COMPARATIVE STUDY OF BALA IN RAKTASARA AND MAMSASARA HEALTHY INDIVIDUAL W.S.R TO HARVARD STEP TEST

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ABSTRACT

Objectives: To validate the relation between the Bala of Raktasara and Mamsasarata with the help of Harvard Step test. Method: It is an analytical observational study. Sarata deals with Bala and Bala can be assessed with vyayamshakti. For evaluation of Bala Harvard step test can be used which deals with physical fitness of individual. Each 50 individual of Raktasara and Mamsasarata were screened out with the help of simple questionnaire. Bala parikshan of healthy individual is carried out with the help of Harvard Step test and fatigue index of each individual is calculated. Result: Mean body fitness is found highly significant in Mamsasarata with p<0.0001, t value= 11.9357 by performing independent t test. Conclusion: It is concluded that, fitness of Mamsasarata individual is highly significant. Hence Bala of Mamsasarata is more than Raktasara when fitness is carried out with the help of Harvard Step test in healthy individual.

Keywords: Bala, Raktasara, Mamsasarata, Harvard Step Test.

INTRODUCTION

Charak has addressed Bala as a seat of Arogya that is health¹. While, according to Dalhana, Bala is a karmasamrathyā which we can predict with the help of Vyayamshakti². Nobody can function in absence of Bala and can’t resist it also. For both aims of Ayurveda science, namely, maintenance of health and if diseased to cure the disease and come back to homeostatic condition; one needs to know his Bala.

Thus, eight types of essence of Dhatus have been described in the Ayurvedic classics. The essence of Dhatus is termed as Dhatusarata in Ayurveda. It is the unique concept described only in Ayurveda. The knowledge of Sarata is helpful in deciding the degree of strength of various Dhatus in the Sharira. It is very much helpful to lead life happily for that the knowledge of Sara is truly required which deals with Bala of an individual.

According to Chakrapani, Sara means Vishudhatar Dhatu. Sarata in Ayurveda is said to be the Vishudhatar awastha or Utkrushtha awastha of Dhatus in the body. Balwan Dhatu is called as Sarwan Dhatu. This proves that Sara means Bala, moreover Stir Bala of sharira³. Thus, Bala or strength of Sharira depends on the Sarata of Dhatus. This Dhatusara awastha of different Dhatus in sharira not only enables an individual to maintain its healthy
status but also helps in combating various ailments. The Sara Parikshan is the novel concept described exclusively in the Ayurvedic context and the importance of Sara Parikshan has been described by Acharya Charaka—

As stated and explained above, eight types of Sara have been described by our ancient Acharyas for the purpose of knowing the degree of strength or Sharira Bala. Thus, Bala differs in accordance with Dhatusarata from individual to individual. The strength of the body depends upon the muscular tissues viz. Mamsa Dhatu. Mamsa Dhatu gives strength to the body and it is meant for the non-displacement of soft tissues. Bala of Majja Dhatusara is mainly concerned with the intellectual work rather than physical work whereas the Bala of Shukra Dhatusara is concerned with the sexual potency of an individual. Though Asthi Dhatusara also possesses strength, he is more stubborn for any physical work. So, Bala has definite meaning in relation to the function of Dhatus in the Sharira. In case of Rakta Dhatusara and Mamsa Dhatusara, the entity Bala refers to the Sharira Bala of the body means physical strength of an individual. From the above two references, the Bala or the physical strength of Rakta Sara and Mamsa Sara Purusha need to be evaluated by taking aid of the modern tool like the physical fitness index of a person. Also, the Bala or Karma Shakti of an individual can be evaluated by the Vyayam Shakti Parikshana. So, for the purpose of evaluation of Bala or physical fitness of an individual the Harvard Step Test can be used as modern tool in this study. It is a type of cardiac stress test for detecting or diagnosing cardiovascular disease and also a good measurement of fitness and a person ability to recover after a strenuous exercise. It is a kind of cardiovascular endurance test, computing the capability to exercise continuously for extended intervals of time without tiring. Physical fitness implies not only the absence of disease but also a sense of physical well being. Fatigue is described as a failure to maintain the required or expected force or power input.

METHOD OF ACTUAL OBSERVATIONAL STUDY:

Material:-
1. Healthy individuals belonging to Rakta and Mamsa evaluated with the help of CRF.
2. Stopwatch
3. A stable gym bench of 45 cm height and 50 cm height.
4. Metronome.

A. CRITERIA OF SELECTION:
1. Only healthy individuals were selected for this study from same territory (Desh)
2. Male and Female individuals between age group 20 years to 40 years were selected.
3. Individuals who co-operated for evaluation of Dhatusarata and fatigue index by Harvard Step Test were selected.

