

# Prevalence of Anemia among Women Patients Visiting A Dental Hospital

Jagadheeswari Ramamoorthy<sup>1</sup>, Gifrina Jayaraj<sup>2</sup>, Geo Mani<sup>3</sup>

<sup>1</sup>Research Associate, Dental Research Cell, <sup>2</sup>Reader, Department of Oral Pathology, <sup>3</sup>Reader, Department of Pedodontics and Preventive Dentistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai

## Abstract

Anemia is the decreased oxygen carrying capacity of the blood due to reduction in the concentration of Hemoglobin or RBC. Anemia has a high prevalence and it is considered as a public health issue affecting developed and developing countries. It occurs most commonly in women and children. Prevalence of Anemia worldwide suggests the need for substantial improvement in the nutritional status of women. The aim of the study is to assess the prevalence of Anemia among women patients visiting a Dental hospital. Patient records of a total of 86000 patients who visited the hospital between June 2019 to March 2020 were reviewed and the laboratory values of Hemoglobin levels and RBC count of women patients undergoing complete hemogram were collected from the case sheets of . The age, Hb% and RBC values were collected. The collected data was tabulated in Excel. It was then imported to SPSS software. Descriptive statistics was performed for the obtained results and comparison between groups were done by using Chi square tests.  $p < 0.05$  was considered as statistically significant. The prevalence of Anemia among the total women patients was 39.1%. Among the 39.1% women who were diagnosed with anemia, it was found to be more prevalent in the women of age group 40-60 years with a frequency of 17.8%. The most commonly observed range of Haemoglobin is 12-13g/dl with a frequency of 26.6% . 0.6% of women had RBC count less than 3 million cells/mm<sup>3</sup>. A significant number of female patients were tested with abnormal results. The most common age group diagnosed with Anemia are women belonging to 40-60 years of age. Routine hemoglobin testing in Dental practice of population at risk may be beneficial. Screening of Anemia is essential to avoid late diagnosis.

**Keywords:** Anemia; Haemoglobin; Investigations; Diagnosis; Treatment

## Introduction

Anemia is a condition which causes the deficiency of red blood cells or haemoglobin in the blood, which results in low oxygen carrying capacity of the blood and produces signs and symptoms like pallor and weakness.

(1) Anemia affects one third of the global population and is a major factor that causes increased morbidity, mortality, decreased productivity of work, and impaired physiological and neurological development. The normal range of hemoglobin for men is 13.5-17.5g/dl whereas for women it is 12- 15.5g/dl<sup>(2)</sup>. There is a need to understand the different and sophisticated etiology of anemia to emphasize on the prevention and control programmes of anemia<sup>(3)</sup>. It is considered as a largely preventable and treatable public health issue if detected on time and strategies for its prevention are well documented<sup>(4)(5)</sup>.

Anemia needs to be correctly defined and identified by establishing appropriate Hemoglobin thresholds, and thereby preventing its negative impact on health. For the

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### Corresponding author:

**Gifrina Jayaraj**

Reader, Department of Oral Pathology  
Saveetha Dental College and Hospitals  
Saveetha Institute of Medical and Technical Sciences  
Saveetha University, Chennai -600077

Email ID - gifrina@saveetha.com

Telephone no : +91 9952096111

development of the required interventions that address the causes of anemia which are content specific and to monitor the success rate of anemia prevention programs, understanding the etiopathology of anemia is essential<sup>(5,6)</sup>. The concentration of Hemoglobin varies naturally by gender, age, pregnancy status, genetics, environmental factors, economic status and geographical factors<sup>(7)</sup>. The clinical features of anemia are predominantly non-specific which includes conjunctival pallor, fatigue, dyspnea, and tachycardia. After the diagnosis of anemia, the mean corpuscular volume (MCV) should be checked to differentiate between microcytic, normocytic, and macrocytic anemia which thereby determines the successive steps in diagnosis and treatment. Reticulocyte count can also be checked to evaluate any abnormalities of the bone marrow. Treatment for anemia depends on the type of anemia present and the underlying condition. In cases of acute/severe anemia, blood transfusion may be required

The gender differences in Hemoglobin concentrations usually begins at puberty. It is due to the effect of menstruation, depletion of iron stores and which subsequently causes anemia. This continues throughout the reproductive phase of the individual.<sup>(8)</sup> In females, during pregnancy, there is expansion of blood volume which consequently has a dilution effect. Therefore the concentration of Hemoglobin declines naturally during the first and second trimesters of pregnancy<sup>(9)</sup>. Social behavior and environmental conditions like smoking, altitude, also affects the concentration of Hemoglobin. During their reproductive phase and pregnancy women are at a high risk of anemia, which consequently leads to maternal morbidity and mortality<sup>(10)(11)</sup>. Both anemia and lower BMI are indications of poor nutritional status. Poor diet quality may end in the lower bioavailability of dietary iron, thus increasing the danger of developing anemia<sup>(12)(13)</sup>.

