

### Study Association between *Dhatu Sarata* and Mosso's Ergography

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#### Abstract

*Dhatu sarata* is a factor which represents the *Bala* of *Dhatu*, patient or person has to be examined with reference to *Sara* or the excellence of their *Dhatu*, with a view to determining the specific measurement of strength. They are classified into eight categories, depending upon the *Sara* or excellence of their *Dhatu*. Seven of seven *Dhatu* and eighth one is *Satva Sara*. Ergography is a procedure by which a graphical record of muscle contractions is obtained and the amount of work done i.e., muscle power is calculated. It was first described by Angelo Mosso and is therefore called Mosso's Ergography. It is also used to study the phenomenon of fatigue in human skeletal muscles. 215 healthy students (Male and Female both), age between 18 to 25 years from Bharati Vidyapeeth Ayurved College, Pune were selected for research. Examination of *Dhatu sarata* of every student was done with the help of Standard *Dhatu Sarata* Questionnaire which was prepared by Ayu Soft C-DAC and with the help of Mosso's ergograph Work done by muscle was calculated. The percentage of *Sarata Lakshana* of every *Dhatu* and work done by muscle was compared by Pearson's correlation test. P value is lesser than 0.05 in *Mamsa Dhatu sarata* and *Asthi Dhatu sarata* in both male and female therefore there is significant correlation found between Work done by muscle and *Mamsa Sarata* and *Asthi Sarata*.

#### Keywords

*Dhatu Sarata, Ergography, Mosso's Ergograph, Work done, Correlation*



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## INTRODUCTION

*Ayurveda*, aims to maintain health of a healthy individual and cure disease of a patient<sup>1-2</sup>. According to *Ayurveda* our body is made up of *Dosha*, *Dhatu* and *Mala* they are compared to roots because as roots starts life of plant, these three factors starts life of human<sup>3</sup>. *Dosha* is responsible for origin of diseases in living body, *Malas* are those constituents which are regularly eliminated from the body and thus keep the body clean. Those who give support and strength to living body are called as *Dhatu*.

“Health depends on Strength”. If we are willing for good health, happiness, enjoyment and longevity then everybody should pay attention to maintain equilibrium of root factors of body ie. *Dosha*, *Dhatu* and *Mala*. The aim of *Ayurveda* is twofold, first maintenance of health in a healthy individual and second to eliminate diseases in patient.

In present era fast paced life, people are ignoring or unable to give proper attention towards the health. Also the irregular food and sleep habits, lack of exercise, excessive medication, excessive stress all these becoming a contributory factors for health hazards. Psychological causes affect on physical health of an individual. For

prevention from disease good immunity is needed this is achieved by good quality *Dhatu*, it gives support and strength to living body<sup>4</sup>. There are seven *Dhatus* explained by *Acharya*: *Rasa*, *Rakta*, *Mamsa*, *Meda*, *Asthi*, *Majja* and *Shukra*. The *Rakta Dhatu* produced from *Rasa*, *Mamsa* from *Rakta*, *Meda* from *Mamsa*, *Asthi* from *Meda*, *Majja* from *Asthi*, and *Shukra* from *Majja*<sup>5</sup>.

It is always better to prevent the disease than treating it. But first we should know the condition of *Dhatu* whether they are strong or weak. If any *Dhatu* is weak then it is necessary to increase the *Bala* of *Dhatu* before it leads to *Vikruti*. For knowing the *Bala* of *Dhatu* our *Acharya* mentioned the *Sarata Parikshana*.

Person to person the strength of every *Dhatu* differs. There are three conditions of *Dhatu* in the body *Shudha*, *Vishudhda* and *Vishudhdatarata*. *Vishudhdatarata Dhatu* is called as “*Sara*” *Dhatu* or “*Prasad*” *Dhatu*<sup>6</sup>. “*Sarata*” is a factor, which represents the *Bala* of *Dhatu*, Patient or person has to be examined with reference to *Sara* or the excellence of their *Dhatu*, with a view to determining the specific measurement of strength. They are classified into eight categories, depending upon the *Sara* or

excellence of their *Dhatu*. Seven of seven *Dhatu* and eighth one is *Satva Sara*<sup>7</sup>.

All seven *Dhatu* also have their particular action in the body. When these *Dhatu* are in their purest form they produce strength and vitality of the body. This kind of condition is known as *Dhatu Sarata*.

In tenfold examination *Acharya Charaka* said person should be examined with reference to his *Prakruti* (physical constitution), *Vikruti* (Examination of Morbidity), *Sara* (excellence of *Dhatu* s or tissue elements), *Samhanana* (compactness of organs), *Pramana* (measurement of the organs of the body), *Satmya* (homologation), *Satva* (psychic conditions), *Aharshakti* (power of intake and status of digestion), *Vyayamshakti* (power of performing exercise), and *Vaya* (age) in order to ascertain his strength<sup>8</sup>.

