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## Review Article

### PHYSICAL FITNESS TESTS: A TOOL TO ASSESS SHARIRIKA BALA

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#### ABSTRACT

Bala, arbitrarily quoted to the word “strength” is an important concept of Ayurveda. The increase of Bala is said to be good for health, where as Bala is said to be lost in disease condition and in certain stage of life too, the Bala will be minimal. Ayurveda proposes many modules to increase the Bala. Balya mahakashaya of Acharya Charaka are said to increase Bala and Rasayana is claimed to be balya too. The food consumed is said to yield Bala and the state of body tissues (Dhatu) also determines the Bala. The Bala of a person is governed by many factors like Age, Sex, Food, Health, Disease Status, Time/Seasons etc. Providing objectivity to the Ayurvedic concepts is a herculean task. In the present era of providing objectivity to all the parameters, Bala too demands an attention. The Bala is classified into Different types viz, Sharirika Bala, Mano Bala, Indriya Bala, Atma bala etc. Hence this paper is an attempt made to establish and explore the objective parameters to assess the sharirika Bala through the physical fitness tests especially Modified Harward Step Test (HST). The parameters like Physical Fitness Index (PFI) and Maximal Oxygen Consumption (VO<sub>2</sub> MAX) are discussed in the present paper. HST is basically carried out to assess physical fitness /cardiopulmonary fitness and it uses the parameters similar to Vyayama.

**Keywords:** Bala, Sharirika bala, Modified Harward Step Test, Physical Fitness Index, Maximal Oxygen Consumption.

#### INTRODUCTION

Ayurveda has proposed many novel concepts much before the followers of modern medicine can think or imagine. Concept of Bala is one of the fundamental principles that serve as a substratum for many related concepts like Ojus, Vyadhi kshamatva, Balya, Bala vruddikara Bhava, Sara Etc. The term Bala basically means Strength. The contemporary science has developed many tools to measure Physical strength or physical fitness. Therefore herewith critical analysis of Sharirika Bala and its assessment in comparison with Physical Fitness and its tests is done with the Use of Modified Harward Step Test (HST), and by the parameters like Physical Fitness Index (PFI) and Maximal Oxygen Consumption (VO<sub>2</sub> MAX).

#### Bala

According to Acharya Sushruta the supreme essence of all the Dhātus beginning with Rasa and ending with Sukra is known as Ojas and the same is also called Bala<sup>1</sup>. Acc to Acharya Charaka, the Prakrutha Kapha is mentioned as the Bala and Vaikruta Kapha as the mala<sup>2</sup>. Though the Bala and Ojas seem similar on account of therapeutics, their difference is clear as Ojas has Physical Appearance, Quantity, Taste etc but Bala is not having all these<sup>3</sup>. Hence Bala is inferred by the power/fitness/strength to do any strenuous work like exercises, weight lifting etc.

#### Classification of Bala

Bala is classified in many ways in Ayurveda by the Acharyas at different contexts is mentioned below Table 1. Sahaja Bala is the one which exists in the body and

mind since birth, can be correlated with constitutional strength. According to Acharya Chakrapani the constitutional Strength/ fitness is present in every living being from the time of birth. The sharirika and manasika Bala which is attained by the parental factors like Rasa, Rakta, Virya, Ojus is Sahaja Bala, which can be considered as strength attained from heredity. Thus the natural strength does not require any extraneous factor for its growth. It is known that, there are some people who are by naturally strong; some others are weak, which is decided genetically. Kalaja Bala is one, based on the age of the person and the seasonal changes. The Bala in adulthood will be more compared to childhood and old age. Pertaining to seasons, Bala is more in sheeta rutus (cold seasons) like Hemanta, Shishira compared to other rutus. Yuktikrita Bala is achieved by the proper combination of the intake of wholesome foods like pulses, rice, ghee, meat etc. and following other regimen like exercise, proper rest and also with the use of elixirs-rejuvenators. In this part Ayurveda having more interventions like promoting the Bala of an individual by using the Dravya having like Balya, Brumhana, Shramahara, Vayastapana, Rasayana, Vajikarana Karma. Upchaya Lakshana Bala is the inherent power of growth and vitality whereas Shakti Lakshana Bala is the capacity for work or physical exertion. All these decide the Sharirika Bala.

#### Sharirika Bala

Sharirika Bala is strength of an individual which helps to do any strenuous work and prevents disease manifestation. Charaka mentions sama samhatha purusha,

one whose sharira mamsa and sharira samhanana are even in measurement, whose indriyas are stable, devoid of deformities due to the Bala, who can tolerate hunger, thirst, heat, cold, increased body activities, whose digestion is good, is said to be balavan<sup>7</sup>.