Anemia is diagnosed typically by the measurement of Hemoglobin and Hematocrit(HCT)<sup>(14)(15)</sup>. Reducing the burden of anemic disorders in women includes understanding risk factors, making rapid, accurate diagnoses when symptoms occur, implementing appropriate therapies, and monitoring treatment<sup>(16,17,18)</sup>. Since anemia is typically detected through routine blood tests, laboratory diagnostic testing plays an integral role in caring for ladies throughout the continuum of anemia

treatment<sup>(19,20)</sup>

This study aims to assess and study the prevalence of Anemia among women patients visiting a Dental hospital and the possible factors associated with it. In a Hospital setting patients undergo routine blood investigations before procedures<sup>(21)</sup>. This study helps in identifying anemic patients who are otherwise not diagnosed and those who do not visit physicians with symptoms of Anemia as a chief complaint. Identifying and treating the patients is the best way to address the disease that is most often unreported and treated despite wide prevalence<sup>(22)</sup>. This study explores the prevalence of anemia among women who were the outpatients of a Dental hospital and the significant role played by the hospital in identifying and addressing the diseases.

## Materials and Method

### Study setting:

This study was conducted as a retrospective study in a hospital setting. The sample taken for the study are predominantly South Indians. The study setting had certain advantages like flexibility in data collection and less expenditure. The ethical approval for the current study was obtained from the Institutional Review Board.

### Study sample:

We reviewed the patient records and analysed data of 86,000 patients between June 2019 to March 2020. All the case sheets of female patients were collected and reviewed. The laboratory values of Hemoglobin levels and RBC count of women patients undergoing complete hemogram were collected from the case sheets of patients undergoing Complete Blood Count in the In-house laboratory.

### Diagnostic criteria and data Collection:

The inhouse laboratory uses an automatic analyser (Sysmex 3 part XP 300) for Complete blood count analysis from venous blood. The diagnostic criteria for Anemia is based on Hemoglobin levels and RBC count. The necessary data such as Age, Hb level, RBC count were collected. State For hemoglobin, the cut-off criterion indicating anemia was the WHO cut-off of 12 g/dL for females and RBC for females was considered normal in the range of 4200–5800/mm<sup>3</sup>. Values below

this were considered anemic<sup>(23)</sup>. The data was tabulated in Microsoft Excel 2016. The Data was cross verified by the analyser. Incomplete data of patients was excluded from the study to reduce errors. The tabulated data from Excel is imported to SPSS software for Windows (Version 20.0, SPSS, Inc, Chicago, USA) for statistical analysis. Descriptive statistics was performed for the obtained results and comparison between groups were done by using Chi square tests.  $p < 0.05$  was considered as statistically significant.

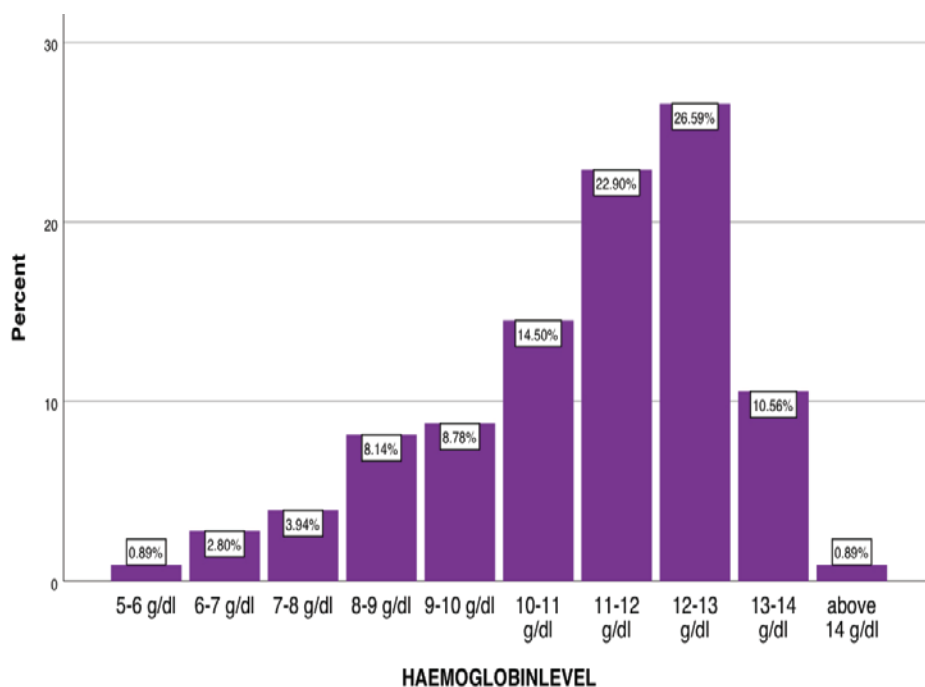
### Results and Discussion

The total study sample consists of 786 female patients undergoing blood investigations. The prevalence of Anemia in the total population is 39.1% of the women since their Hemoglobin level was less than 12 g/dl. In the total study, 18.3% belong to 1-20 years age group, 34.2% belong to 20-40 years age group, 37.9% belong to 40-60 years and 9.6% of them belong to the age group above 60 years (Table 1). The most commonly observed range of Hemoglobin level is 12-

