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PANCHBHAUTIC CONSTITUTION OF *RAKTA DHATU* WITH RESPECT TO AGE- AN ANALYTICAL STUDY

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ABSTRACT

Ayurveda the ancient science of life is based upon certain principles like *Panchmahabhoot* theory which states that every *bhav padarth* in the universe and hence *Rakta Dhatu* in human body is also composed from *Panchmahabhootas*. The aim of this study was to examine changes in the *panchbhautik* composition of *Rakta Dhatu* in different age groups and establish bio physical, biochemical and microscopic parameters for the evaluation of *Panchbhautik* composition of *Rakta Dhatu*. Five bio-physical ,one Bio-chemical and two microscopic parameters were selected which were correlated to the bio-physical and bio-chemical properties of *Rakta Dhatu*. The observations in this study were done by the examination of blood samples of 63 persons each 21 in *Bal* (Children), *Tarun* (Adult /Middle Aged), *Vriddha* (Old Aged) of which 7 of *Vata* , 7*Pitta* and 7*Kapha Prakriti* respectively. Every blood sample was evaluated for Sp. gravity, Surface tension, Optical density, Evaporation Rate, ESR, Hb%, RBC count, TLC.

The study reveals that Sp. Gravity and ESR can be considered as parameters for *Prithvi* and *Akash mahabhoot* in blood. Optical Density and Hb% can be considered as parameters for *Tej mahabhoot*.

Keywords ESR, Evaporation Rate, Hb%, Optical density, *Panchmahabhoot, Rakta Dhatu,* , RBC count, Specific gravity, Surface tension, TLC

INTRODUCTION: Ayurveda is study of life science. Science is based upon certain basic principles. *Panchabhautic* Principle is one of the basic principles of Ayurveda. *Panchmahabhoot* theory states that everything in the universe is made up of five elements i.e. *Prithvi,Aap, Tej,Vayu,Akashmahabhoot*.[1] Each *mahabhoot* is having certain characteristics and accordingly plays a vital role in the formation of every substance.[2]The characteristics of the substances that are living or non-living depend upon the composition by these *Mahabhootas*. *Tridoshas* are composed of these *Panch Mahabhootas*. It has been mentioned that the predominance of these *Doshas* differ according to age. *Kapha* is dominant in the *Balyaavastha*, *Pitta* is dominant in *Tarunavastha* and in *Vriddhaavastha Vatdosha* is dominant, which are again composed of *Panchmahabhootas*[3]. Hence the validity of the parameters can be established with the investigations in different age group people.

Ayurveda describes the characteristics of drugs according to their *Gunas* and *Panchbhautic* composition.

Characteristics of the *Panchmahabhootas*:

1.*Aakash*- Present in hollow cavities within body and empty areas of cosmos. It characterises non-resistant to anything, frictionless or smooth, subtle, soft, abundant. Its functions are creating porosity, softness, and lightness. [2]

2.*Vayu*- Light, dry, subtle, mobile, transparent & rough are the properties of

Air. It is responsible for movement, dryness and creating lightness. [2]

3.*Tej*- It is hot, sharp, intense, dry & light. Fire emits light and heat. It is responsible for digestion, transformation of energies. It is also responsible for the generation and perception of colours. [2]

4.*Jal*– Water is moist, cohesive or sticky, cool, soft and oily (unctuous). It is responsible for creating bonds, moistness, softness, heaviness and satiety. [2]

5.*Prithvi*- It is solid, dense, stable, heavy, hard, dull and slow. It is responsible for heaviness, stability, concreteness, growth. [2]

Panchbhautik composition of *Rakta Dhatu* has been clearly stated in *Sushrut Samhita* [4][5]. Following are the representative characteristics of *Panchmahabhootas* that are seen in the *Rakta dhatu* stated in *Sushrut Samhita*.[4][5]

