

Study of Hematological Parameters in Patients of Different Subtypes of *Panduroga*

Shalini Rai¹, Madhukar Rai², Vineetha Gupta³, Vijai Tilak⁴, AC Kar⁵

¹Assistant Professor, Department of Roga Nidan Evum Vikriti Vigyan, All India Institute of Ayurveda, Gautampuri, Sarita Vihar, New Delhi, India.

²Head, Department of Medicine, Faculty of Medicine, Institute of Medical Sciences, BHU, Varanasi, Uttar Pradesh, India.

³Department of Paediatrics, Faculty of Medicine, Institute of Medical Sciences, BHU, Varanasi, Uttar Pradesh, India.

⁴Department of Pathology, Faculty of Medicine, Institute of Medical Sciences, BHU, Varanasi, Uttar Pradesh, India.

⁵Head, Department of Vikriti Vigyan, Faculty of Ayurveda, Institute of Medical Sciences, BHU, Varanasi, Uttar Pradesh, India.

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Abstract

Introduction: Diagnosis in Ayurveda depends on history and clinical examination of the patient. Application of technological advancements and diagnostics in Ayurveda may increase its acceptability globally and add objectivity to it. This research is advancement in the same direction to observe and analyze the haematological profile in patients of *Panduroga* (anemia) after categorizing them into *Pandu roga* subtypes and report the findings.

Material and Methods: A prospective non – interventional observational exploratory study was conducted for a period of 18 months on hundred newly diagnosed adult and pediatric cases of anemia presenting to department of pediatrics and general medicine. Patients were categorized into *Panduroga* subtypes after examining them in detail with history, physical examination, hematological and other relevant investigations and with their due written informed consent. The data was then put to statistical analysis.

Results: Differences were observed in the values of hematological parameters for the different subtypes of *Panduroga* which were statistically significant for Hemoglobin, Total Red blood cell count (TRBC), Hematocrit (HCT), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC) and Red cell distribution width (RDW).

Conclusion: The differences in the objective profile as uncovered in the study reveals that the subtypes of *Panduroga* correlate to some extent to the different stages and pathology of anemia. However, the application of this study to the management of different types of anemia will require further confirmatory study with larger sample size in each subgroup.

Keywords: Anemia, Haematological profile, *Panduroga*

Introduction

Application of the technological advancements to a science provides it with objectivity and increases its reproducibility and reliability. A number of technological advancements have been made in the field of science which has been adopted by the modern medicine to aid in the diagnosis and monitor management. Diagnostics in Ayurveda

depends on history and clinical examination of the patients which are subjective in nature. Application of modern technological advancements and diagnostics in Ayurveda will add objective criteria to Ayurveda and increase its global acceptance. This study is an attempt in the same direction to observe and explore for the objective profiles in patients of different subtypes of *Panduroga*.

Corresponding Author: Dr. Shalini Rai, Department of Roga Nidan Evum Vikriti Vigyan, All India Institute of Ayurveda, Gautampuri, Sarita Vihar, New Delhi, India.

E-mail Id: vd.raishalini@gmail.com

Orcid Id: <https://orcid.org/0000-0002-7851-7208>

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Panduroga is a disease characterized by the development of pallor as the cardinal feature. The ascribed clinical features and the management of *Panduroga* correlate closely to anemia. However, *Panduroga* has been sub typed into varieties with a different management principle of each. The application of those treatment principles requires the categorization of patients into sub types as per the clinical presentation i.e. *Vatika Pandu*, *Paittika Pandu*, *Kaphaja Pandu*, *Tridoshaja Pandu*, *Mrittikabhakshanajanya Pandu*. This study was planned to explore the relationship between the hematological profile of the patients of anemia categorized into the subtypes of *Pandu Roga* on the basis of clinical features.

Material and Methods

A prospective, non-interventional open ended observational exploratory study was conducted for a period of 18 months on total number of hundred adult and pediatric cases of anemia presenting to department of pediatrics and general medicine of the hospital.