#### **Balavruddikara Bhava (Factors responsible for promotion of strength)**

- Birth in a place where people are naturally strong;
- Birth at a Specific time when people naturally gain strength;
- Favorable disposition of time (pleasant and moderate climate);
- Excellence of the quality of the Bija (sperm, and ovum) and Ashaya (uterus) of the parents;
- Excellence of the ingested food;
- Excellence of the physique;
- Excellence of the Satmya (wholesomeness of various factors responsible for the maintenance of the body);
- Excellence of the mind;
- Favorable disposition of the nature;
- Youthfulness;
- Exercise; and
- Cheerful disposition<sup>8</sup>

#### **Physical Fitness**

Physical fitness is defined as a general state of health and well-being or specifically the ability to perform aspects of sports or occupations. Physical performance is generally achieved through correct nutrition, exercise, hygiene and rest. It is a set of attributes or characteristics that people have or achieve that relates to the ability to perform physical activity. Factors affecting the physical performance are age, somatotype, personality, diet and drugs; other factors can affect performance such as physical factors, psychological or external factors<sup>9</sup>.

#### **Assessment of Bala**

According to Acharya Charaka, generally Bala should be inferred by the Vyayama Shakthi<sup>10</sup> and also opines Saratah Pareeksha<sup>11</sup> for Visheshajnana.

#### **Vyayama**

Any physical activity performed to increase strength and stability is known as Vyayama. It brings about lightness in the body, ability to work, stability, resistance to discomfort, enhancement of metabolic activity and alleviation of Doṣas (especially Kapha). It stimulates the power of digestion<sup>12</sup>. The other benefits of vyayama are bodily nourishment, gracefulness, and symmetrical growth of the body parts, agility, firmness, sound health and depletion of excess fat<sup>13</sup>.

#### **Physical Exercise**

Physical exercise is any bodily activity that enhances or maintains physical fitness, overall health and wellness. Types of Exercises are

#### **Aerobic Exercise**

It involves activities with lower intensity and performed for longer periods. Energy (ATP) is obtained by utilizing nutrients in presence of oxygen. Aerobic exercise

improves cardiovascular endurance. Ex- Cycling, Swimming, Walking, Running, etc

#### **Anaerobic Exercise**

It involves exertion for short period followed by periods of rest. It uses muscles at high intensity and a high rate of work for a short period. Body obtains energy by burning nutrients stored in muscles without oxygen (Anaerobically), as oxygen supplied by blood is not sufficient to provide large amount of energy in short time aerobically Ex: - Push-ups, Weight lifting, Sprinting, Any rapid burst of strenuous exercise<sup>14</sup>.

#### **Physical Fitness Tests**

##### **Ergometers**

It is an Exercise machine, equipped with an apparatus for measuring the work performed by exercising or an instrument for measuring the amount of work done by human muscles. The use of an ergometer is essential when performing common exercise tests. Conventional ergometers include the treadmill and the cycle, which are used in order to evaluate exercise capacity. A single step can also be used as an ergometer, having the advantage of being readily available for the performance of a very common field test (the step test).

##### **Treadmill**

Treadmill is a motor driven instrument with a conveyor belt that is large and strong enough for the subject to walk and run upon. This device is constructed such that the speed of the belt and inclination are adjustable. Use of this instrument is advantageous in using a skill with which everyone is familiar.

##### **Bicycle Ergometer**

It is an instrument whose front and back wheel is driven by the subject peddling. The resistance against which the subject peddles is provided by a frictional band or by electromagnetic braking. The work load can be quickly and easily adjusted by changing the tension of brake's band. The work is calculated by the scale reading easily.

##### **Step test**

In field studies and testing in large groups, step test is ideal. The subject steps up and down on a step of fixed height at a fixed rhythm for a maximum time fixed or until exhaustion

##### **The Harvard step test (HST)**

In 1943, during World War II, one of the most popular exercise test was introduced by professors at Harvard University, the Harvard Step Test (HST) for assessing the aerobic capacity of young athletes attending that university. The test is performed on a single 50.8 cm high step, the stepping rate is paced by metronome at a stepping rate of 30 steps/min and the duration is 5 minutes. HST was adapted for use in adolescents by Gallagher and Brouha. The adaptation involved changes in duration of the test, which was reduced to 4 min, and the height of step test was set at one of two levels (45 cm and 50 cm) according to body surface area of the adolescents (<1.85 m<sup>2</sup> and >1.85 m<sup>2</sup> respectively).

Exercise capacity is estimated from duration of the test and duration of the return to the resting heart rate.

#### Modified Harvard step test

In this each subject will be asked to complete 'up' and 'down' at task 22 cycles per min on 40 cm's height bench for male volunteers and f for female volunteers 33 cm's height bench will be used for 5 minutes or until exhaustion whichever is early. Based on the Harvard Step Test many modifications are made and the methods are followed like 3 Stage Step test, The Queen's College Step Test, The Memorial Hospital Step Test, The Chester Step Test and The YMCA Step Test (Kasch step test).

#### Physical Fitness Parameters

- ✓ Heart rate
- ✓ Blood pressure
- ✓ Exercise duration
- ✓ Physical Fitness Index

It is used to evaluate the cardiopulmonary fitness; it is a powerful indicator cardiopulmonary fitness and there by physical performance. The regular exercise and nutritious food intake can increase PFI by increasing oxygen consumption. The PFI score will be calculated as follows:

$$PFI = \frac{\text{Duration of exercise in seconds} \times 100}{2 \times (\text{Sum of Pulse counts at 1, 2 and 3 min})}$$

#### