

**“A comparative study of *Raktasaratva* with special reference to blood indices”.****Sandip Keval Birari,**Assistant Professor, KVTR Ayurved College, *Boradi* (Dhule), Maharashtra.**Author Correspondence:** Mob. 9960735623, Email – sandipbirari@gmail.com**ABSTRACT****Background and objectives-**

In today's evidenced based medicine and growing popularity of *Ayurveda* globally, the need is felt to provide modern parameter for everything we study. *Dosha*, *Dhatu* and *Mala* are no exception to this. Hence, this study was undertaken to know relationship between Blood Indices and *Raktasaratva* (i.e. *Pravar*, *Madhyam* and *Avar*).

Material and Methods –

60 healthy subjects were selected randomly according to inclusive and exclusive criteria. Selected subjects were categorized into three groups viz.: *Pravar*, *Madhyam* and *Avar* *Raktasaratva* on the basis of proforma prepared from *granthokta* features. From obtained values of Hb, PCV, RBC count; the blood indices were computed and compared.

Results –

Statistical analysis of the data obtained revealed that –MCV, MCH, CI do not differ significantly but MCHC differ significantly according to *Raktasaratva*.

Conclusion - MCHC is a relevant factor in the assessment of *Raktasaratva*.

Keywords: Blood Indices, *Dhatu*, MCHC, *Raktasaratva*.

INTRODUCTION

Ayurveda, recognized as new age medicine now, represents the science of life and longevity originating in the Vedic tradition of India. A traditional holistic health care system, older than any other system of medicine, *Ayurveda* has been practiced in India for more than 5000 years. Based on the principle of eternal life, this medical system has a vast body of knowledge covering eight branches¹. Its major premise involves the symbiosis of mind, body and spirit. Any imbalance in this synthesis results in physical ailments. This ancient Indian science of healing seeks to reestablish the harmony between the body and its habitat by creating the optimum health environment.

The health is the supreme foundation for achievements of life². Therefore, the *Ayurveda* aims to get rid of diseased condition i. e. to cure a sick person, to prevent disease and to keep a healthy person in healthy condition³. *Dosha*, *Dhatu* and

Mala are root cause of *sharira* which are responsible for health and disease⁴. So before going to treat the patient, it is very important to study *prakrut avastha of Dosha, Dhatu* and *Mala* with *Sharir – Kriya Vidhyan* i. e. Physiology which deals with normal functions of the body. Among the fundamental constituents of *sharira dhatu*s are of more importance as they form the pillars of body; which are means of nourishment (structural framework) and growth (nutritional pool) while providing support to mind (*manas*) and body both .

*Dhatu*s have same set of functions in every individual; but quality and richness of these functions may vary from person to person which is decided by *sarata* of individual *dhatu*. The supreme quality of *dhatu* and superb functional aspect is *Sara*⁵. It is purest or genuine form of *dhatu*⁶.

Research based knowledge is key to success in this scientific word. If we want globalization of *Ayurveda*, we must prove our principles in the language of modern science by means of logical and systematized methods. Because, only classical references can not be sufficient to establish any theory.

According to *Ayurveda Rakta-sara* individual is one in which *Rakta dhatu* is of supreme quality and the Blood indices (MCV, MCH, MCHC, C.I) are modern parameters that describes the size and Oxygen carrying protein (i.e. Haemoglobin) content of an erythrocyte.

Therefore, present study, “**A comparative study of *Raktasaratva* with special reference blood indices**”, was under taken to study the relationship between Blood

indices (MCV, MCH, MCHC, CI) and *Raktasaratva* (*Pravar, Madhya* and *Avar*).

Need and Rationale of study

In today’s scientific modern era due to globalization of *Ayurveda*, we have to provide modern parameter for everything we study. Therefore, present study entitled “**A comparative study of *Raktasaratva* with special reference blood indices**”, was undertaken to study relationship between Blood Indices and *Raktasaratva* (i.e. *Pravar, Madhyam* and *Avar*).

As described earlier the supreme quality of *dhatu* and superb functional aspect is *sara*. The healthy people have an adequate number of correctly sized RBCs containing enough Hemoglobin to carry sufficient oxygen to all the body tissues. Therefore, Blood indices that describes size and Hb content of RBC were taken as parameter for comparison.

AIM AND OBJECTIVES

Aim and Objective of the present study are:

1. To study *Sharir Kriyatmak* aspect of *Rakta dhatu*.
2. To study concept of *Raktasaratva*.
3. To study relation between *Raktasaratva* (*Pravar, Madhyam & Avar*) and Blood Indices (i.e. MCV, MCH, MCHC, CI)
4. To find out some objective parameter for the determination of *Rakta-Saratva*.