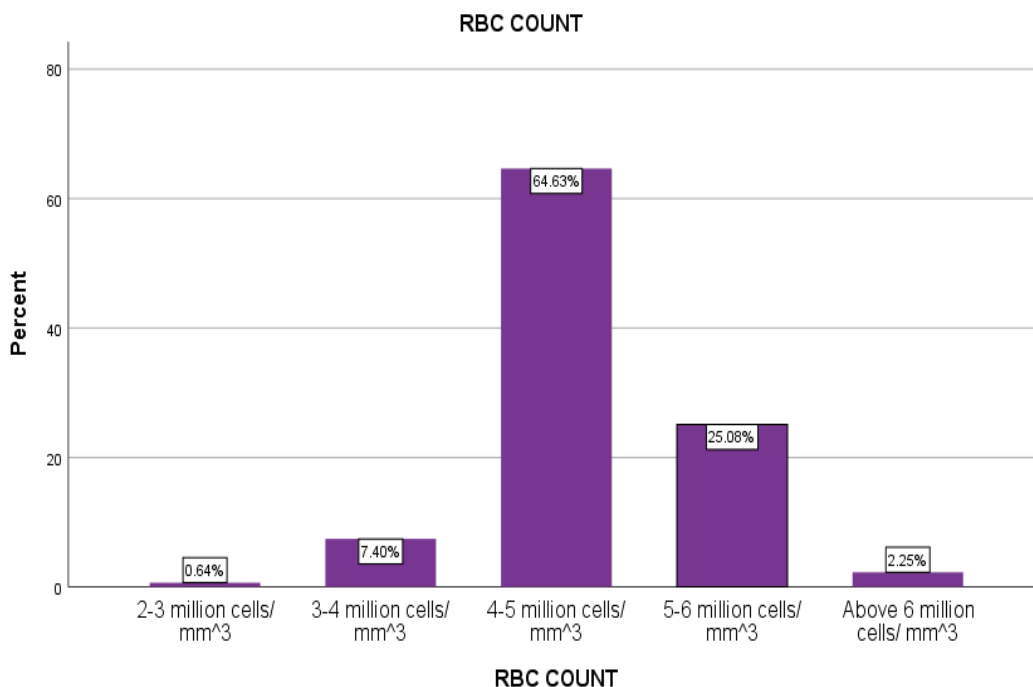
13g/dl with a frequency of 26.6% followed by 11-12g/dl with a frequency of 22.9%(Graph 1). In case of RBC count, the commonly observed range was 4-5 million cells/mm<sup>3</sup> with a frequency of 64.6% followed by 5-6 million cells/mm<sup>3</sup> with a frequency of 25.08%. 0.6% of the population had RBC count less than 3 million cells/mm<sup>3</sup>(Graph 2). The lowest value of Hemoglobin level was 5 g/dl found in the age group of 60-70 years. Anemia was found even in children < 10 years. Women in the age group of 10-30 years had as low as 6-7g/dl. 0.9% of the female patients had the lowest hemoglobin level of 5-6 g/dl. However there is no statistically significant difference in Hemoglobin levels among different age groups( Graph 3). RBC count as low as 2-3 million cells/mm<sup>3</sup> were found in the age group of 50-70 years with a prevalence of 0.6%. RBC count above 6 million cells/mm<sup>3</sup> were most prevalent in the age group 40-50 years (1%) (Graph 4). Anemia was found to be more prevalent in the age group 50-60 years with a frequency of 9.41% followed by 40-50 years with a frequency of 8.40% (Graph 5).

