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Hemoglobin Levels and the Associated Factors in the Patients Visiting A University Hospital in Chennai, India

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Abstract

Hemoglobin is a protein molecule present in the red blood cells that carries oxygen from the lungs to the body's tissues and returns carbon dioxide from the body tissues to the lungs. The normal Hemoglobin level for males is 13.5 - 17.5 -grams per deciliter and for females is 12.0 - 15.5 - grams per deciliter. However, Adult men and women have different haemoglobin levels, which are independent of iron status. Estimation of Hemoglobin levels is essential due to several reasons and this research is unique in the aspect of its importance in dentistry. This study aims at the assessment of Hemoglobin levels of patients, based on their gender visiting Saveetha dental college outpatient department. This is a comparative and descriptive study for which the data was obtained from reviewing the patient records. The data collection was from the Undergraduate,postgraduate clinics, Saveetha dental college, SIMATS. The data was collected and compiled followed by its statistical analysis by using the SPSS software by IBM. Out of the total sample size (1825 cases), various hemoglobin result values obtained were, 5-8 g/dl - 5.2%; 8-12 g/dl - 38.0%; 12-16 g/dl -52.3%; and 16-20 g/dl - 4.5%. Where 12-16 g/dl was considered as normal level Hemoglobin levels among males showed 65.0% under normal range; 27.12% anaemic ; 7.88% above normal level and Hemoglobin levels among females showed 35.54 % under normal range ; 64.33 % anaemic ; 0.13% above normal level. Chi square test between gender and Hemoglobin result values resulted in a P value < 0.05 statistically significant. Hemoglobin levels among the age group 1-31 years were 38.4%; 32-55 years were 45.2%; and above 55 years were 16.4%; Chi square tests between various age groups and Hemoglobin result values resulted in a P value < 0.05 statistically significant. Our study assessed the association of Hemoglobin levels of patients with various parameters such as age, gender and result values. The overall results show a Male predilection in hemoglobin levels and females having lesser hemoglobin levels than their normal range. The study also reveals that Anemia is strongly associated with females when compared to males and both males and females attain the peak in hemoglobin levels during their young and Middle Age and gradually come down during old age.

Key words: *Hemoglobin, anemia, gender, age, association, comparison.*

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Introduction

Hemoglobin is a protein molecule present in the red blood cells that carries oxygen from the lungs to the body's tissues and returns carbon dioxide from tissues to the lungs.[1] A Hemoglobin molecule consists of four globin chains, two alpha-globin chains and two beta-globin chains. Each globulin chain contains an important iron-containing porphyrin compound termed

heme. Hemoglobin is a metalloprotein.Embedded within the heme compound is an iron atom that is vital in transporting oxygen and carbon dioxide in our blood. The iron contained in hemoglobin is also responsible for the red color of blood.[2]

Hemoglobin also plays an important role in maintaining the shape of the red blood cells.[3]. In their natural shape,[4] red blood cells are round with narrow centers resembling a donut without a hole in the middle. Abnormal hemoglobin structure can, therefore, disrupt the shape of red blood cells and impede their function and flow through blood vessels. [5]

The normal range of Hemoglobin in males is 13.5 - 17.5 -grams per deciliter and females is 12.0 - 15.5 - grams per deciliter.[6] Fluctuation in hemoglobin levels, known as hemoglobin variability, is a well-documented phenomenon.[7] Low levels of hemoglobin and serum iron are suggestive of iron deficiency anemia. Anemia is a condition where the body suffers with lack of red blood cells or hemoglobin. Anemia affects about one-third of the global population. In India, the prevalence of anemia among adolescent girls was 56% and this amounts to an average 64 million girls Several factors have been found to affect hemoglobin variability, including drug-related issues, such as pharmacokinetic parameters, patient-related differences in demographic characteristics, and factors affecting clinical status, as well as clinical practice guidelines and treatment protocols [8].However, early detection and prompt diagnosis can lead to better prognosis and help in the implementation of successful clinical treatment.[9] A study by William G Murphy in 2015 revealed that Men and women have different mean haemoglobin levels in health in venous blood — women have mean levels approximately 12% lower than men.[10]. Adamu AL et al in 2017, in his study, revealed that Among women, the odds of anemia were higher among urban residents and those with higher socioeconomic status. Increasing age was associated with higher anemia prevalence in men. However, on gender comparison, a larger number of women were anemic when compared to men [11]. Research by Gautam S et al in 2019 also revealed an Overall percentage of about 41% of women aged 15–49 years were anemic. [12]