MATERIALS AND METHODS –

Plan of Study –

The present work has been planned in the following steps.

Selection of subjects according to inclusive and exclusive criteria.

Categorization of selected subjects into three groups – *Pravar, Madhyam* and *Avar Rakta-*

Saratva on the basis of proforma prepared from granthokta features.

Estimation of Haemoglobin, RBC count and packed cell volume in the subjects of all the three groups and calculation of Blood indices (MCV, MCH, MCHC, CI) from above estimated values.

Comparison of Blood Indices in between the three groups.

5) Discussion about observations and results obtained.

6) After reviewing various texts and observations from the experiments conclusion drawn.

Selection of Subjects –

Inclusive criteria :-

Sixty healthy individuals of either sex having age limit 20 to 50 years were selected randomly for the study.

Exclusive criteria :-

Individuals below age 20 years and above 50 years, Known cases of Hematological disorders, Haemoglobinopathies, Bone marrow diseases, Chronic renal disease, COPD, Active bleeding and any other major illness were excluded from the study.

Assessment of rakta-saratva -

According to proforma prepared from granthokta features detailed history and examination of every subject was carried out in order to assess their *Rakta-saratva*.

Examination of Physical Features :-

These can be directly examined by *darshan* and *sparshan pariksha* i.e. by *Pratyaksha pariksha*. Here total ten sites (body parts) were examined which include *Karna* (Ear pinna), *Akshi* (Conjunctiva), *Mukha* (Oral cavity), *Jivha* (Tongue), *Nasa*

(Nose), *Oshtha* (Lips), *Pani-tala* (Palm), *Pada-tala* (Sole) and *Lalat* (Forehead). These sites were examined for three features – *Snigdha*, *Rakta varna* and *Srimad bhrajishnuta*. For presence of each feature the respective site had been given 1 score. Thus each site was given score out of 3.

The total score observed for physical features was calculated and its percentage (A) was determined. Genitals (*Medhra*) was excluded from the examination.

Examination of Physio-Psychological features :-

These features of *Rakta-Sarata* e.g. *Sukha*, *Uddhata medha*, etc. were assessed by *Prashna parikshya* (Asking some relevant questions to this) and then *Yukti* and *Anuman pramana* i.e. inductive and deductive reasoning. After assessment the individual feature had been given score as 3 for *pravar*, 2 for *madhyam* and 1 for *avar* swarup. Thus each feature was given score out of 3. The total score for Physio-psychological percentage was calculated and its percentage (B) was determined.

Categorization of Subjects -

The mean of the score of Physical and Physio - Psychological features (i.e. $\frac{A+B}{2}$) Was calculated and the subjects were grouped as given below :

Table no. 1- Categorization of Subjects:

<i>Rakta saratva</i>	Mean Score (%)
<i>Pravar</i>	More than 65
<i>Madhyam</i>	35 to 65
<i>Avar</i>	less than 35

Experimental study-

- A) Collection of blood sample -
About 3-5 ml of blood obtained by
vene puncture method was collected
in EDTA bulb.
- B) Colorimetric Estimation of
Hemoglobin. (*Cyanmethaemoglobin*
method)^{7,7a}

- C) Estimation of Packed Cell Volume.⁸
D) Estimation of Red Blood Cell
Count.⁹
E) Calculation of blood indices¹⁰

$$1) \text{ Mean Corpuscular Volume -} \\ \text{MCV} = \frac{\text{PCV}(\%) \times 10}{\text{RBC Count (million/mm}^3\text{)}}$$

$$2) \text{ Mean Corpuscular Hemoglobin -} \\ \text{MCH} = \frac{\text{Hb(gm/dl)} \times 10}{\text{RBC Count (million/mm}^3\text{)}}$$

$$3) \text{ Mean Corpuscular Hemoglobin Conc. -} \\ \text{MCHC} = \frac{\text{Hb(gm/dl)} \times 100}{\text{PCV}(\%)}$$

$$4) \text{ Color Index - CI} = \frac{\text{Hb}(\%)}{\text{RBC}(\%)}$$

Where; $\text{Hb}(\%) = \frac{\text{Hb content in the individual} \times 100}{\text{Normal Hb content (15gm/dl)}}$

and $\text{RBC}(\%) = \frac{\text{Hb content in the individual} \times 100}{\text{Normal RBC count (5 millions/cu.mm)}}$

OBSERVATIONS AND RESULTS

In present work 60 individuals were selected and examined for *Raktasaratva* on the basis of granthokta features. Then they were divided into three groups - *Pravar*, *Madhyam* & *Avar Raktasaratva*. Whole observations and the results of present study were summarized as given below.