Age	Percentage
1-10 years	12.8%
10-20 years	5.5%
20-30 years	14.0%
30-40 years	20.2%
40-50 years	23.7%
50-60 years	14.2%
60-70 years	7.8%
70-80 years	1.8%

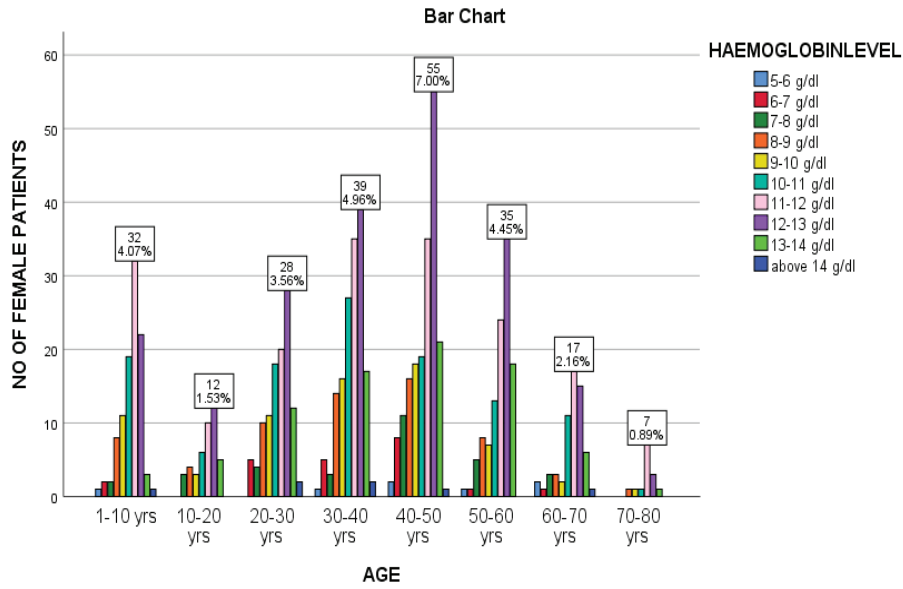
Table 1 - Table showing the percentage of age distribution of female patients taken for the study. 18.3% belong to the 1-20 years age group, 34.2% belong to the 20-40 years age group, 37.9% belong to the 40-60 years and 9.6% of them belong to the age group above 60 years.



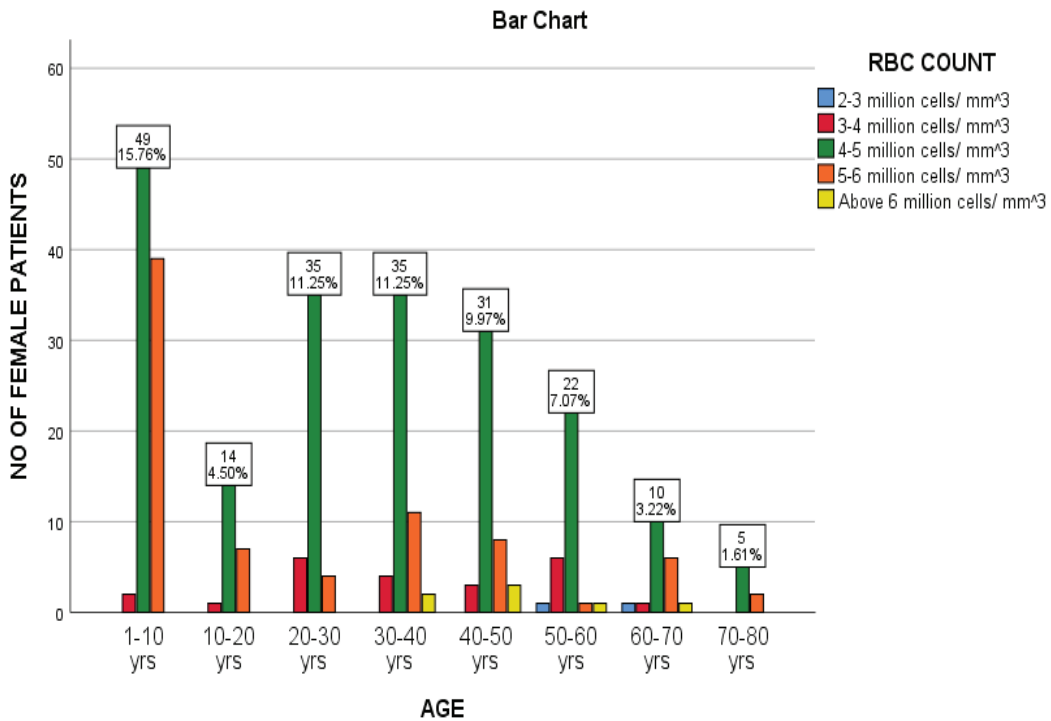
**Graph 1 - Bar chart showing the frequency of Hemoglobin levels of Female patients. X axis denotes the range of Hemoglobin levels and Y axis denotes the percentage of distribution. The most commonly observed range of Hemoglobin level is 12-13g/dl with a frequency of 26.6% followed by 11-12g/dl with a frequency of 22.9%. The mean hemoglobin value was found to be 11.22g/dl.**