Anaemic disorders are often associated with orofacial signs and symptoms and have several oral manifestations[13] .The manifestations include conjunctiva and facial pallor, atrophic glossitis, angular stomatitis, dysphagia, magenta tongue, midfacial overgrowth, osteosclerosis, osteomyelitis and paraesthesia/anaesthesia of the mental nerve. [14].Orofacial petechiae, conjunctival haemorrhage, nose-bleeding, spontaneous and post-traumatic gingival haemorrhage and prolonged post-extraction bleeding are common orofacial manifestations[15] Dental management of patients of anaemia requires interdisciplinary care with the consultation of the treating dentist with haematologist.[16]Patients with abnormal hemoglobin conditions tend to experience orthopnea in dental chair along with dizziness, headache, red facial colouring and dyspnea; further, abnormal hemoglobin levels also influences wound healing to a great extent. [17]. Recording the required data serves as a precaution is in the interest of the patient and also a record for future uses..[18,19]. Hemoglobin levels are thus examined prior to procedures such as extraction or any suspicion of anemia in the patient. Estimation of Hemoglobin levels is thus an essential examination, as a dental practitioner, as Hemoglobin level has its own importance in dentistry.[20]

This study aims in assessment of Hemoglobin levels of patients along with various parameters such as age, gender and result values obtained and throws some limelight on the Hemoglobin levels analysis , as its knowledge is of importance for a dental surgeon.

Materials and Methods

Study Design and Setting

This Study was carried out in a university setting which consists of subjects of predominantly South Indian population. Approval for the study is by the ethical board of Saveetha University (applied). Number of people involved include 3 reviewers - A Guide, researcher and a reviewing expert.

Data Collection

This is a retrospective study in which the samples were considered from the time period of June 2019 to March 2020. Case sheets reviewed for the research includes All patients applicable for study and cross verification of the required samples were performed by a reviewing expert. Measures were taken to minimise the sampling bias. These are inclusion of only clear

and readily available data Followed by simple random sampling. Both Internal and external validation was also obtained to carry out the study. The required data for the study was obtained from reviewing about 86000 patient records to. The required data- i.e, the Hemoglobin levels of males and females who visited the out patient department were collected and entered in a methodical manner in an excel sheet for the tabulation of data and further statistical analysis. Data was validated by 1-2 external reviewers and all the non specific , unclear or incomplete data were excluded from the study.

Statistical Analysis

Statistical software used for analysis is the SPSS (statistical package for the social sciences) by IBM and the statistical tests used were Pearson's chi square tests[21], frequency tables along with bar graphs to analyse and compare the obtained results. The type of analysis performed was correlation and association. Independent variables include ethnicity, reasons for hemoglobin examination , age, gender and the dependent variables include Hemoglobin levels of males and females.

Results and Discussion

Results Summary

Out of the total sample size (1825 cases), distribution of males and females for hemoglobin examination revealed 57.0% males and 43.0% females **(Figure 1).** various hemoglobin result values obtained were, 5-8 g/dl - 5.2%; 8-12 g/dl - 38.0%; 12-16 g/dl -52.3%; and 16-20 g/dl - 4.5% (**Figure 2)**, Where 12-16 g/dl was considered as normal level Hemoglobin levels .Hemoglobin levels among the age group 1-31 years were 38.4%; 32-55 years were 45.2% and above 55 years were 16.4% **(Figure 3).** males showed 65.0% under normal range; 27.12% anaemic ; 7.88% above normal level and Hemoglobin levels among females showed 35.54 % under normal range ; 64.33 % anaemic ; 0.13% above normal level; Chi square test between gender and Hemoglobin result values resulted in P value < 0.05 statistically significant.**(Figure 4).**