The registered patients included only newly diagnosed cases of the deficiency anemia, the hemolytic anemia and anemia due to bone marrow failure of both gender and all age groups. The patients with anemia due to other diseases or inflammatory processes, therapeutic induced anemia, anemia of leukemia etc. were excluded from the study to avoid erroneous results because of mixing of the clinical picture of the associated ailments or conditions (since the categorization into *Panduroga* subtypes is based on clinical presentation). First of all, the cases of anemia were subjected to detailed clinical history and thorough physical examination followed by haematological and relevant laboratory investigations using standard methodology in the respective departments. The patients who were found to be associated with other diseases (as depicted by history or investigations) were excluded from the study. The patients who were found only to be suffering from anemia were included for further study and categorized into *Panduroga* subtype on the basis of clinical presentation and their hematological profile was studied. The observations were then put in a master chart and tested statistically using software SPSS version 16.

The study protocol was approved by the institutional Ethics Committee and the study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Due written informed consent was taken from each patient included in the study.

Recording of Data related to Clinical Features of *Panduroga* Subtypes

For the categorization of patients into *Panduroga* subtype the clinical features as described in the classical Ayurveda texts were used. Since no previous such kind of study was available and this was the first kind of a study it was assumed that all the clinical features carry equal weightage

and the presence of every feature of *Panduroga* subtype was given score 1 and absence as 0, and the total number of features present for a particular subtype were summed up to find the total cumulative score for each. Then this score was treated as quantitative data and put to statistical tests.

Criteria for Categorization of *Panduroga* Subtype

Since no such kind of previous study was available, the classically described description of *Ulbanata* (dominance) was used to develop the criteria for categorization of *Panduroga* subtype on the basis of the percentage of the cumulative scores of clinical features of each *Panduroga* subtype as described below:

- Features of only one subtype of *Pandu Roga* present - was designated as that particular subtype.
- Cases where features of two subtypes of *Pandu Roga* coexisted the one with predominance (amounting to 60 % or more out of total features present) was taken as the *Pandu Roga* subtype.
- Cases where features of all the three *Doshas* were present and ranged between 30-39% each, was graded as *Tridoshaja Pandu*.
- Cases with features of three *Doshas* present, but any one *Dosha* amounted to 40% or more of the total features present, that particular *Dosha* predominance was considered for designating the subtype of *Pandu*.
- The history of eating Mud or materials contaminated by it was considered a must for designating *Mrittika Bhakshanajanya Panduroga*.

Hypothesis of the Study

Null hypothesis was taken for the study stating that patients of different *Panduroga* subtypes exhibit no difference in their hematological profile.

Statistical Analysis

The analysis of data was done using statistical software SPSS version 16.0 (Chicago, Illinois, U.S.A.). *Panduroga* subtype as identified by the above methodology was then assessed for the correlation between the hematological profile of the patients. p value less than 0.05 has been considered significant.

Recording of Observations

The cases of anemia were assembled according to the main cause identified in them into five main groups as:

- Group 1 - Haemolytic Anemias (HA)
- Group 2 - Dual Deficiency Anemia [DDA (Iron and vit B₁₂ / Folic acid deficiency)]
- Group 3 – Megaloblastic Anemia [MA (B₁₂ and/or Folic acid deficiency)]
- Group 4 - Iron Deficiency Anemia (IDA)
- Group 5 - Anemias due to Bone Marrow Failure (ABMF)

The various observations have been mentioned in these 5 groups mainly.

Results

Amongst the 100 patients of anemia registered in the study 32 patients were of hemolytic anemia [HA (4 adults and 28 children)]; 8 cases were of anemia due to deficiency of iron coupled with deficiency of Vitamin B12 or folic acid [Dual deficiency anemia (DDA)], 21 patients of megaloblastic anemia (MA); 27 patients of iron deficiency anemia (IDA) and 12 cases of anemia due to bone marrow failure (ABMF).

Observations on the Demographic Profile of the Patients Registered for Anemia

The maximum frequency of age suffering from anemia was observed in the age group of 20-30 years (24), followed by 10-20 years (18). It was observed in the study that out of the 100 cases registered, 54 were males and 46 females. Amongst them majority of females were in group 4 [Iron Deficiency Anemia (21 out of 27)] and group 2 [Dual Deficiency Anemia (8 out of 8)]. In the group 1 (Thalassemia) cases especially in children, majority of cases registered were males. Amongst the 100 cases registered 55 patients were married and 45 unmarried. Amongst the cases registered, 92 cases were Hindus; while only 8 were Muslims.