Table no. 2- *Raktasaratva*-wise Composition of Sample

Sr. No.	<i>Raktasaratva</i>	Frequency	Percentage
1	<i>Pravar</i>	13	21.67
2	<i>Madhyam</i>	32	53.33
3	<i>Avar</i>	15	25
Total		60	100

Table no.- 3 MCV – wise distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva*.

Sr. No.	MCV (fl)	<i>Pravar Raktasaratva</i>		<i>Madhyam Raktasaratva</i>		<i>Avar Raktasaratva</i>	
		Freq.	%	Freq.	%	Freq.	%
1	<77	5	38.46	10	31.25	5	33.33
2	77-93	8	61.54	18	56.25	8	53.33
3	>93	0	0	4	12.50	2	13.33
Total		13	100	32	100	15	100

Table no. 4- MCH – wise distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva*.

Sr. No.	MCH (pg)	<i>Pravar Raktasaratva</i>		<i>Madhyam Raktasaratva</i>		<i>Avar Raktasaratva</i>	
		Freq.	%	Freq.	%	Freq.	%
1	<27	8	61.54	19	59.37	11	73.33
2	27-32	5	38.46	12	37.50	4	26.67
3	>32	0	0	1	3.13	0	0
Total		13	100	32	100	15	100

Table no. 5 -MCHC – wise distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva*.

Sr. No.	MCHC (%)	<i>Pravar Raktasaratva</i>		<i>Madhyam Raktasaratva</i>		<i>Avar Raktasaratva</i>	
		Freq.	%	Freq.	%	Freq.	%
1	<30	0	0	9	28.12	8	53.33
2	30-35	10	76.92	20	62.50	7	46.67
3	>35	3	23.08	3	9.37	0	0
Total		13	100	32	100	15	100

Table no. 6 -C.I. – wise distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva*.

Sr. No.	C.I.	<i>Pravar Raktasaratva</i>		<i>Madhyam Raktasaratva</i>		<i>Avar Raktasaratva</i>	
		Freq.	%	Freq.	%	Freq.	%
1	<0.8	1	7.69	7	21.87	7	46.67
2	0.8-1.2	11	92.31	25	78.13	8	53.33
3	>1.2	0	0	0	0	0	0
Total		13	100	32	100	15	100

STATISTICAL ANALYSIS

For statistical analysis one – way analysis of variance (ANOVA) Test was applied.

Table no. 7 -Statistical comparison of MCV in between *Pravar, Madhyam & Avar Raktasaratva*.

Parameter	<i>Pravar Raktasaratva</i>	<i>Madhyam Raktasaratva</i>	<i>Avar Raktasaratva</i>
Mean	78.72	83.11	80.31
S.D.	6.29	9.54	9.81

Table no. 8 -Analysis of Variance (ANOVA)

Source of variation	df	Sum of squares	Mean sum of squares	F Ratio
Between the Classes	2	204.91	102.46	1.26
Within the Classes	57	4647.70	81.54	
Total	59	4852.60	-	-

Computed F-value is less than the table value at 5% level of significance ($p > 0.05$). Therefore null hypothesis of no difference is accepted. MCV according to *Raktasaratva* do not differ significantly.

Table no. 9 -Statistical comparison of MCH in between *Pravar, Madhyam & Avar Raktasaratva*.

Parameter	<i>Pravar Raktasaratva</i>	<i>Madhyam Raktasaratva</i>	<i>Avar Raktasaratva</i>
Mean	26.37	26.32	24.45
S.D.	2.37	3.06	3.64

Table no. 10 -Analysis of Variance (ANOVA)

Source of variation	df	Sum of squares	Mean sum of squares	F Ratio
Between the Classes	2	40.07	20.04	2.10
Within the Classes	57	543.39	9.53	
Total	59	583.47	-	-

Computed F-value is less than the table value at 5% level of significance

($p > 0.05$). MCH according to *Raktasaratva* do not differ significantly.

Table no. 11 -Statistical comparison of MCHC in between *Pravar*, *Madhyam* & *Avar Raktasaratva*.