B. CRITERIA OF EXCLUSION:
1. Individuals suffering from Auto-immune disorders were excluded.
2. Pregnant, lactating or female in menstrual phase were excluded.
3. Individuals suffering from any Systemic disorders like Hypertension, Diabetes Mellitus, Sickel cell Anaemia, Muscular Dystrophy e.t.c or any chronic illness were excluded.
4. Individual who did not co-operate for evaluation of Dhatusarata and fatigue index by Harvard Step test were excluded.
5. Individuals having any addiction like smoking, tobacco chewing or alcoholism were excluded.

METHODS:
2. The selected healthy individuals were screened for Rakta and Mamsa individuals were selected for the study. The “Dhatusarata” of these selected individuals was assessed after solving a validated questionnaire.
3. The Dhatusarata of these individuals were categorized into three sub groups as Pravar, Madhyam and Avar groups and individuals belonging to Pravar Rakta and
Mamsasarata were selected. Individuals having 75% and above score obtained after solving questionnaire were selected. Each 50 individuals of Raktasarata and Mamsasarata were selected for the study.

Criteria used to assess Pravar Dhatusararta are as follows:
1. 75% and more than 75% of all positive features of subjective criteria: Pravarsara (Best tissue quality.)
2. Positive features of subjective criteria between 74-25%: Madhyam Sarata (Moderate tissue quality.)
3. Positive features of subjective criteria 24% and below: Asarata (Poor tissue quality.)
4. Bala Parikshana was done with the help of Harvard step test and fatigue index of each individual were calculated as follows:

**Procedure of Harvard Step Test:** Complete procedure and possible risk factors of Harvard step test were explained to participant. Written and Verbal consent regarding the procedure were taken. The Harvard step test was conducted in following manner.

**Step 1** - The participant was asked to step up and down on a standard gym bench once every two seconds for 5 min. i.e. total 150 steps.

**Step 2** - The rate at which the subject step up and down was fixed with help of metronome.

**Step 3** - The experiment was stopped if the subject gets exhausted earlier than 5 min.

**Step 4** - The subject was asked to sit on a chair immediately after either exhaustion or completion of 5 min.

**Step 5** - After finishing the test the pulse rate was counted at an interval of 1-1.5 min, 2-2.5 min, 3-3.5 min.

**Step 6** - The fatigue index was calculated with the help of following formula—

\[ \text{Fatigue Index} = \frac{\text{Duration of exercise in sec.} \times 100}{2 \times (\text{Sum of pulse count during Recovery})} \]

**Classification of physical fitness**—

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Fatigue index</th>
<th>Fitness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Up to 49</td>
<td>Poor</td>
</tr>
<tr>
<td>2.</td>
<td>50-80</td>
<td>Average</td>
</tr>
<tr>
<td>3.</td>
<td>81 and above</td>
<td>Good</td>
</tr>
</tbody>
</table>

Then with the help of statistical analysis comparative study of bala of Raktasar and Mamsasarar individuals were done with the help of fatigue index calculated with the help of Harvard Step test.

**RESEARCH TOOL:**
1. CRF, 2. Haemoglobin percentage, 3. BMI

Haemoglobin percentage was estimated with the help of Sahli’s haemoglobinometer.

**SAMPLING PLAN:**
Healthy individuals were selected for the study and were screened for Rakta Dhatusarata and Mamsa Dhatusarata. Written and vocal consent were taken from the participants. Out of these screened healthy individuals, only Rakta and Mamsa Dhatusarata individuals were selected for the study. 50 Raktasara and 50 Mamsasara individuals were selected. The “Dhatusarata” of these selected individuals were assessed after solving a simple questionnaire. Individuals with Pravar Rakta and Mamsasarata were selected, satisfying the criteria for Pravar Dhatusarata.

Laboratory investigations like haemoglobin percentage were carried out of selected Raktasara and Mamsasara individual. Body mass index of selected individuals were calculated with the help of formulae weight in kg divided by height in meter square.

**Statistical analysis**
All demographic variables included, were expressed in actual frequency and percentages. Haemoglobin, BMI and body fitness index were presented as mean± sd. Mean haemoglobin, BMI and body fitness were compared between two groups, raktasarata and mamsasarata by performing independent t-test. Correlation coefficient (r-value) was calculated to assess magnitude and strength of correlation between demographic parameters with body fitness in raktasarta and mamsasarta. Statistical significance was considered at p<0.05 level. Statistical software stata version 13.0 was used for statistical analysis.