Majority of the patients belonged to middle class (60), with 3 belonging to lower socio economic status (measured by Kuppuswamy Scale) and 37 cases in lower middle group. An analysis of hygienic status revealed fair hygienic status was found present in the maximum number of cases (59), good hygienic status in 26 cases and poor hygienic status in 15 cases.

Occupation wise, the maximum number of cases of Pandu Roga registered in the study were found to be student (39), followed by housewives (25), farmers (11), workers (10) and office working people (8). The data presented here is for 93 individuals only as 7 children included in the HA group remained at home only due to various reasons.

Observations on Some Important Components from the History in the Registered Patients of Anemia

Amongst the 46 female cases registered in the study, 2 were small girls and in the remaining 44 cases - 25 were having normal menstruation, followed by 8 having menorrhagia and 1 case with no menarche inspite of age, 2 cases had oligomenorrhia and 8 had menopause.

The obstetric history revealed that amongst 33 married women registered in the study, 18 were multiparous with 2 or more children, 6 were uniparous and 9 had not conceived. Amongst the multiparous women maximum were in group 4 (IDA) followed by group 2 (DDA).

An interrogation into stool habits in the patients, revealed that majority of the patients had normal stool habits (47), while 25 patients suffered from constipation mostly. Yellowish stools were found in 10 patients out of which maximum were in the hemolytic anemia group (9). Majority

of the patients were found to have normal micturition (69), followed by 28 patients having yellow urine – amongst which the maximum was in hemolytic anemia group. Cola coloured urine was found in one patient of hemolytic anemia group and burning micturition found in two patients of group 5 (ABMF).

Sleep was found to be normal in the majority of patients (74), decreased in 9 and increased in 17. Majority of the patients (55) were found having no addiction, 20 were found addicted to tea, 9 to tobacco, 7 to alcohol and 5 to gutka. Some of the patients were found addicted to multiple things mentioned in the above table as tea, pan and alcohol or pan and gutka or alcohol and ganja etc. simultaneously.

TRBC: Total red blood cell count, MCV: mean corpuscular volume, MCH: mean corpuscular haemoglobin, MCHC: mean corpuscular haemoglobin concentration, RDW: red cell distribution width, TLC: total leukocyte count, TPC: total platelet count.

Observations on the Predominance of *Doshika Pandu Roga Lakshanas* in the Groups of Anemia

On observing the *Doshika Pandu Roga* features present in the patients of various types of anemia, a specific pattern was visualized. It was observed that *Paittika Pandu* features were observed predominantly in haemolytic anemia while *Vatika Pandu* features were found more in iron deficiency anemia as well as in megaloblastic anemia patients. Megaloblastic anemia patients showed the presence of more *Kaphaja Pandu Lakshanas* than any other group. The patients of anemia due to marrow failure again showed the predominance of *Paittika Pandu* features. The features of *Paittika Pandu Roga* were found in all the patients of the above stated groups constantly, while some of the patients showed zero score for the features of *Vatika* and *Kaphaja Pandu Roga*. However, mostly the features of all the three *Doshas* were found present in majority of the patients.

The Cumulative Scores of *Doshika Pandu Roga Lakshanas* in the Groups of Anemia

The comparison of the cumulative scores of the different *Pandu Roga Lakshanas* present in the five groups of anemias using one-way ANOVA reveals that *Vatika Pandu Lakshana* mean cumulative score value in all the groups is higher as compared to haemolytic anemia group mean cumulative score and statistically this finding is highly significant. The greatest cumulative score mean value for *Vatika Pandu* features (5.6667) was found in IDA patients' group. *Paittika Pandu Lakshana* mean cumulative score value in hemolytic anemia group is greatest (5.9375) and statistically highly significant when compared to mean values found in MA and IDA (lowest mean value 3.8148). *Kaphaja Pandu Lakshana* mean cumulative score value in MA (maximum - 4.4762) and IDA group is statistically highly significant as compared to HA group mean cumulative score (lowest, 1.343). *Kaphaja Pandu Lakshana* mean

cumulative score for MA group is also highly significant as compared to IDA group mean value. The categorization of *Tridoshaja Pandu* as subtype was established only in two patients hence statistical values cannot be computed for them. The maximum number of *Mrittika Bhakshanajanya Pandu* features was found in IDA group. All of these values were found to be statistically highly significant at the level of $p < 0.001$ (Table 1).