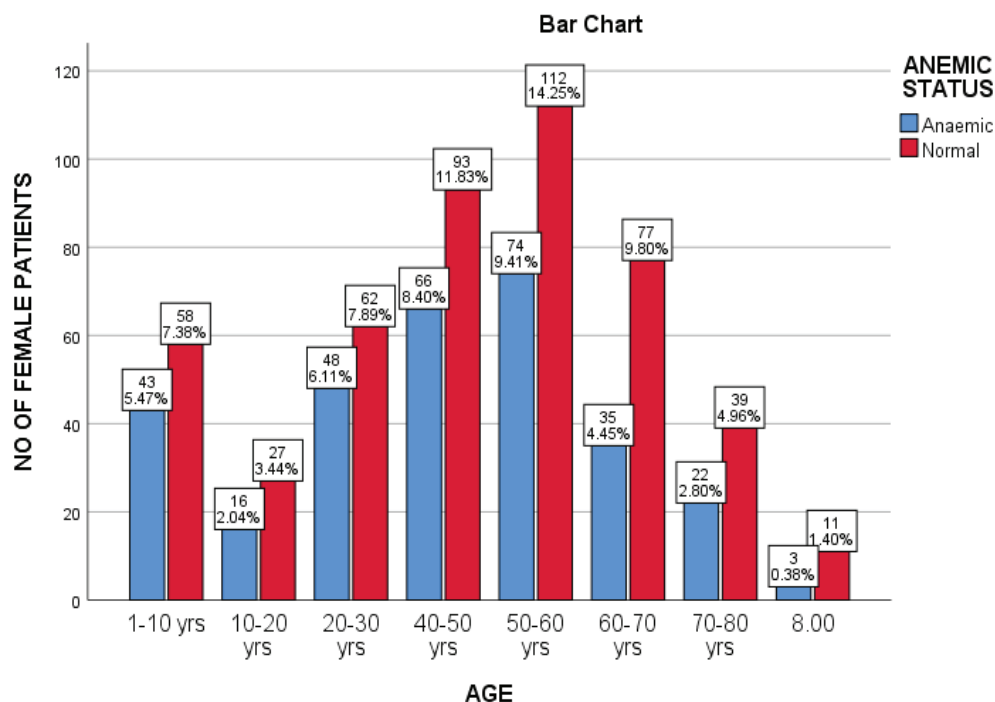
**Graph 2 - Bar chart showing the frequency of RBC count of Female patients. X axis denotes the range of RBC count and Y axis denotes the percentage of distribution. The commonly observed range of RBC count was 4-5 million cells/mm<sup>3</sup> with a frequency of 64.6% followed by 5-6 million cells/mm<sup>3</sup> with a frequency of 25.08%. 0.64% of the population had RBC count less than 3 million cells/mm<sup>3</sup>**



**Graph 3 - Bar chart showing the comparison of Hemoglobin levels in different age groups among the female patients. X axis denotes the age group of the patients and Y axis represents the number of patients. The lowest value of Hemoglobin level was 5 g/dl and was found in the age group of 60-70 years. 0.9% of the female patients had the lowest hemoglobin level of 5-6 g/dl. There is no major difference in Hemoglobin levels among different age groups. Chi square test was done and p value was found to be 0.696 (p value > 0.05, statistically not significant)**



**Graph 4- Bar chart showing the association of age groups and RBC count in females in the study population . X axis denotes the age group of the patients and Y axis represents the number of patients. RBC count as low as 2-3 million cells/mm³ were found in the age group of 50-70 years with 0.6%. RBC count above 6 million cells/mm³ were mostly seen among the age group 40-50 years ( 1%). Chi square test was done and p value was found to be 0.000 ( p value < 0.05 , statistically significant)**



**Graph 5-** Bar chart showing the association of age groups and Anemia in females in the study population. X axis denotes the age group of the patients and Y axis denotes the number of patients. Blue colour represents anemic patients and Red colour represents normal patients. Anemia was mostly seen in the age group 50-60 years with a frequency of 9.41% followed by 40-50 years with 8.40%. There is no major difference in anemic status among different age groups. Chi square test was done and p value was found to be 0.437 ( p value >0.05, statistically not significant)

The purpose of this study was to identify anemic patients who are otherwise not diagnosed and those who do not visit physicians with symptoms of Anemia as a chief complaint. This study explores the prevalence of anemia among women visiting a Dental hospital and the possible role played by the institution in identifying and addressing the diseases. This study shows that a significant number of female patients were diagnosed with anemia. The prevalence of anemia among the women patients visiting the Dental hospital was found to be 39.1%. This can be considered as a moderate public health issue. Poverty in India is a major barrier to positive health outcomes for both men and women, but poverty tends to yield a higher burden on women and girls' health due to malnutrition and unsafe fuels. The prevalence was found to be higher than some previous studies<sup>(24)</sup>. According to the World Health Organization, 54.8 % of women around 15-49 years and 50.4% of children under 5 years of age were reported to be anaemic in Tamil Nadu by a National Family Health Survey. This had reflected even in our present study. The possible reasons

could be lack of awareness, Geographical variations, poor socioeconomic status and nutrition deficiency such as Iron deficiency and Vitamin B-12 deficiency<sup>(25,26,27)</sup>.