Also it can be stated that the person who is having good *Sarata* he definitely has a good *Bala*. One should determine the *Bala* of a person with the help of *Sarata Parikshana*.

Ergography is a procedure by which a graphical record of muscle contractions is obtained and the amount of work done i.e., muscle power is calculated. Scientists used the Ergograph for a range of investigations viz., measurement of physiological measures

of muscular contraction, fatigue, strength and physical capacity or endurance.<sup>9</sup>

It was first described by Angelo Mosso and is therefore called Mosso's Ergography. An Ergogram is a recording of the voluntary contractions of the skeletal muscles of a human being on a moving kymograph. It is also used to study the phenomenon of fatigue in human skeletal muscles. The subject contracts the flexors of the fingers against resistance, using Mosso's Ergogram, till the finger is fatigued. The work done is calculated to study the effect of various factors on the performance.

Mosso's Ergography is one of the modern parameters to study muscle power in humans. Prolonged and strong contraction of muscles leads to the well known state of muscle fatigue. Intense, repeated activation of skeletal muscles causes a decline in contractile performance known as muscle fatigue. It is used as a diagnostic and as a prognostic measure in all conditions in which weakness of the muscles is present i.e. myasthenia gravis, muscle weakens, muscle dystrophy etc.<sup>10-11</sup>

So if we consider both *Ayurvedic* and modern view there must be some co-relation in between Ergography and *Dhatu Sarata*. Ergography calculate work done capacity

and gives us idea about the strength and power of an individual, as well as *Dhatu Sarata*. This study will help to establish a correlation between Modern parameter and *Ayurvedic* parameter.

## AIM

Assess the correlation between *Dhatu sarata* and Ergography.

## OBJECTIVES

*Dhatu sarata* examination with the help of Ayu Soft C-DAC.

Calculate work done by muscle with the help of Mosso's ergograph.

To study Correlation between percentage of *Sarata lakshana* of each *Dhatu* and Ergographic records (work done by muscle) with the help of statistical analysis.

## MATERIALS & METHODS

### Materials

Standard *Sarata Parikshana Proforma*. (Ayu Soft C-DAC -Centre for Development of Advance Computing)

Mosso's Ergograph, Kymograph and Metronome to calculate total work done by muscle.

- 215 healthy students (Male and Female both), age between 18 to 25 years from Bharati Vidyapeeth Ayurved College, Pune.

### Inclusion criteria

- Only healthy subjects were selected.
- Age limit between 18-25 years.
- Only right handed subjects were selected.

### Exclusion criteria

- Those with age less than 18 years and more than 25 years were excluded.
- Left hand subjects were excluded.
- Subjects suffering from any major illness were excluded.
- Those who taking steroid, drugs for muscle gain were excluded.

### Methodology -

*Sarata parikshana* was done with the help of standard *sarata parikshana proforma* AYUSOFT C-DAC (Centre for Development of Advance Computing) Pune, along with other collaborating institutes and Ministry of Communications and Information and Technology, Govt. of India have developed the AYUSOFT software.

The *sarata parikshana* of 215 subjects was done with the help of standard *sarata parikshana proforma* AYUSOFT C-DAC. After performing *sarata parikshan*, the percentage of *sarata lakshanas* of every

*Dhatu* was calculated and results put in chart.

Work done by muscle was calculated with the help of Mosso's Ergography. Calculation of work done for each Ergogram by the formula:  $W = F \times S$  where  $W$  is the work done (in kgm),  $F$  is the load (in kg) and  $S$  is the total distance (in meters) through which the load is lifted 'S' is the sum of all the vertical amplitudes in each Ergogram that is, total length of all vertical lines.<sup>12</sup>

To avoid bias the same time, place, and environment was maintained for all subjects, same instrument, weight and method will be applied to test muscle power of all subjects.

The percentage of *Sarata Lakshana* of every *Dhatu* and work done by muscle was compared by statistical analysis.

## OBSERVATION

- Total 250 subjects were screened for study out of that 215 subjects were selected for this observational type of research (105 male and 110 female).

## FINDINGS

- Positive correlation is observed by Pearson's correlation test between

*Mamsa Dhatu Sarata*, *Asthi Dhatu sarata* and work done by muscle.