**OBSERVATIONS AND RESULTS**
The study was done in total 120 individuals irrespective of their sex; religion etc. 50 individuals were categorized in Rakta sarata and 50 individuals in Mamsasara with the help of CRF.
Table 1.1
Table showing Fatigue Index wise distributions in frequency and percentage of 100 individuals:

<table>
<thead>
<tr>
<th>FATIGUE INDEX</th>
<th>RAKTASARATA</th>
<th>MAMSASARATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>&lt;49 (POOR)</td>
<td>47</td>
<td>94</td>
</tr>
<tr>
<td>50-80 (AVERAGE)</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>&gt;80 (GOOD)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

In Raktasarata all 47 individuals comprising 94% were having poor fitness (Fatigue Index <49) while 3 individuals comprising 6% of total population of Raktasarata were having average fitness (Fatigue Index 50-80).

In Mamsasarata 13 individuals comprising 26% were having poor fitness (Fatigue index i.e. <49) while 37 individuals comprising 74% were having average fitness (Fatigue Index i.e. 50-80).

TABLE 1.2 Table showing Mean Haemoglobin In Raktasarata And Mamsasarata of 100 individuals.

<table>
<thead>
<tr>
<th></th>
<th>RAKTASARATA</th>
<th>MAMSASARATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN</td>
<td>13.95</td>
<td>13.07</td>
</tr>
<tr>
<td>SD</td>
<td>1.70</td>
<td>1.83</td>
</tr>
<tr>
<td>RANGE</td>
<td>10.3-16</td>
<td>9.1-17.2</td>
</tr>
<tr>
<td>t-VALUE</td>
<td>2.4864</td>
<td></td>
</tr>
<tr>
<td>p-VALUE</td>
<td>0.0146, S</td>
<td></td>
</tr>
</tbody>
</table>

The individuals belonging to Raktasarata has their Mean Haemoglobin 13.95 with standard deviation 1.70. The individuals belonging to Mamsasarata has their Mean Haemoglobin 13.07 with standard deviation 1.83. After applying independent t-test to the Haemoglobin of Raktasarata and Mamsasarata, results found were significant in Raktasarata.

TABLE 1.3: MEAN BMI IN RAKTASARATA AND MAMSASARATA.

<table>
<thead>
<tr>
<th></th>
<th>RAKTASARATA</th>
<th>MAMSASARATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN</td>
<td>20.52</td>
<td>22.54</td>
</tr>
<tr>
<td>SD</td>
<td>1.83</td>
<td>1.76</td>
</tr>
<tr>
<td>RANGE</td>
<td>18.6-24.4</td>
<td>18.7-24.9</td>
</tr>
<tr>
<td>t-VALUE</td>
<td>5.6349</td>
<td></td>
</tr>
<tr>
<td>p-VALUE</td>
<td>&lt;0.0001, HS</td>
<td></td>
</tr>
</tbody>
</table>

The individuals belonging to Raktasarata has their Mean BMI 20.52 with standard deviation 1.83. The individuals belonging to Mamsasarata has their Mean BMI 22.54 with standard deviation 1.76. After applying independent t-test to the BMI of Raktasarata and Mamsasarata, results found were Highly significant in Mamsasarata.
TABLE 1.4: MEAN FATIGUE INDEX RAKTASARATA AND MAMSASARATA.

<table>
<thead>
<tr>
<th></th>
<th>RAKTASARATA</th>
<th>MAMSASARATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN</td>
<td>28.72</td>
<td>50.37</td>
</tr>
<tr>
<td>SD</td>
<td>10.94</td>
<td>6.67</td>
</tr>
<tr>
<td>RANGE</td>
<td>13.05-48.38</td>
<td>29.03-66.96</td>
</tr>
<tr>
<td>t-VALUE</td>
<td>11.9357</td>
<td>&lt;0.0001, HS</td>
</tr>
<tr>
<td>p-VALUE</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
</tbody>
</table>

The individuals belonging to Raktasarata has their Mean Fatigue Index 28.72 with standard deviation 10.94., The individuals belonging to Mamsasarata has their Mean Fatigue Index 50.37 with standard deviation 6.67., After applying independent t-test to the Fatigue Index of Raktasararata and Mamsasarata, results found were Highly significant in Mamsasarata.