Parameter	<i>Pravar Raktasaratva</i>	<i>Madhyam Raktasaratva</i>	<i>Avar Raktasaratva</i>
Mean	33.52	31.75	30.43
S.D.	1.81	2.38	2.43

Table no. -12 Analysis of Variance (ANOVA)

Source of variation	df	Sum of squares	Mean sum of squares	F Ratio
Between the Classes	2	66.55	33.28	6.36
Within the Classes	57	298.00	5.23	
Total	59	364.55	-	-

Computed F-value is greater than the table value at 5% level of significance ($p < 0.05$). Hence null hypothesis of no difference is rejected. MCHC differs significantly according to *Raktasaratva*.

From above analysis it is clear that the three groups showed significant difference. To find out where the actual difference is, **Tukey's multiple Comparison test** was applied.

Table no. 13 - Statistical comparison of MCHC in between pair of groups by Tukey's Multiple Comparison Test.

Comprision	q value	p value	Significance
Pravar vs Madhyam	3.32	$P > 0.05$	Non significant
Pravar vs Avar	5.04	$P < 0.01$	More significant
Madhyam vs Avar	2.61	$P > 0.05$	Non significant

When MCHC was compared between *Pravar*, and *Madhyam Raktasara* group, the difference was non significant ($p > 0.05$).

MCHC was more significant ($P < 0.01$) whereas when MCHC was compared between *Madhyam* and *Avar Raktasara*; the difference was again non significant.

The difference between *Pravar* and *Avar Raktasara* groups with respect to

Table no. -14 Statistical comparison of CI in between *Pravar*, *Madhyam* & *Avar Raktasaratva*.

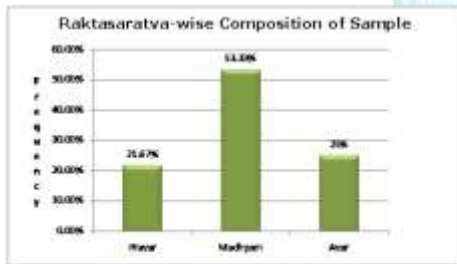
Parameter	<i>Pravar Raktasaratva</i>	<i>Madhyam Raktasaratva</i>	<i>Avar Raktasaratva</i>
Mean	0.88	0.88	0.81
S.D.	0.08	0.1	0.12

Table no. 15 -Analysis of Variance (ANOVA)

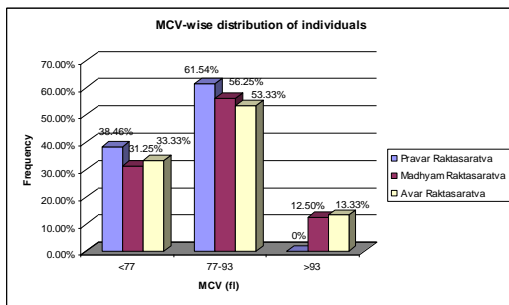
Source of variation	Df	Sum of squares	Mean sum of squares	F Ratio
Between the Classes	2	0.04	0.02	2.0
Within the Classes	57	0.60	0.01	
Total	59	0.64	-	-

Computed F-value is less than the table value at 5% level of significance ($p > 0.05$). CI according to *Raktasaratva* do not differ significantly

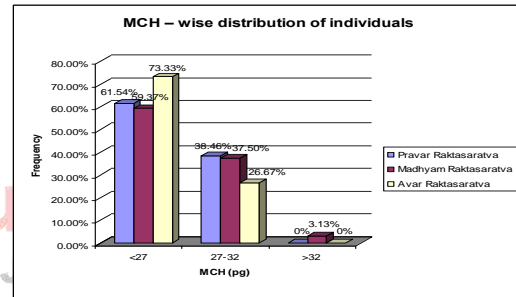
Graph no. 1



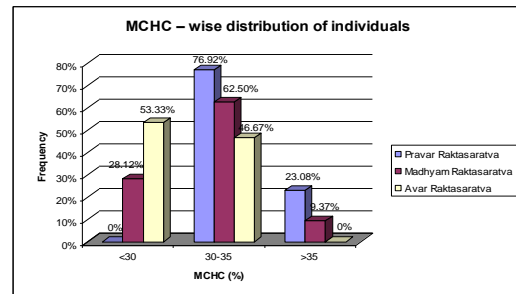
Graph no.2



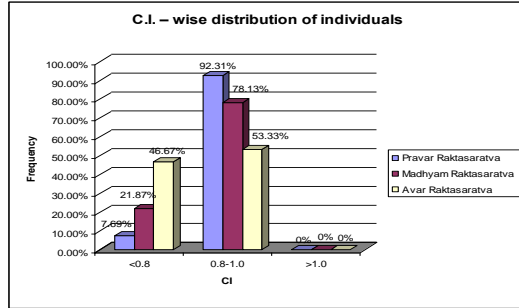
Graph no. 3



Graph no. 4



Graph no. 5



Rakta Dhatu and its modern co-relation :-

After detailed literature review various similarities between *Rakta dhatu* and Erythrocyte can be understood . From which they can be co-related in various aspects such as properties, origin, time of formation, different stages of formation and functions.