In this study anemia was found to be more prevalent among the middle aged women belonging to 40-60 years of age with a frequency of 17.8% followed by the age group of 20-40 years. The possible reason could be Iron deficiency which can be associated with Cardiovascular disease in middle aged women. Also in post menopausal women, there is an increased risk of Anemia.

Iron deficiency anemia in post menopausal women occurs due to gastrointestinal bleeding or malabsorption<sup>(27)</sup>. The prevalence of anemia in younger age groups is less compared to some of the previous studies.<sup>(28)</sup>The difference could be due to geographic variations and socioeconomic status which affects their nutrition and health. Women of reproductive age have an additional risk of developing anemia because of periodic menstrual blood loss.<sup>(29)</sup> Also women have extra iron requirements

especially during pregnancy for the proper development of the foetus. In fact, pregnant women need 50 percent more iron than usual (27 mg per day rather than the standard 18 mg per day). There is also loss of blood in women during childbirth. It is essential for females who are pregnant to keep their Hemoglobin and Iron levels checked and to intimate their caretakers if they have one or more symptoms of anemia.<sup>(30)</sup> Iron and Vitamin B12 supplements can be taken regularly which may help prevent low iron levels and pregnancy-related anemia. In the study, the most commonly observed range of Hemoglobin level is 12-13g/dl with a frequency of 26.6% followed by 11-12g/dl with a frequency of 22.9%.<sup>(31)</sup> The mean hemoglobin value was found to be 11.22g/dl which was found to be related to previous studies conducted in Tamil Nadu due to the same geographical location and economic conditions of the people.<sup>(32)</sup>

The normal range of RBC count for females is 3.5-4.5 million cells/mm<sup>3</sup>. In this study, 0.6% of women had RBC count less than 3 million cells/mm<sup>3</sup>. The commonly observed range of RBC count in this study was 4-5 million cells/mm<sup>3</sup> with a frequency of 64.6%. In many cases the RBC count may be normal but the Hemoglobin level may be decreased.<sup>(33)</sup> This situation occurs with iron-deficiency anemia, during which red blood cells have less hemoglobin than normal. Iron deficiency anemia is additionally mentioned as hypochromic anaemia.<sup>(34)</sup> Decrease in RBC count may be caused due to Anemia, Bone marrow failure, Erythropoietin deficiency, Hemolysis or destruction of RBCs, Internal or external bleeding and leukemia. Assessment of both RBC count and Hemoglobin level is essential for the diagnosis of Anemia. Anemia is associated with impaired survival and health related quality of life. It may cause adverse effects in the health of an individual especially women, which hinders their day to day activities<sup>(35)</sup>. It may also cause complications in their later stages of life. A pan European study concluded that anemia affects the quality of life and their testing awareness is quite low.<sup>(36)</sup> So, in order to reach out to the patients in a populated country like India, a Dental hospital might function along with primary health care facilities to improve the health status and quality of life of these patients thereby contributing to women health.<sup>(37,38)</sup> Hence the early diagnosis and treatment of Anemia is essential for a healthy living. The study is limited by a few factors. The sample size can be expanded and it is a short duration

study. The quality of life is not assessed. Some of the clinical features of anemia may not be known and may be left undiagnosed. The study also has geographical limitations as it was done in a hospital setting. A large sample size of people from different ethnicities would give better results for the study. Further study can be done to classify the anemic patients as mild, moderate or severely anemic.

## Conclusion

A significant number of female patients were tested with abnormal results. The most common age group diagnosed with Anemia are middle aged women. Routine Hemoglobin testing in Dental practice of populations at risk or diagnosed with Anemia may be beneficial. Screening of Anemia is essential to avoid late diagnosis and better treatment options. An overall higher prevalence of Anemia suggests the necessity of developing appropriate nutrition intervention. Further research studies on anemia are recommended to estimate the prevalence and determinants of Anemia on a large scale. High prevalence of anemia in Indian population, especially females may cause a burden for them, their family, and for the economic development and productivity of the country. Iron supplementation programs, for a spread of reasons, haven't been effective in reducing anemia prevalence and operational research on how best to enhance existing iron supplementation programs is required. New and innovative strategies are needed, particularly people who improve the general health and nutrition status of adolescent girls before they enter their reproductive years.