- In Male P value is lesser than 0.05 in *Mamsa Dhatu sarata* and *Asthi Dhatu sarata* therefore there is significant correlation between Work done by muscle and *Mamsa Sarata* and *Asthi Sarata*.
- Same result found in Female P value is lesser than 0.05 in *Mamsa Dhatu sarata* and *Asthi Dhatu sarata* therefore there is significant correlation between Work done by muscle and *Mamsa Sarata* and *Asthi Sarata*.
- No significant correlation was found in both Male and Female in *Rasa Sarata*, *Rakt Sarata*, *Meda Sarata Majja Sarata*, *Shukra Sarata*, *Satva Sarata* and work done by muscle in scattered diagram.
- In Pearson correlation test P value is higher than 0.05 in *Rasa Sarata*, *Rakt Sarata*, *Meda Sarata Majja Sarata*, *Shukra Sarata*, *Satva Sarata* therefore there is no significant correlation between these *Sarata* and Work done by muscle

**Table 1** Pearson Correlation values of all *Dhatu sarata* and work done

<b>MALE</b>		
Sarata %		Work Done gm/cm
Rasa	Pearson Correlation	.176
	P-Value	.075
	N	104
Rakta	Pearson Correlation	.156
	P-Value	.113
	N	104
Mamsa	Pearson Correlation	.570**
	P-Value	.000
	N	104
Meda	Pearson Correlation	.153
	P-Value	.120
	N	104
Asthi	Pearson Correlation	.224*
	P-Value	.023
	N	104
Majja	Pearson Correlation	.028
	P-Value	.781
	N	104
Shukra	Pearson Correlation	.006
	P-Value	.951
	N	104
Satva	Pearson Correlation	.140
	P-Value	.155
	N	104

From the above table we can conclude that, there is significant correlation between Work done and *Mamsa Sarata* and also in *Asthi Sarata* (P-Value < 0.05). There is no correlation between Work done and other *Sarata*.

**Table 2** Pearson Correlation values of all *Dhatu sarata* and work done

<b>FEMALE</b>			
Sarata%		Work done gm/cm	
Rasa	Pearson Correlation	.114	
	P-Value	.237	
	N	110	
Rakta	Pearson Correlation	.067	
	P-Value	.484	
	N	110	
Mamsa	Pearson Correlation	.228*	
	P-Value	.017	
	N	110	
Meda	Pearson Correlation	.093	
	P-Value	.332	
	N	110	
Asthi	Pearson Correlation	.348**	
	P-Value	.000	
	N	110	
Majja	Pearson Correlation	.046	
	P-Value	.631	
	N	110	
Shukra	Pearson Correlation	.106	
	P-Value	.270	
	N	110	
Satva	Pearson Correlation	.001	
	P-Value	.989	
	N	110	

From the above table we can conclude that, there is significant correlation between Work done and *Mamsa Sarata* and also in *Asthi Sarata* (P-Value < 0.05). There is no correlation between Work done and other *Sarata*.

## DISCUSSION

This is today's need to give more attention towards preventive measures of health because ignorance towards them is major cause for early and frequent health hazards in today's population, resulting in decreased lifespan.

If we are willing for good health physical and mental strength is necessary for that we must pay attention towards condition of body and its constituents (*Dosha, Dhatu and Mala*) and to determine the physical and mental strength 'Sarata' examination is one of the most important examination (for *Dhatu* examination) explained by our science. If we want, theories like *Sarata* examination should be understood by today's world then we must explain them in their ways by co-relating our theories with their theories with the help of modern tools and by this we can also add new tools in *Ayurveda* to improve our science.

*Dhatu sarata* examination gives us idea about qualitative state of seven *Dhatu* and *Satva* (mind), it is a subjective type of examination, for quantification of *Bala* (Strength) we need some objective parameter, Ergography is a modern parameter which is used for recording of muscle contraction and to calculate total work done by muscle, this instrument also

used in modern science for diagnostic as well as prognostic purpose of muscle weakness or dystrophy.

According to reference from *Samhitas* about *Dhatu sarata* it was observed that *Mamsa Dhatu Sarata, Majja Dhatu sarata, Asthi Dhatu sarata* and *Shukra Dhatu sarata* shows comparatively more strength than other *Dhatu Sarata*.

In this research it was found that when *Mamsa Dhatu* and *Asthi Dhatu sarata* percentage is higher than work done capacity is also higher therefore there is positive correlation between workdone capacity and *Mamsa dhatu sarata* and *Asthi dhatu sarata*.

**So, it can be stated that if person having good *Mamsa dhatu* and *Asthi Dhatu sarata* then he has good Work done capacity (Strength).**

## CONCLUSION

- *Sarata* examination is one of the most important qualitative estimation of *Dhatu*
- In Male and Female both the statistical analysis (Pearson's correlation test) shows that there is positive correlation between *Mamsa Dhatu Sarata, Asthi Dhatu sarata* and Work done capacity.

- In Male and Female both when percentage of *Masma Dhatu sarata* and *Asthi Dhatu sarata* increases work done is also increases.
- Other *Dhatu sarata* like *Rasa Sarata*, *Rakta Sarata*, *Meda Sarata*, *Majja Dhatu Sarata*, *Shukra Dhatu Sarata*, *Satva Sarata* did not show any significant correlation with Ergographic records (work done ,Same result was found in both Male and Female volunteers.)

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