DISCUSSION

Table no.16 - Rakta Dhatu and its modern co-relation

Sr. No.	Similarity	Rakta Dhatu	Erythrocyte
1.	<i>Varna</i>	Like colour of red hot gold, indragopa insect, gunja. ^{11 & 12}	Scarlet red colour is due to oxyhaemoglobin
2.	<i>Utpatti Sthana</i>	I) <i>Yakrit</i> ^{13 & 14} II) <i>Pliha</i> ^{13 & 14} II) <i>Amashaya</i> ¹⁵ IV) <i>Sarakta medas</i> ¹⁶	I) Liver-Main organ of erythropoiesis during early and last 3 months of intra uterine life. II) Spleen – During some bone disorders RBCs produced in spleen and it also serves as reservoir of blood. III) Intrinsic factor of castle produced by gastric mucosa is essential for erythropoiesis. IV) In post natal life and adults, RBCs are produced in red bone marrow.
3.	Time & stages of formation	I) 7 days (<i>Harit 15/10</i>) II) During these seven days there are many changes occur in colour of Rakta dhatu.	I) It takes 7 days for development of mature erythrocyte from pro-erythroblast stage. II) Different colour changes indicates stages of erythropoiesis

From above observations we can correlate Rakta dhatu with erythrocytes (RBCs).

Reliability of MCHC among the Blood indices :-

MCHC is the most reliable and useful parameter for the following reasons:

- 1) It does not take RBC count into consideration for its calculation; MCV, MCH, CI on other hand depends on RBC

count which is very variable (RBC count is calculated in millions / cu.mm.)

- II) MCHC tells us actual Hb concentration in red cell only & not in whole blood.

Distribution of individuals according to *Raktasaratva* revealed that in the sample maximum 53.33% subjects were belonging to *Madhyam Raktasara* group followed by 25% & 21.67% from *Avar* and *Pravara*

Raktasara groups. This indicates higher incidence *Madhyam Raktasata* in the population as compared to *Pravar and Avar Raktasarata*.

Distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva* according to MCV showed that in *Pravar Raktasara* group, maximum 61.54% subjects were having normocytic (i.e MCV within normal range) RBCs, while *Madhyam Raktasara* group 56.25% subjects were having normocytic RBCs. In *Avar Raktasara* group 53.33% were having normocytic RBCs.

Distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva* according to MCH showed that in *Pravar Raktasara* group 38.46% subjects were having MCH within the normal range 27-32 pg where as in *Madhyam and Avar Raktasara* groups 37.50% & 26.67% subjects were having MCH within the normal range 27-32 pg, respectively.

Distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva* according to MCHC showed that in *Pravar Raktasara* group maximum 76.92 % subjects were having normochromic RBCs (i.e. MCHC within normal range) followed by 62.50% and 46.67% subjects in *Madhyam and Avar Raktasara* groups respectively.

Distribution of individuals of *Pravar, Madhyam and Avar Raktasaratva* according to CI showed that in *Pravar Raktasara* group maximum 92.31% subjects were having CI within normal range 0.8-1.2 and in *Madhyam Raktasara* group 78.13% subjects were having normal CI and in *Avar Raktasara* group 53.33% subjects were having CI in normal range.

CONCLUSION

On the completion of work, the achievements have to be narrated. These can be placed under the umbrella of the

conclusion or the *nishkarsha*. Thus, any research work is to be completed by giving a final word or conclusion, which reflects the work accomplished. The conclusions based on proper discussion leads us to asses and evaluate the whole work done in a short time.

Based on the statistical analysis it is clear that – comparison between *Pravar, Madhyam and Avar Raktasaratva* with respect to MCHC shows significant difference, however more variation of MCHC is found in *Pravar and Avar Raktasaratva*.

Comparison between *Pravar, Madhyam and Avar Raktasaratva* with respect to other blood indices (MCV/MCH/CI) shows non-significant difference.

The conclusion drawn by this study is ‘MCHC’ is a relevant factor in the assessment of *Raktasaratva*; especially in differentiation between *Pravar and Avar Raktasaratva*. We believe that the further study with a large sample can develop MCHC as a parameter in the assessment of *Raktasaratva*.

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