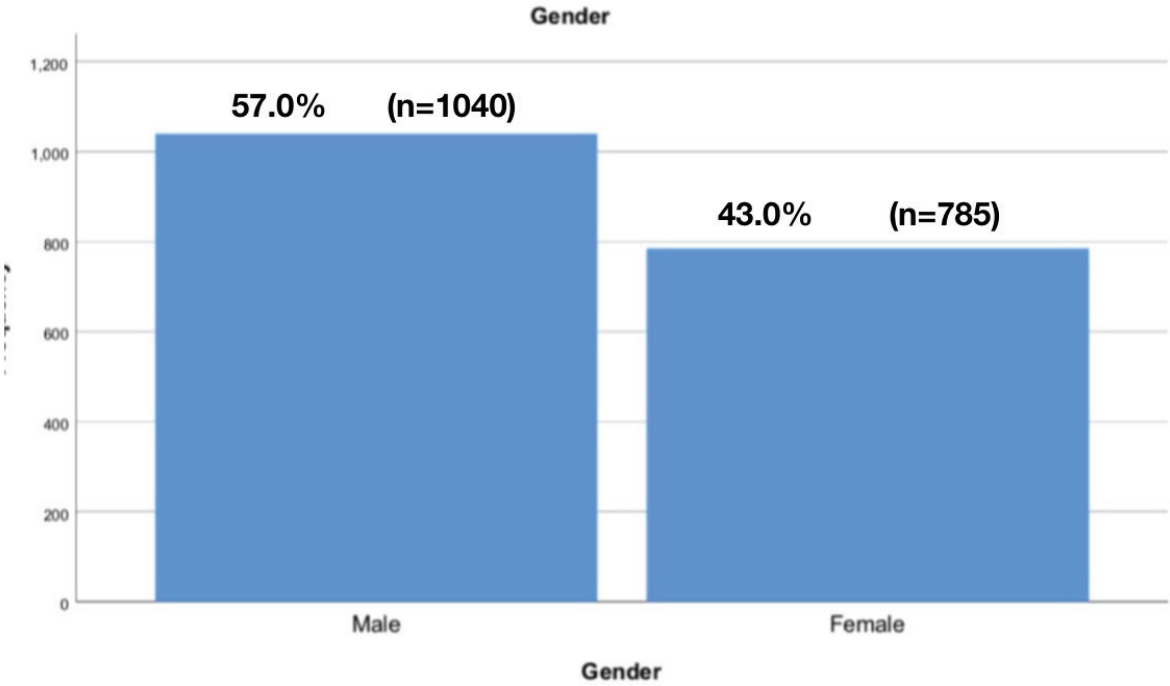

Figure 1 - Bar graph showing the distribution of males and females for hemoglobin examination. x axis represents gender and y axis represents the number of patients under each gender for hemoglobin examination on a scale of 1-100%. Males were found to be significant over the females.