Visrata that is the specific unctuous odour of *Rakta Dhatu* is because of the presence of *Prithvi Mahabhoot*, *Dravata* the flowing characteristic of *Rakta Dhatu* is because of the presence of *Aap Mahabhoot*, *Raga* ,the colouring (red colour) property of *Rakta Dhatu* is because of the presence of *Tej Mahabhoot*, *Spandan* that is pulsation of *Rakta Dhatu* in *Nadi* is because of the presence of *Vayu Mahabhoot* and *Laghuta* that is property of *Rakta Dhatu* to reach to the *Strotas* or microcellular level is because of *Aakash Mahabhoot.*

Dhatus are the building structures of body and a sample of *Dhatu* can be derived for examination of the *Panchmahabhootas* if certain parameters in the sample can be examined. As *Rakta dhatu* possesses the *panchbhautik* properties and can be easily derived for bio physical, biochemical and microscopic examinations *Rakta Dhatu* was finalised to be studied for quantitative examination of *Panchmahabhootas.* Yet the *Panchmahabhootas* represent the bio physical and bio chemical parameters,

Laghuguna of *Akash Mahabhoot* and *guru guna* of *Prithvi Mahabhoot* can be assessed by estimating Sp.gravity which is defined as weight of a substance compared with an equal volume of water. *Snehbandhan* the specific function of *Aap mahabhoot* can be assessed by obtaining Surface Tension (S.T) which is defined as the special strain that the surface layer of liquid experiences as a sequence of unbalanced forces in the liquid. *Vishad* the specific *guna* which causes cleanliness is also mentioned as *guna* of Agni and *Prithvi Mahabhoot*. Here it must be considered that the *Vishadata* of *Agni Mahabhoot* works with *Ushna guna* heat or increased temperature where as *Vishadata* of *Vayu Mahabhoot* works by drying the water content which can be assessed by estimation of Evaporation Rate (Ev. Rate) where temperature is kept constant at 27^0C. *Varnprakashan* the specific function of *Tej Mahabhoot* can be assessed by estimation of Haemoglobin (Hb%), RBC count and also by deriving Optical Density (O.D) by means of Spectrophotometry. When light falls on any object the object absorbs some specific wavelengths (absorbance) and transmits remaining part (transmittance) of the wavelength of light which is electromagnetic radiation.[7] The transmittance is devoid of the absorbed wavelengths what is seen as the colour of the object. *Murtata*, *Sthirata* and *Upchaykar* functions of *Prithvi Mahabhoot* can be assessed by counting no. of cells in the Blood i.e. RBC count and Total Leucocyte Count (TLC). Here RBC count is considered as no. of cells only .Erythrocyte Sedimentation Rate

Sr.No.	Bio-physical Parameters	Mahabhoot to be analysed
1	Sp.gravity	*Prithvi & Akash*
2	Surface Tension	*Aap*
3	Evaporation rate	*Vayu*
4	Spectrophotometry	*Tej*
5	ESR	*Prithvi, Vayu,Akash*
	Bio-chemical Parameters	**Mahabhoot to be analysed**
6	Hb % Estimation	*Tej*
	MicroscopicParameters	**Mahabhoot to be analysed**
7	Erythrocyte count	*Tej,Prithvi*
8	TLC(Total Leucocyte count)	*Prithvi*

(ESR) of Blood which is Rate of sedimentation of Red blood cells which is again dependent on the Sp. gravity of blood as well as plasma which is dependent on *laghuguna* of *Vayu* and *Akash Mahabhoot* as well as *guru guna* of *Prithvi Mahabhoot*

Table No. 1 : Bio-Physical , Bio-chemical and Microscopic Parameters for the quantitative analysis of *Panchmahabhootas*.

Null hypothesis-

There is no difference in the results of 8 parameters of blood samples in every group i.e.*bala-Tarun, Tarun-Vriddha and Bala-Vriddha.*

AIM OF THE STUDY:

1.To examine changes in the *panchbhautik* composition of *rakta dhatu* in different age groups stated by Ayurveda viz. *Balya*(childhood), *Tarunya* (Adults) and *Vriddha* (Old aged) healthy persons.

2.To establish bio physical, biochemical and microscopic parameters for the evaluation of *Panchbhautik* composition of *Rakta Dhatu*.