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**Ethical Clearance:** It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

## References

1. Assessment of Efficiency of Antianemic Therapy in Pregnant Women Suffering from Anemia [Internet]. Vol. 5, International Journal of Science and Research (IJSR). 2016. p. 1266–8. Available from: <http://dx.doi.org/10.21275/v5i2.nov161202>
2. Alemayehu A, Gedefaw L, Yemane T, Asres Y. Prevalence, Severity, and Determinant Factors of Anemia among Pregnant Women in South Sudanese Refugees, Pugnido, Western Ethiopia [Internet]. Vol. 2016, Anemia. 2016. p. 1–11. Available from: <http://dx.doi.org/10.1155/2016/9817358>
3. Chakraborty A, Ramani P, Sherlin HJ, Premkumar P, Natesan A. Antioxidant and pro-oxidant activity of Vitamin C in oral environment. *Indian J Dent Res.* 2014 Jul;25(4):499–504.
4. Alene KA, Dohe AM. Prevalence of Anemia and Associated Factors among Pregnant Women in an Urban Area of Eastern Ethiopia [Internet]. Vol. 2014, Anemia. 2014. p. 1–7. Available from: <http://dx.doi.org/10.1155/2014/561567>
5. Premkumar J, Ramani P, Chandrasekar T, Natesan A, Premkumar P. Detection of species diversity in oral candida colonization and anti-fungal susceptibility among non-oral habit adult diabetic patients. *J Nat Sci Biol Med.* 2014 Jan;5(1):148–54.
6. Seid MH, Butcher AD, Chatwani A. Ferric Carboxymaltose as Treatment in Women with Iron-Deficiency Anemia [Internet]. Vol. 2017, Anemia. 2017. p. 1–9. Available from: <http://dx.doi.org/10.1155/2017/9642027>
7. Ahad M, Gheena S. Awareness, attitude and knowledge about evidence based dentistry among the dental practitioner in Chennai city [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1863. Available from: <http://dx.doi.org/10.5958/0974-360x.2016.00380.2>
8. Ullah A, Sohaib M, Saeed F, Iqbal S. Prevalence of anemia and associated risk factors among pregnant women in Lahore, Pakistan [Internet]. Vol. 59, Women & Health. 2019. p. 660–71. Available from: <http://dx.doi.org/10.1080/03630242.2018.1544966>
9. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Oral Pathol Med.* 2019 Apr;48(4):299–306.
10. Singh DJ, Davidson J. How to Prevent Anemia in Women and Children. Mendon Cottage Books; 2017. 57 p.
11. Thangaraj SV, Shyamsundar V, Krishnamurthy A, Ramani P, Ganesan K, Muthuswami M, et al. Molecular Portrait of Oral Tongue Squamous Cell Carcinoma Shown by Integrative Meta-Analysis of Expression Profiles with Validations. *PLoS One.* 2016 Jun 9;11(6):e0156582.
12. Purandare A, Purandare I. Anemia in Adolescent Girls and Young Women [Internet]. *Gynecological Manual on Adolescent Girls and Young Women.* 2009. p. 334–334. Available from: [http://dx.doi.org/10.5005/jp/books/11090\\_42](http://dx.doi.org/10.5005/jp/books/11090_42)
13. Hema Shree K, Ramani P, Sherlin H, Sukumaran G, Jeyaraj G, Don KR, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma - a Systematic Review with Meta Analysis. *Pathol Oncol Res.* 2019 Apr;25(2):447–53.
14. Uma Maheswari TN, Nivedhitha MS, Ramani P. Expression profile of salivary micro RNA-21 and 31 in oral potentially malignant disorders. *Braz Oral Res.* 2020 Feb 10;34:e002.
15. Solovyova AV, Gace V, Ermolenko KS, Khorolskiy VA. Anemia in Women of Reproductive Age [Internet]. *Current Topics in Anemia.* 2018. Available from: <http://dx.doi.org/10.5772/intechopen.71520>
16. Jayaraj G, Sherlin HJ, Ramani P, Premkumar P, Natesan A. Stromal myofibroblasts in oral squamous cell carcinoma and potentially malignant disorders. *Indian J Cancer.* 2015 Jan;52(1):87–92.
17. Dünder B. The Prevalence And Analysis Of Risk Factors For Postpartum Anemia In Women Without Prepartum Anemia [Internet]. *Haydarpasa Numune Training and Research Hospital Medical Journal.* 2019. Available from: <http://dx.doi.org/10.14744/hnhj.2019.75436>
18. Gomez J. Anemia in Women: Self-help and Treatment. Hunter House; 2002. 164 p.
19. Jangid K, Alexander A, Jayakumar N, Varghese S, Ramani P. Ankyloglossia with cleft lip: A rare case report [Internet]. Vol. 19, Journal of Indian Society of Periodontology. 2015. p. 690. Available from: <http://dx.doi.org/10.4103/0972-124x.162207>
20. Jayaraj G, Ramani P, Herald J, Sherlin, Premkumar P, Anuja N. Inter-observer agreement in grading oral epithelial dysplasia – A systematic review