Observations on Hematological Profile

The mean value of haemoglobin (Hb) in HA group was 6.82 gm/dl, 4.75 gm/dl in DDA, 5.49 gm/dl in MA, 6.05 gm/dl in IDA and 4.00 gm/dl in ABMF group. The mean value of total Red blood cell count (TRBC - $10^6/\text{mm}^3$) was 2.96 in HA group

2.69 in IDA group, 1.86 in DDA, 1.49 in MA and the least 1.15 in ABMF. The maximum mean value for haematocrit (HCT) was observed in IDA group (20.63%), followed by HA (19.18%), MA (16.72%), DDA (16.25%) and minimum mean value was observed in ABMF group (12.95%).

The maximum mean value for mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), red cell distribution width (RDW) was observed in MA group (111.95fl, 37.86pg, 34.66%, 19.30% respectively) followed by intermediate values in other groups and minimum mean value was in group IDA for MCV, MCH and MCHC, (67.93fl, 21.39pg, 29.51%) while lowest RDW value was observed in ABMF (16.74%).

Table 1. The cumulative score means of *Panduroga* subtypes in the groups of anemia

Variables	Cumulative score of Panduroga subtype							
	Vatika Pandu		Paittika Pandu		Kaphaja Pandu		Mrittikabhakshanaj Pandu	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Group 1 (HA) (n=32)	0.81	1.40	5.93	1.89	1.34	.78	0	0.0
Group 2 (DDA) (n=8)	4.00	2.00	5.12	1.55	3.25	1.48	0.12	.35
Group 3 (MA) (n=21)	5.33	1.85	4.04	2.35	4.47	2.24	0.04	.21
Group 4 (IDA) (n=27)	5.66	2.18	3.81	2.32	3.07	1.29	0.42	.94
Group 5 (ABMF) (n=12)	4.58	2.53	5.25	1.48	3.75	1.76	0.08	.28
p value	p < 0.001		p < 0.001		p < 0.001		p < 0.05	
Significant pairs by post – Hoc test	2-1, 3-1, 4-1, 5-1		1- 4, 1-3		2-1, 3-1, 3-4 4-1, 5-1		2-1, 3-1, 3-4 4-1, 5-1	

HA: Haemolytic anemias, DDA: Dual Deficiency Anemia (Iron and vit B₁₂/ Folic acid deficiency), MA: Megaloblastic anemia (B₁₂ and Folic acid deficiency), IDA: Iron Deficiency Anemia, ABMF: Anemias due to bone marrow failure.

Table 2. Co-efficient of correlation and significance value of haematological parameters in relation to the *Doshika Pandu Lakshanas*

Variables	Vatika Pandu Lakshanas	Paittika Pandu Lakshanas	Kaphaja Pandu Lakshanas
Haemoglobin n =100	r = - 0.109 p = 0.278 (p > 0.05)	r = - 0.216 p = 0.031 (p < 0.05)	r = - 0.264 p = 0.008 (p < 0.01)
Haematocrit n =100	r = 0.065 p = 0.520 (p > 0.05)	r = - 0.249 p = 0.013 (p < 0.05)	r = - 0.216 p = 0.031 (p < 0.05)
TRBC n =100	r = - 0.061 p = 0.545 (p > 0.05)	r = - 0.188 p = 0.061 (p > 0.05)	r = - 0.314 p = 0.001 (p < 0.001)
MCV n =100	r = 0.164 p = 0.102 (p > 0.05)	r = - 0.082 p = 0.418 (p > 0.05)	r = 0.401 p = 0.000 (p < 0.001)
MCH n =100	r = 0.091 p = 0.366 (p > 0.05)	r = - 0.050 p = 0.623 (p > 0.05)	r = 0.260 p = 0.009 (p < 0.001)
MCHC n =100	r = - 0.074 p = 0.464 (p > 0.05)	r = - 0.040 p = 0.689 (p > 0.05)	r = 0.041 p = 0.687 (p > 0.05)
RDW n =100	r = 0.096 p = 0.342 (p > 0.05)	r = 0.002 p = 0.982 (p > 0.05)	r = 0.352 p = 0.000 (p < 0.001)
TLC n =100	r = - 0.294 p = 0.003 (p > 0.05)	r = 0.018 p = 0.862 (p > 0.05)	r = - 0.333 p = 0.001 (p < 0.001)
TPC n =100	r = - 0.161 p = 0.110 (p > 0.05)	r = 0.043 p = 0.674 (p > 0.05)	r = - 0.353 p = 0.000 (p < 0.001)