MATERIALS AND METHODS:

The study was conducted in the Anand Ayurved College,Vaijapur. The bio physical biochemical and microscopic examinations were carried out in the pathology laboratory of Anand Ayurved College, Vaijapur. Considering the variables, age and *Prakriti*, the study was conducted in 3 different age groups according to the type of their dominant *ekdoshaj Prakriti.*

The age limits has been stated differently in different Samhitas. Also the span of every *Avastha* is huge. For our study we have restricted all age groups in a span of five years for availability of samples.3 age groups were decided for the study as *Bal*-7 to 12 age, *Tarun*- 22 to 27 and *Vriddha* - 62-67 respectively.[11]Among each age group persons were examined to derive their state of health and Prakriti.7 healthy persons who had *ekdoshaj Prakriti* were selected in every group. Total sample size of 63 persons was divided into 3 age groups and 3 *Prakritis* respectively.

Materials –

1. Instruments and chemicals for the laboratorial tests.[6,7,8,9]
2. *Swasthya Parikshan Patra*k As per MUHS guidelines.[10]
3. *PrakritiParikshanPatrak.*:As per MUHS guidelines.[10].

Inclusion criteria:

1. They must be physically and psychologically healthy according to Ayurveda. According to *Swasthya* and *Prakriti* parikshan patrak.[10]
2. They must be either in *Balya* (7-12),*Tarun*(22-27) or *Vruddha*(62-67) age group. The age limits has been set differently in different Samhitas.[11] Also the span of every *Avastha* is huge. In *Balyaavstha* the *dhatus* are in building stage. In boys pubertal changes occur at around 12 years of age. Hence these changes may cause changes in the composition of *Rakta Dhatu* especially HB%(haemoglobin conc.)[13]. Hence to avoid these variables this group was limited with a limit of 5 years from 7 to 12. To maintain equity in each group they were limited to 5 years span.
3. Only male persons were examined.
4. Those who are having *ekdoshaj prakriti.*

Exclusion criteria:

1.Persons who are not healthy either physically or psychologically were excluded.
2. Persons not in the age group of 7-12,22-27 and 62-67 were excluded
3. Female persons were excluded. As the Females in the age groups selected for this study e.g. in 7 to 12 are in pubertal age, to exclude the variables of different hormones in these different age groups this study excluded female persons. Estrogens, like aldosterone and some other adrenocortical hormones, cause sodium and water retention by the kidney tubules. During pregnancy, the tremendous formation of estrogens by the placenta may contribute to body fluid retention. [12]
4. Those are having *Dwandwaj prakriti* or *tridoshaj prakriti* were excluded. Results of means of the parameters discussed with respect to *age* and *prakriti*

Results:

1.*Bal*(children) group:

Table no.2: Average of parameters in *Bal* group

Prakriti	Hb%	TLC	RBC	ESR	S.T.	Eva.Rate	O.D.	SP.Gr.
KAPHA	13.95	7.8	5.36	5.71	79.99	58.29	0.4035	1.0612
PITTA	13.35	8.14	5.57	5.28	79.70	73.71	0.3708	1.0595
VATA	11.4	7.24	5.04	6	79.43	71.43	0.3426	1.0563

2.*Tarun* (Adults)group:

Table no.3: Average of parameters in *Tarun* group

Prakriti	Hb%	TLC	RBC	ESR	S.T.	Eva.Rate	O.D.	SP.Gr.
KAPHA	12.57	7.61	5.43	8	79.2467	78.14	0.3488	1.0555
PITTA	12.21	6.73	4.7	7.57	78.2737	75.14	0.3724	1.0561
VATA	10.95	6	4.78	10.57	78.653	66.14	0.3468	1.0513

3.*Vriddha* (Old age)group

Table no.4: Average of parameters in *Vriddha* group

Prakriti	Hb%	TLC	RBC	ESR	S.T.	Eva.Rate	O.D.	SP.Gr.
KAPHA	10.87	5.25	4.42	13	71	43.14	0.2953	1.035
PITTA	11.24	5.68	4.2	14.71	73.95	40	0.3159	1.038
VATA	9.92	6.02	4.10	17.57	64.21	39.29	0.2677	1.038

Data Analysis:

The observations in this study was done by the examination of blood samples of 63

persons each 21 in *Bal* (Children), *Tarun* (Adult /Middle Aged), *Vriddha* (Old Aged) of which 7 of *Vat* ,7 *Pitta* and 7 *Kapha Prakriti* respectively. Every blood sample was evaluated for Sp. gravity, Surface tension, Optical density, Evaporation Rate, ESR, Hb%, RBC count, TLC. Means, standard deviation (S.D.) and standard error (S.E.) of the values of the above said examinations in each age group has been derived.