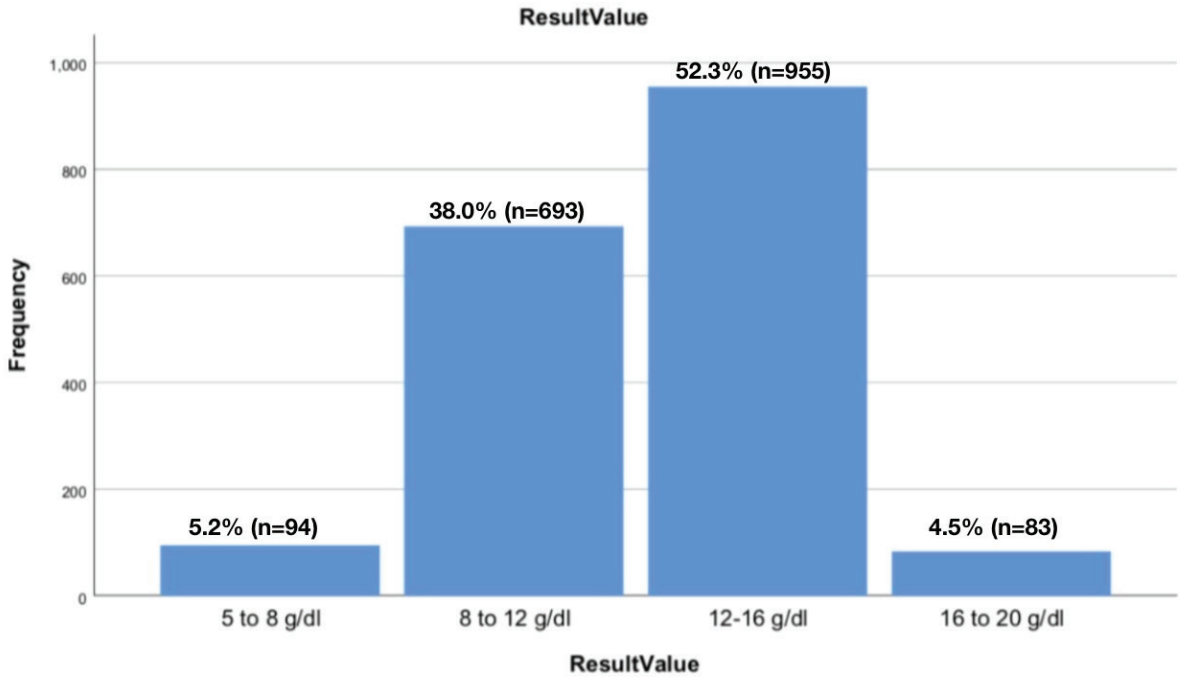

Figure 2- Bar graph showing the distribution of various result values for hemoglobin examination. x axis represents result values and y axis represents the number of patients under each category of result values for hemoglobin examination on a scale of 1-100%. 12-16g/dl range was found to be significant over others followed by 8-12g/dl, 5-8g/dl that and 16-20 g/dl which was the least prevalent.

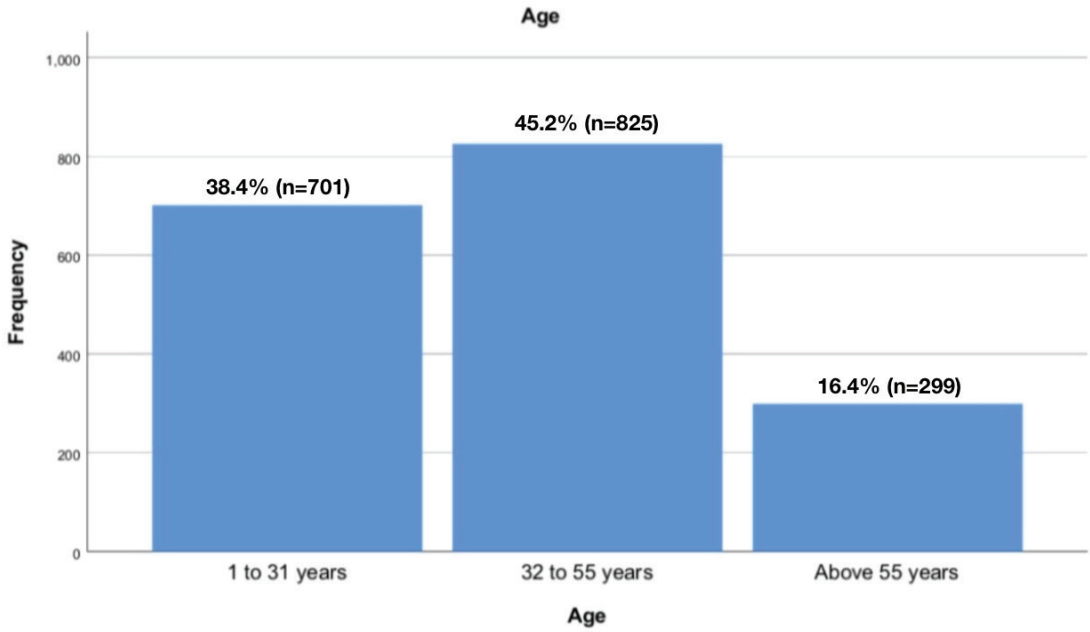

Figure 3- Bar graph showing the distribution of various age groups for hemoglobin examination. x axis represents age groups and y axis represents the number of patients under each age group for hemoglobin examination on a scale of 1-100%. 32-55 years age group was found to be significant over others followed by 1-31 years age group and above 55 years age group which was the least prevalent.