The maximum mean value for the total leukocyte count (TLC) was observed in HA group (8690.31/mm³) and minimum value in ABMF group (2716.72/mm³). The maximum mean value of platelet count was 261560.70 platelets/mm³ observed in IDA group and 43567.33 platelets/mm³ in ABMF group which was minimum. Reticulocyte count was performed in 56 patients and was found to have the highest mean value in HA group (8.13) and lowest mean value of 0.73 in ABMF group.

Correlation between the Subtype of *Panduroga* (*Pandu Roga Lakshana Cumulative Score Values*) and the Various Objective Criteria's

An analysis was made to interpret the relation between the cumulative scores of *Vatika*, *Paittika* and *Kaphaja Pandu Roga Lakshanas* with the various objective criteria examined in the patients to test for any statistical correlation existing between them using bivariate correlation.

On analyzing the table data, it was observed that the data for the RBC indices showed statistically highly significant correlation with the *Kaphaja Pandu Roga Lakshanas for Hb.*, HCT and TRBC in an inverse way and direct correlation with MCV, MCH and RDW. Statistically significant inverse correlation was also observed between TLC and TPC and *Kaphaja Pandu Roga Lakshanas*.

Discussion

Discussion on the Demographic Profile of the Patients Registered for Anemia

Anemia is a disease affecting people of all ages and similar findings were observed in the study, yet there was a preponderance of the age group of 20-30 years, followed by 10-20 years and 3-10 years. This age pattern noticed in the study indicates the increased prevalence of anemia in the above stated age groups i.e. children and young adults. This also indicates the reasons which may be negligence about the hygiene and thus worm infestation, increased physiological demands of growth, pregnancy and lactation and poor nutrition.

More male cases were found in the study, though anemia globally affects females more. The maximum numbers of female cases were found in the IDA and DDA group, which shows the poor nutritional status of these females. Again, the number of male cases found in the MA group is a fascinating finding which account to 66%. Majority of the cases in the HA group were males. This was found so, because this group also included the Thalassemia major pediatric cases, in which the majority of cases registered, were males (25 cases out of 32). This could reflect the gender biased mentality of the population in the study area - of giving more preference to the male child - for such a continuous and relatively costly regime of monthly blood transfusion.

All the anemia groups had a greater percentage of married people except HA group [which was due to more number

of children present in that group (25 out of 32)]. This observation can be taken as significant if inferred in terms of incidence, rather than association as a cause. Again, it is significant finding related in terms of females due to pregnancy and lactation. Religion can have a role in the incidence of anemias, especially the deficiency anemias in female patients due to poor hygiene, poor nourishment status, repeated pregnancies, poor medical support etc. which is still found relatively more in the Muslims. However, the patients of Hindu religion were 92% while Muslims were only 8%. The area where the study was carried out is having the same religion statistics in population also, so the significance vanishes. The middle-class socio-economic status group was highest with 60% and lower middle 37%. This could be so because the predominant population of the study coming to BHU consisted of people of middle and lower middle class mainly. In accordance with the above data of socio-economic status, the data on hygiene too demonstrates similar finding of satisfactory hygienic status in maximum individuals - due to the increased awareness among such people about hygiene now a days.

Majority of the patients were students [which was due to more number of children present in HA group who were mostly school going (21 out of 32)], followed by housewives (more in the IDA and DDA group), farmers (more in the IDA and MA group) and office going individuals and workers (more in MA group). The above data gets support from the known etiopathology of the IDA, yet the relatively more incidence of MA in the office going people and workers could not be related to any specific cause in the history.