- [Internet]. Vol. 27, Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology. 2015. p. 112–6. Available from: <http://dx.doi.org/10.1016/j.ajoms.2014.01.006>
21. Baskar K, Student BDS, Saveetha Dental College, 077. C-. 600, Raj D, Prasad. P, et al. EVALUATION OF PREPAREDNESS FOR MEDICAL EMERGENCIES AT DENTAL OFFICES IN CHENNAI – A cross-sectional study [Internet]. Vol. 5, International Journal of Advanced Research. 2017. p. 2633–6. Available from: <http://dx.doi.org/10.21474/ijar01/3452>
  22. Hannah R, Ramani P, Herald. J. Sherlin, Ranjith G, Ramasubramanian A, Jayaraj G, et al. Awareness about the use, Ethics and Scope of Dental Photography among Undergraduate Dental Students Dentist Behind the lens [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 1012. Available from: <http://dx.doi.org/10.5958/0974-360x.2018.00189.0>
  23. UNICEF., World Health Organization. Indicators and Strategies for Iron Deficiency and Anemia Programmes. 1994.
  24. Goetz LG, Valeggia C. The ecology of anemia: Anemia prevalence and correlated factors in adult indigenous women in Argentina [Internet]. Vol. 29, American Journal of Human Biology. 2017. p. e22947. Available from: <http://dx.doi.org/10.1002/ajhb.22947>
  25. Brimson S, Suwanwong Y, Brimson JM. Nutritional anemia predominant form of anemia in educated young Thai women [Internet]. Vol. 24, Ethnicity & Health. 2019. p. 405–14. Available from: <http://dx.doi.org/10.1080/13557858.2017.1346188>
  26. Swathy S, Gheena S, Varsha SL. Prevalence of pulp stones in patients with history of cardiac diseases [Internet]. Vol. 8, Research Journal of Pharmacy and Technology. 2015. p. 1625. Available from: <http://dx.doi.org/10.5958/0974-360x.2015.00291.7>
  27. Gheena S, Ezhilarasan D. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells. Hum Exp Toxicol. 2019 Jun;38(6):694–702.
  28. Sridharan G, Ramani P, Patankar S. Serum metabolomics in oral leukoplakia and oral squamous cell carcinoma. J Cancer Res Ther. 2017 Jul;13(3):556–61.
  29. Sarbeen JI, Insira Sarbeen J, Gheena S. Microbial variation in climatic change and its effect on human health [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1777. Available from: <http://dx.doi.org/10.5958/0974-360x.2016.00359.0>
  30. Nwose EU. Prevalence of Anemia and Risk of Adverse Bleeding Effect of Drugs: Implication for Therapy [Internet]. Vol. 2012, Anemia. 2012. p. 1–5. Available from: <http://dx.doi.org/10.1155/2012/795439>
  31. Macciò A, Madeddu C. Management of Anemia of Inflammation in the Elderly [Internet]. Vol. 2012, Anemia. 2012. p. 1–20. Available from: <http://dx.doi.org/10.1155/2012/563251>
  32. Shaw JG, Friedman JF. Iron Deficiency Anemia: Focus on Infectious Diseases in Lesser Developed Countries [Internet]. Vol. 2011, Anemia. 2011. p. 1–10. Available from: <http://dx.doi.org/10.1155/2011/260380>
  33. Garrison C. Iron Disorders Institute Guide to Anemia. Sourcebooks, Inc.; 2009. 496 p.
  34. Benz (Jr. E, (Hematologist) NB, Schiffman FJ. Anemia: Pathophysiology, Diagnosis and Management. 2018.
  35. Sivaramakrishnan SM, Ramani P. Study on the Prevalence of Eruption Status of Third Molars in South Indian Population [Internet]. Vol. 07, Biology and Medicine. 2015. Available from: <http://dx.doi.org/10.4172/0974-8369.1000245>
  36. Stevens PE, O'Donoghue DJ, Lameire NR. Anaemia in patients with diabetes: unrecognised, undetected and untreated? Curr Med Res Opin. 2003;19(5):395–401.
  37. Jayaraj G, Sherlin HJ, Ramani P, Premkumar P, Anuja N. Cytomegalovirus and Mucoepidermoid carcinoma: A possible causal relationship? A pilot study. J Oral Maxillofac Pathol. 2015 Sep;19(3):319–24.
  38. Gupta V, Ramani P. Histologic and immunohistochemical evaluation of mirror image biopsies in oral squamous cell carcinoma. J Oral Biol Craniofac Res. 2016 Sep;6(3):194–7.