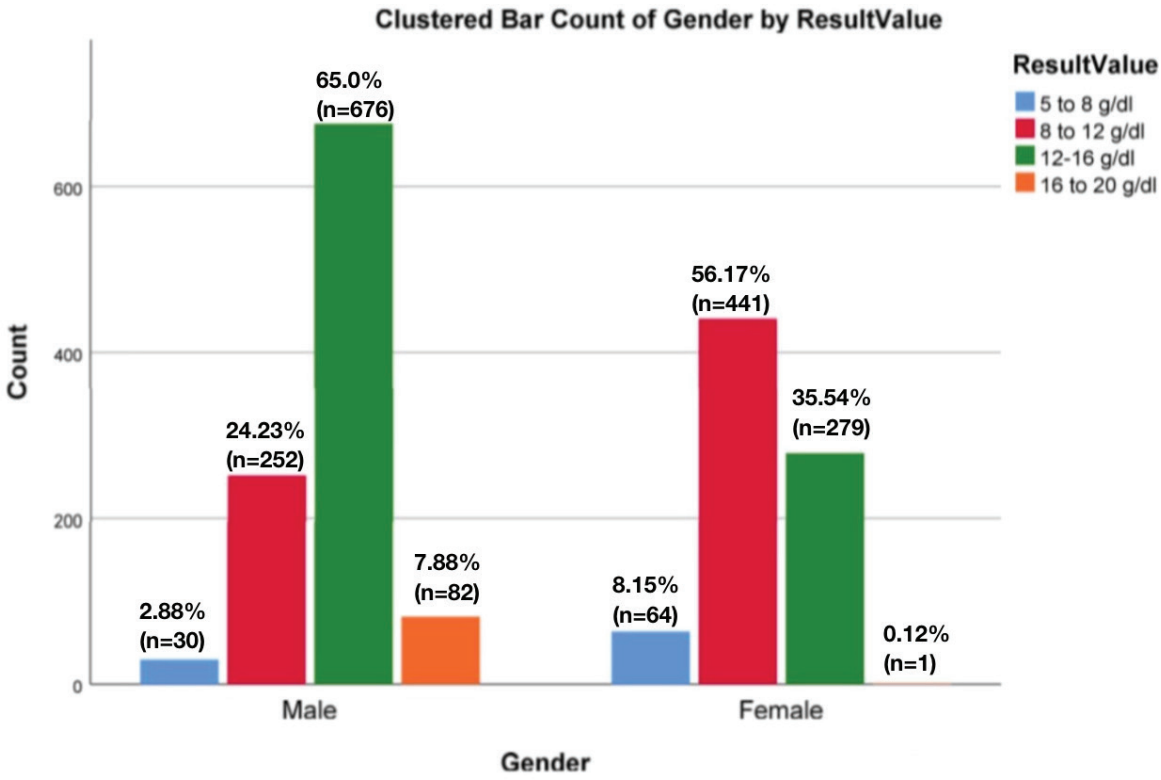

Figure 4- Clustered bar graph depicting the association of gender and hemoglobin result values on a scale of 1-100%. Blue colour depicts 5-8g/dl, red colour depicts 8-12 g/dl, green colour depicts 12-16g/dl and orange colour depicts 16-20 g/dl. The graph reveals that most of the males have their hemoglobin levels in the 12-16 g/dl range, whereas most of the females have their hemoglobin levels in the 8-12 g/dl range. Chi square test between gender and Hb result values reveals p value<0.05 (chi square value=277.719, df=3, p value=0.011) statistically significant. Thus, gender can be considered as a determinant parameter to correlate with the Hemoglobin levels.

Discussion

The need to transport oxygen and remove carbon dioxide from animal tissue is a fundamental requirement of life, independent of age or sex. The role of iron in humans and many other mammals is central to this process. Haemoglobin concentration and red blood cell count are important diagnostic indicators for anaemia in humans.[22] Not only anemia, they can also play a diagnostic tool in detection of certain severe disease conditions such as hodgkin's lymphoma, aplastic , iron deficiency anemia,Hypothyroidism or even oral squamous cell carcinoma [23],[18],[24] apart from other diagnostic tools such as saliva.[25]