As the samples are from different age groups, Unpaired t test has been applied. We have obtained degree of freedom (df) of 40.With df 40, we have derived P value in the t-table with level of significance at 5%.

Table No. 5:*t values of the results in parameters of blood in different age groups and significance*

Parameters /Groups of comparison	***Bala/Tarun***	***Tarun/Vriddha***	***Vriddha/bala***
Sp.gravity	3.37	2.58	3.677
Significance	**significant**	**significant**	**significant**
Surface Tension	9.88	0.22	9.91
Significance	**significant**	**insignificant**	**significant**
Evaporation Rate	0.859	7.52	8.35
Significance	**insignificant**	**significant**	**significant**
ESR	4.19	4.16	6.64
Significance	**significant**	**significant**	**significant**
Optical Density	1.025	3.93	6.08
Significance	**significant**	**significant**	**significant**
Hb%	**2.67**	**3.64**	**6.49**
Significance	**significant**	**significant**	**significant**
RBC Count	1.875	4.05	6.04
Significance	**significant**	**significant**	**significant**
TLC	2.59	3.74	16.41
Significance	**significant**	**significant**	**significant**

P-value for df=40 at the 5% is 1.96. Hence if t-value observed in the comparison of groups is more than 1.96, the difference observed in the parameters of compared group is significant)

DISCUSSION:

As we have postulated more than one parameter for every *Mahabhoot* and there is correlation in the percentage or proportion of *Mahabhootas* according to Ayurveda, the parameters could be finalised for every *Mahabhoot.*

Table no.6: Parameters experimented for each *Mahabhoot*

Sr. No.	Mahabhoot	Parameters
1	*Prithvi*	Sp.gravity ,Esr ,TLC ,RBC count
2	*Aap*	Surface Tension
3	*Tej*	Optical Density,Hb%, RBC count
4	*Vayu*	Evaporation rate, Sp. Gravity ,ESR
5	*Akash*	Sp.gravity ,ESR

1.*Prithvi Mahabhoot:*

Table no.7: Correlation of Sp. Gravity & ESR among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1.	*Bal* Sp.gr.&*Bal* ESR	0.04	No correlation
2.	*Tarun*Sp.gr.&*Tarun* ESR	-0.22	Weakly negative correlation
3.	*Vriddha*Sp.gr.&*Vriddha* ESR	-0.27	Weakly negative correlation

Table no.8: Correlation among TLC & RBC count

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalTLC&BalRBC count	0.12	Weakly positive correlation
2	TarunTLC.&TarunRBC count	0.43	Intermediate positive correlation
3	VriddhaTLC&VriddhaRBC count	-0.3	Weakly negative correlation

Table no.9: Correlation of Sp.gravity&TLC among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalSp.gravity&BalTLC	0.3	Weakly positive correlation
2	TarunSp.gravity&Tarun TLC	0.1	Weakly positive correlation
3	VriddhaSp.gravity&VriddhaTLC	0.02	No correlation

Table no.10: Correlation of Sp. gravity& RBC count among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalSp. gravity &BalRBC count	0.5	Intermediate positive correlation
2	Tarun Sp. gravity.&TarunRBC count	0.10	Weakly positive correlation
3	VriddhaSp. gravity &VriddhaRBC count	0.1	Weakly positive correlation

Table no.11: Correlation of TLC& ESR among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalTLC&BalESR	-0..1	Weakly negative correlation
2	TarunTLC.&Tarun ESR	-0.3	Weakly negative correlation
3	VriddhaTLC&VriddhaESR	-0.2	Weakly negative correlation

2.AapMahabhoot:

Table no.12: Correlation among Surface Tension (S.T.)