It is interesting to note here that majority of multiparous and menorrhagic women were found in the IDA and DDA groups. This is in correlation with the greater prevalence of the deficiency anemias in the females more due to reasons stated above. Stool habit and micturition were found to be normal in most of the individuals, but fascinatingly yellowish coloured urine and stool were found to be present in the individuals of HA group due to the increased bilirubin turnover in these patients. Ayurveda relates this development of *Peeta* (yellow) colour in the body to *Pitta Dosh*a. Constipation was a feature found mainly in the various deficiency anemia, which in Ayurveda is understood as *Kshaya* leading to *Vata Vridhi*.

Though, statistically significant data was obtained for sleep pattern; greater part of the subjects had normal sleep pattern in all the groups. Increased sleep was found mainly in the IDA group, while decreased sleep in MA group; but the exact cause for such a distribution cannot be understood.

Tea addiction was chiefly found in the IDA group and alcohol in MA group, otherwise largely the people showed no addiction. Tea is known to have an interfering effect with the absorption of iron, while folate absorption is affected by alcohol.

19% patients had lying decubitus, which is quite parallel to the data of severe anemia (18%) and could be the cause for it, as severely anemic patients (haemoglobin less than 6 gm%) are dyspnoeic even on the slightest of exertion and thus are most comfortable lying down. Rests of the patients were having normal decubitus, while 13% were more comfortable in sitting posture.

The Doshika Pandu Roga Features in the Individual Group of Anemia

Predominance and occurrence of *Paittika Pandu* features in the patients of HA and in MA group respectively account to increased bilirubin turnover due to increased haemolysis.¹ Features like *Peeta* (yellowish discoloration of the skin), *Peeta Netra* (yellowish eyes/bulbar conjunctiva), *Peeta Anana* (yellowish face), *Peeta Mutra* (yellow urine), *Peeta Shakrit* (yellow stools), *Bhinna Varcha* (loose stools) etc. manifest because of it. Hyperdynamic circulation in thalassemia patients is the cause behind presentations as *Jvara/Mandoshmata* (fever/raised body temperature), *Swedanah* (profuse sweating), *Sheeta Kama* (longing for cold) and *Ushna Anupashaya* (dislike for hot).³

A study conducted on thalassemia in Jodhpur has stated that there is *vata - pitta* predominance in thalassemias, correlating it to *Halimaka*, which seems to contradict this study.⁴ But, a consideration of other facts reported in the study reveal that the cases included in that study were not able to afford the regular chelation therapy and were thus maintained by transfusions while the children included in this study were taking regular folic acid, chelation therapy and transfusions as advised. Hence the features of iron overload and folic acid deficiency were not visualized in these patients. In case of development of these features the overall *Doshika* presentation in these patients would have changed.

The *Paittika Pandu* features may be coupled with other *Doshika Panduroga* features in the patients according to their pathological condition as a patient of intravascular haemolysis presents with cola coloured urine¹ (*Krishnamutra*, which is the feature of *Vatika Pandu*) when the plasma haemoglobin exceeds the haptoglobin binding capacity.² Similarly if folic acid deficiency develops in a patient with haemolytic anemia, then features as tremors, hyperpigmentation, constipation etc. develop which bear resemblance to *Vatika Pandu* features and will again change the *Doshika* presentation of the case.

An observation of higher proportion of *Vatika Pandu* features in the patients of the iron deficiency anemia as well as in megaloblastic anemia may be explained by the principle of Ayurveda which states that loss or deficiency of any nutrient or body tissues results in aggravation of *Vata*.⁷ *Rukshanga* (ununctuousness/dryness of skin), *Krishna Mala* (blackish stools/melena), *Varcha Shosha* (dryness of stools/constipation), *Angamarda* (body ache), *Ruja* (pain), *Shiroruja* (headache) and *Balakshaya* (weakness) were

found mainly in the patients of IDA group; *Asya Vairasya* (distaste of mouth), *Krishna Nakha* (blackish nails), *Bhrama* (giddiness) and *Kampa* (tremors) were found mainly in MA group; and *Anaha* (abdominal distension due to retention of flatus and stool) found equally in the both the groups.