Association of hemoglobin result values and gender revealed males- 65.0% under normal range; females - 35.54 % under normal range Chi square test - P VALUE < 0.05 statistically significant and the normal range was observed significantly among the males. A study by WT Kimberly et al in 2013, stated that Females have lesser Hemoglobin levels than their normal range when compared to males. The reason being the hormonal environment that is a possible cause for the observed sex difference in red blood cell count and haemoglobin and serum ferritin concentrations in human[26].Adding to this result, the study by William G Murphy et al in 2014 also stated that Hemoglobin levels has a Male predilection[10]. And this is prevalent in the modern women who have a different reproductive history from those in the past. They reach sexual maturity at an earlier age, have fewer pregnancies, and breast feed for shorter periods; as such they menstruate for more years than women in the past. Menstruation is the principal cause of iron loss in women [10] which is similar to our study finding and is in

concordance with the literature that also is compounded by the fact that females are the vulnerable gender for iron deficiency anemia owing to excessive blood loss during menstruation.

Association of hemoglobin result values and Age revealed 1-31 years - 38.4%; 32-55 years - 45.2%; above 55 years- 16.4%. Chi square test- P VALUE < 0.05 statistically significant. Maximum Hemoglobin levels were attained by the middle aged population. W.W Hawkins et al in 2001 revealed that Females, in their period of adolescence and middle age attain maximum Hemoglobin levels; whereas males, in their middle age and old age, attain The Maximum Hemoglobin levels. The reason for reduced hemoglobin levels in older age groups is because with increasing age , people tend to develop more systemic diseases and health problems and most of them affect the hemoglobin levels.[27] Another study by N Hanafusa et al in 2014 also supported our results by stating that Hemoglobin levels decreases with age, and that lesser Hemoglobin levels is prone among the elderly population, which is caused by a few diseases and conditions that cause your body to produce fewer red blood cells than normal [28] again similar to our study findings as well as the literature that states that hemoglobin count can be associated with a disease or condition that causes body to have lesser red blood cells,that can occurs if the body produces fewer red blood cells than usual, destroys red blood cells faster than they can be produced or have excessive blood loss.

Analysis of hemoglobin result values revealed 5-8 g/dl among 5.2%; 8-12 g/dl among 38.0%; 12-16 g/dl among 52.3%; 16-20 g/dl among 4.5%- predominant populations were within normal Hemoglobin levels. BJ Lee et al in 2016, in his study, revealed that anemic conditions are strongly associated with females, especially above 60 years of age or during the menopause period in females, the reason being iron deficiency anemia [29] . Study by Devi K et al revealed that adolescents are not much more prone to anemia as they have lesser disease conditions, healthier lifestyle with adequate nutritional status when compared to the aged population.[30] Our study findings, thus is in concordance with similar studies and also with the literature.

The overall implications and highlight of this study is the knowledge of hemoglobin levels and their importance in dentistry. The patients visiting dental clinics may have several disease or medical conditions and maybe on regular medications or without medications. Many of these systemic conditions have manifestations in the oral cavity, among which the altered hemoglobin levels is the common condition affecting various age groups, irrespective of males and females. The alterations in hemoglobin values, is thus significant in any dental practice and there is lesser knowledge regarding the relative frequencies of these alterations and its correlation with parameters such as age, gender and dental diseases associated among the south Indian population, which forms the major strength of this study.

However, there were a few Limitations encountered in this study. This study contained some data that were unclear of certain reporting parameters , such data were not considered.

Another limitation was the Geographic limitations i.e, assessment of predominantly South Indian population. Further, this study is Unicentered and the sample size collected for males and females were unequal.

The future prospects of this study is that the Knowledge and association of Hemoglobin levels with various parameters is essential for a dentist. The alterations in hemoglobin value is considered to be significant in any dental practice, and there is little information regarding the relative frequency of these alterations and its correlation with age, gender and the related dental manifestations. Further, The higher prevalence of anemia in women when compared to men suggests the need for substantial improvement in the nutritional status of women[31] The increased disease burden compared with the past studies highlights the needs to reconsider the existing nutritional policies.

Conclusion

Our study assessed the association of Hemoglobin levels of patients with various parameters such as age, gender and result values. The overall results show a male gender predominance in the and females having lesser hemoglobin levels than their normal range. The study also reveals that Anemia is strongly associated with females when compared to males and both males and females attain the peak in hemoglobin levels during

their young and Middle Age and gradually comes down during old age.

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Conflict of Interest: None declared.

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