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	Bal S.T. &Bal S.T.	0.3	Weakly positive correlation
2	Tarun S.T.&TarunS.T.	0.13	Weakly positive correlation
3	Vriddha S.T. &Vriddha S.T.	-0.2	Weakly negative correlation

3. TejMahabhoot:

Table no.13: Correlation of O.D.&Hb% among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	Bal O.D. &BalHb%	0.6	Intermediate positive correlation

2	Tarun O.D. &TarunHb%	0.33	Weakly positive correlation
3	Vriddha O.D. &VriddhaHb%	0.7	Strongly positive correlation

Table no.14: Correlation of Hb% & RBC count among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalHb%&BalRBC count	0.3	Weakly positive correlation
2	TarunHb% .&TarunRBC count	0.2	Weakly positive correlation
3	VriddhaHb% VriddhaRBC count	0.6	Intermediate positive correlation

Table no.15: Correlation of O.D.& RBC count among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	Bal O.D.&BalRBC count	0.3	Weakly positive correlation
2	Tarun O.D.&TarunRBC count	-0.1	Weakly negative correlation
3	Vriddha O.D. &VriddhaRBC count	0.4	Intermediate positive correlation

4. VayuMahabhoot:

Table no.16: Correlation of Evaporation rate (Ev. rate)& ESR among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalEv.rate&Bal ESR	0.01	No correlation
2	TarunEv.rate&Tarun ESR	-0.4	Intermediate negative correlation
3	VriddhaEv.rate&Vriddha ESR	0.2	Weakly positive correlation

Table no.17: Correlation of Evaporation rate (Ev.rate) among different age groups

Sr.No.	Compared Group	Value of r	Relation according to value of r
1	BalEv.rate&TarunEv.rate	-0.01479	No correlation
2	TarunEv.rate&VriddhaEv.Rate	0.475	Intermediate positive correlation
3	VriddhaEv.rate&BalEv.Rate	0.1397	Weakly positive correlation

5. Akash Mahabhoot:

Table no.18 : Correlation among Sp. gravity & ESR among different age groups

Sr. No.	Compared Group	Value of r	Relation according to value of r
1	Bal Sp. gravity &Bal ESR	0.04	No correlation
2	Tarun Sp. gravity &Tarun ESR	-0.22	Weakly negative correlation
3	VriddhaSp.gravity&Vriddha ESR	-0.27	Weakly negative correlation

Table no.19 : Correlation of Sp. gravity among different age groups

Sr. No.	Compared Group	Value of r	Relation according to value of r
1	BalSp. Gravity &Tarun Sp. Gravity	0.1687	Weakly positive correlation

2	TarunSp. Gravity&VriddhaSp. Gravity	0.0427	No correlation
3	VriddhaSp. Gravity&BalSp. Gravity	-0.1009	Weakly negative correlation

CONCLUSION : Significant difference is observed in the parameters of Sp.gravity, E.S.R. ,Hb% and TLC in the *bal- tarun, Tarun-Vriddha, Bal –Vriddha* groups.

There is significant difference in all groups except Surface Tension in *Tarun- Vriddha* groups and O.D., Ev. Rate, and RBC contain Bal-*Tarungroup* .This difference is significant in terms of statistics and in the form of real variation.

With the help of the statistical values obtained in the differences and correlation coefficient, there is inversely proportional relationship in Sp. Gravity and ESR. Hence Sp. Gravity and ESR can be considered as parameters for *Prithvi* and *Akashmahabhoot* in blood.

Surface tension decreases with the increased age. But as the differences observed are not significant to derive, surface tension cannot be considered as a parameter for *Aapmahabhooot*.

Optical Density and Hb% in bal & *tarun* groups are having positive correlation and can be considered as parameters for *Tej mahabhoot.*

There is no correlation in Evaporation rate in the bal-*tarun-vriddha* groups. Hence Evaporation rate cannot be validated as a parameter for the *Vayu mahabhoot.*

No correlation has been seen in the Sp.gavity in the *bal-tarun-vriddha* age groups. Hence Sp. Gravity cannot be validated as a parameter for the *Akash mahabhoot*.

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