TABLE NO. 1.5: CORRELATION OF DEMOGRAPHIC PARAMETERS WITH BODY FITNESS IN RAKTASARATA AND MAMSASARATA

<table>
<thead>
<tr>
<th></th>
<th>RAKTASARATA</th>
<th>MAMSASARATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r-VALUE</td>
<td>p-VALUE</td>
</tr>
<tr>
<td>AGE IN YRS</td>
<td>-0.1423</td>
<td>0.3242, NS</td>
</tr>
<tr>
<td>HAEMOGLOBIN</td>
<td>0.3306</td>
<td>0.0190, S</td>
</tr>
<tr>
<td>BMI</td>
<td>0.2095</td>
<td>0.1443, NS</td>
</tr>
</tbody>
</table>

DISCUSSION

The study was carried out in individual who had given consent and selected through the simple and valid questionnaire. Individual who were either Pravara Raktasara or Pravara Mamasasara were selected for the study. Selected Pravara raktasara individual were devoid of other sarata and selected Mamsasara individual were devoid of other sarata. It means selected Raktasarata individual were having only Rakta dhatu in its Vishuddhatara avastha and selected Mamsasara individual were having only Mamsa dhatu in its Vishuddhatara avastha. The study was conducted in same ritu which was Vasant to avoid variation in fitness due to season.

Harvard Step test was used as a fitness test to determine the bala of the individuals belonging to above mentioned two groups. Because the test was easy to perform so that individual can give consent to it readily. As it can be performed anywhere and does not require much set up so that individual will also able to perform it in future to know their fitness and can spread the message among their friends and relatives and can become more conscious to fitness.

1) Discussion on Mean Haemoglobin in Raktasarata and Mamsasarata

In present study, when statistical analysis were done, Mean Haemoglobin was found statistical significant p<0.05 (p value= 0.0146) in Raktasarata was 13.95+-1.70 while in Mamsasarata it was 13.07+- 1.83. It may be because the Rakta dhatu is in Vishuttar avastha in Raktasarata. Rakta dhatu is correlated with blood which carries Haemoglobin. Hence If, Rakta dhatu is sarvan, Haemoglobin will also be in its proper range. In contrast to it, in case of Mamsasarata, mamsa dhatu is sarawan.

2) Discussion on Mean BMI in Raktasarata and Mamsasarata

In present study, after statistical analysis Mean BMI was found statistical highly significant p<0.0001 in Mamsasarata. Mean BMI was found to be 20.52+-1.83 and 22.54+-1.76 respectively in Raktasarata and Mamsasarata. Results were may be due to, in case of Mamsasarata, all organs are well covered with muscles and body is proportionate. BMI is weight in kg divided by height in meter square. In Mamsasarata mass dhatu is sarwan and mamsa dhatu perform the function of lepana i.e. provides covering to body.
organ. *Mamsa dhatu* is *parthiv* in nature and *guru* in *guna*. Hence it provides an individual with proper weight or proportionate body while *Raktasara* individuals are delicate in nature.

3) **Discussion on correlation of parameters with Body Fitness in Raktasarata and Mamsasarata**

The Parameters like Age and BMI were found Non-Significant in Correlation with Body Fitness in *Raktasarata* and *Mamsasarata*. Haemoglobin is found significant in *Raktasarata* with r value = 0.3306 and p<0.05 with p= 0.0190

4) **Discussion on Mean Body Fitness in Raktasarata and Mamsasarata**

It is found Highly Significant in *Mamsasarata* with p<0.0001 and t value = 11.9357. Mean Body Fitness in *Raktasarata* and *Mamsasarata* was found to be 28.72+-10.94 and 50.37+-6.67 respectively.

**Discussion on Fatigue Index**

In present study, it has been found that 74% individuals of *Mamsasarata* were having Average Fitness (Fatigue Index= 50-80) and 26% individuals were having Poor Fitness (Fatigue Index < 49). All individuals of *Raktasarata* were having Poor Fitness (Fatigue Index= 50-80). It may be because *Bala* is a *karmasamrthya* of an individual which we can predict with the help of *Vyayam*. In *Mamsasarata*, individual possess stout body while *Raktasarata*, individual is delicate, unctuous and unable to tolerate any type of stress or any stuff hot in nature either climate or any matter. Hence *Mamsasara* individual can possess more *Vyayamshakti* while *Raktasara* individual lag behind it. In this study, Harvard step test had been used to find fatigue index and comparison of the *Bala* of *Raktasarata* and *Mamsasarata* individuals. Harvard step test is a cardiovascular endurance test. It is a sort of *Vyayam* only. Hence *Mamsasara* individual can more easily perform it compare to *Raktasarata* individual. Hence Fatigue index is found more significant in *Mamsasarata* compare to *Raktasarata*.

**CONCLUSION**

*Bala* is an entity differs from individual to individual with various aspects with *Mamsasara* individual possess highest degree of strength while *Raktasara* individual does not possess enough strength. Finally it is concluded that, Fitness of *Mamsasarata* individual is highly significant. Hence *Bala* of *Mamsasarata* is more than *Raktasarata* when Fitness is carried out with the help of Harvard step test in healthy individuals.

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