This presentation of deficiency anemias as described above may also change according to the status of the aetiological factor or the pathology of the deficiency state; and in that case other *Doshika Pandu* features may also appear in the patient. This can be understood with the example of a megaloblastic anemia patient having haemolysis who will present with the features of *Paittika Pandu* simultaneously along with *Vataja* ones.

The comparison of the cumulative score mean values for the overall scoring of *Pandu Roga* subtype in the groups of anemia using one-way ANOVA revealed highly significant statistical values for the inter group differences in the *Vatika Pandu Lakshanas*, *Paittika Pandu Lakshanas* and *Kaphaja Pandu Lakshanas* in the different groups.

Hematological Profile

The relative mean high hemoglobin value in the HA group was due to the fact that it chiefly had thalassemic children for whom it is necessary to maintain haemoglobin value above 8 hence the mean value was greater.⁸ In ABMF group as the bone marrow was affected, the RBC production was reduced along with other parameters and hence the least value was observed. The maximum mean value of TRBC and haematocrit value in the IDA group was because of the fact that though it resembles hypoplastic anemia in the early stages, later it causes hyperplasia of the bone marrow.⁹ The stage of hypoplasia in IDA is lesser as compared to that found in ABMF group (which had the lowest values). These findings were totally in accordance with the pathology of the megaloblastic anemia and iron deficiency anemia. The RDW was found to be the greatest in the MA group and the DDA group due to the variation in the size of the RBCs and the lowest in the ABMF group, as the RBCs are mostly normocytic in this case.

The TLC value was found to be the greatest in the HA group as it mostly included thalassemic children who have a physiologically higher range of white blood cells. ABMF group had the lowest count due to the decreased production of the WBCs from the failed marrow. The eosinophil percentage was found to be highest in the group of IDA probably due to worm infestation present in them as a cause for iron deficiency anemia.¹⁰ The platelet count was found the greatest in the IDA group and the reason for which could be some form of bleeding present in them as due to haematochezia or worm infestation etc., while the lowest count found in ABMF due to bone marrow getting affected and all cell lines getting depressed.

The hemolytic anemias have a high reticulocyte count due to increased marrow erythroid production as well as

the premature release of reticulocytes from the marrow into the circulation, while the same is decreased in the hypoplastic anemias due to any cause found in the ABMF group.¹¹

Correlation of Objective Criteria and *Doshika Pandu Roga* Subtype

Haemoglobin showed negative or inverse correlation with the *Doshika Pandu Lakshana* scores meaning that as the *Doshika Pandu Lakshana* increased the haemoglobin value was found to be decreased. However, this association was found to be statistically significant only in *Kaphaja* and *Paittika Pandu* type. *Kaphaj Pandu Roga Lakshana* scores (KPRLS) showed statistically significant inverse correlation with TRBC and haematocrit and direct correlation with MCV, MCH and RDW. This data reflects that as KPRLS increased in the patients the TRBC count was found to decrease but the RBCs were found to have raised MCV, MCH and RDW. This reflects macrocytic RBCs with normochromasia and an increase in variability of size of RBCs being formed (causing an increased RDW). The decreased haematocrit value reflects that in spite of the increase in the MCV the overall effect of the decreased TRBC's is more pronounced. However, still no conclusive inference can be drawn as the red blood cell indices are average values and a study of general blood picture would add more conclusive evidences.

Statistically highly significant inverse correlation was observed between *Kaphaja Pandu Roga Lakshana* scores with TLC as well as with Platelet count. However, since these parameters are also affected by a number of factors besides anemia. Hence, their correlation turns insignificant.

Conclusion

The different subtypes of *Panduroga* show statistically significant differences for the values of hematological parameters so the null hypothesis taken for the study (that there is no difference in the hematological parameters of the different *Panduroga* subtype) is rejected.

The results of this study reflect that Ayurvedic scientists had developed the idea of the different pathologies of pallor development and equated it to the effect of *Doshas*. Hence, a possibility arises that the different *Pandu Roga* treatment options as per the *Doshika* regime may be applied scientifically for the treatment of anemias as reflected in the study.

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Conflict of Interest: None

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