habicht JP. Iron supplementation of young children: learning from the new evidence. Food Nutr Bull. 2007;28(4 Suppl):S572-84. https://pubmed.ncbi.nlm.nih.gov/18297895/
5. Khusun H, Yip R, Schultink W, Dillon DHS. World Health Organization Hemoglobin Cut-Off Points for the Detection of Anemia Are Valid for an Indonesian Population. J Nutr. 1999;129(9):1669–74. https://pubmed.ncbi.nlm.nih.gov/10460202/
6. Kumar V, Abbas AK, Aster JC. Robbins and Cotran Pathologic Basis of Disease. 9th ed. Philadelphia: Elsevier/Saunders; 2015. https://shop.elsevier.com/books/robbins-and-cotran-pathologic-basis-of-disease/kumar/978-1-4557-2613-4
7. Billett HH. Hemoglobin and Hematocrit. In: Walker HK, Hall WD, Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd ed. Boston: Butterworths; 1990. https://www.ncbi.nlm.nih.gov/books/NBK259/
8. World Health Organization. Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia [Internet]. 2008 [cited 2025 Jul 25]. https://apps.who.int/iris/handle/10665/43894
9. Jeevan J, Karun KM, Puranik A, Deepa C, Mk L, Barvaliya M. Prevalence of anemia in India: a systematic review, meta-analysis and geospatial analysis. BMC Public Health. 2025 Apr 4;25(1):1270. https://pmc.ncbi.nlm.nih.gov/articles/PMC11969930/
10. Joseph JJ, Girija M, Ajitha K, Alice D. Iron deficiency anemia among preschool children belonging to affluent families in Kerala, India. Journal of Current Research in Scientific Medicine 5(1): 23-27. https://journals.lww.com/jcsm/fulltext/2019/05010
11. Rakesh PS. Prevalence of Anaemia in Kerala State, Southern India - A Systematic Review. J Clin Diagn Res. 2017;11(5):LE01–4. https://pmc.ncbi.nlm.nih.gov/articles/PMC5483718/
12. World Health Organization. Global anaemia prevalence and number of individuals affected [Internet]. [cited 2025 Jul 25]. https://www.who.int/vmnis/anaemia/prevalence/summary/anaemia_data_status_t2/en
13. Sasidharan PK. B12 deficiency in India. Arch Med Health Sci. 2017;5(2):261.

file:///C:/Users/User/Downloads/b12_deficiency_in_india.24.pdf
14. Warner MJ, Kamran MT. Iron Deficiency Anemia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 [cited 2025 Jul 25]. https://www.ncbi.nlm.nih.gov/books/NBK448065
15. Pawson R, Mehta A. The diagnosis and treatment of haematinic deficiency in gastrointestinal disease. Aliment Pharmacol Ther. 1998;12(8):687–95. https://pubmed.ncbi.nlm.nih.gov/9726380/
16. Kotecha PV. Nutritional Anemia in Young Children with Focus on Asia and India. Indian J Community Med. 2011;36(1):8–16. https://pmc.ncbi.nlm.nih.gov/articles/PMC3104701/
17. Chai ZF, Gan WY, Chin YS, Ching YK, Appukutty M. Factors associated with anemia among female adult vegetarians in Malaysia. Nutr Res Pract. 2019;13(1):23–31. https://pubmed.ncbi.nlm.nih.gov/30788053/
18. Freeman AM, Rai M, Morando DW. Anemia Screening. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 [cited 2025 Jul 25]. https://www.ncbi.nlm.nih.gov/books/NBK499905
19. Conrad ME. Anemia. In: Walker HK, Hall WD, Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations [Internet]. 3rd ed. Boston: Butterworths; 1990. https://pubmed.ncbi.nlm.nih.gov/21250097/
20. Ehrl D, Rothaug K, Herzog P, Hofer B, Rau HG. "Incidentaloma" of the Liver: Management of a Diagnostic and Therapeutic Dilemma. HPB Surg. 2012;2012: e891787.
21. Cartwright GE. Refractory Anemia. West J Med. 1977;127(2):137. https://pubmed.ncbi.nlm.nih.gov/18748017/
22. Strupp C, Gattermann N, Giagounidis A, Aul C, Hildebrandt B, Haas R, et al. Refractory anemia with excess of blasts in transformation: analysis of reclassification according to the WHO proposals. Leuk Res. 2003;27(5):397–404. https://pubmed.ncbi.nlm.nih.gov/12620291/
23. Lawrence LW. Refractory anemia and the myelodysplastic syndromes. Clin Lab Sci. 2004;17(3):178–86. https://pubmed.ncbi.nlm.nih.gov/15314893/
24. Alem AZ, Efendi F, McKenna L, Felipe-Dimog EB, Chilot D, Tonapa SI, Susanti IA, Zainuri A. Prevalence and factors associated with anemia in women of reproductive age across low- and middle-income countries based on national data. Sci Rep. 2023 Nov 20;13(1):20335. https://pmc.ncbi.nlm.nih.gov/articles/PMC10663544/
25. Yang F, Liu X, Zha P. Trends in Socioeconomic Inequalities and Prevalence of Anemia Among Children and Nonpregnant Women in Low- and Middle-Income Countries. JAMA Netw Open. 2018;1(5):e182899. https://pubmed.ncbi.nlm.nih.gov/30646183/
26. Ugwuja EI, Ogbonnaya LU, Obuna AJ, Awelegbe F, Uro-Chukwu H. Anaemia in Relation to Body Mass Index (BMI) and Socio Demographic Characteristics in Adult Nigerians in Ebonyi State. J Clin Diagn Res. 2015;9(1):LC04–7. https://europepmc.org/article/med/25738011
27. Prochaska MT, Newcomb R, Block G, Park B, Meltzer DO. Association Between Anemia and Fatigue in Hospitalized Patients: Does the Measure of Anemia Matter? J Hosp Med. 2017;12(11):898–904. https://pubmed.ncbi.nlm.nih.gov/29091977/
28. Pawlak R, Berger J, Hines I. Iron Status of Vegetarian Adults: A Review of Literature. Am J Lifestyle Med. 2016;12(6):486–97. https://pubmed.ncbi.nlm.nih.gov/30783404/
29. Wang T, Masedunskas A, Willett WC, Fontana L. Vegetarian and vegan diets: benefits and drawbacks. Eur Heart J. 2023 Sep 21;44(36):3423-3439. https://pmc.ncbi.nlm.nih.gov/articles/PMC10516628/
30. The Recovery Village. Can Anorexia Cause Anemia [Internet]. [cited 2025 Jul 25]. https://www.therecoveryvillage.com/mental-health/anorexia/faq/can-anorexia-cause-anemia.
31. Douwes RM, Gomes-Neto AW, Eisenga MF, Vinke JSJ, de Borst MH, van den Berg E, et al. Chronic Use of Proton-Pump Inhibitors and Iron Status in Renal Transplant Recipients. J Clin Med. 2019;8(9):1382. https://pmc.ncbi.nlm.nih.gov/articles/PMC6780301/
32. Sayedali E, Yalin AE, Yalin S. Association between metformin and vitamin B12 deficiency in patients with type 2 diabetes. World J Diabetes. 2023 May 15;14(5):585-593. https://pmc.ncbi.nlm.nih.gov/articles/PMC10236989/.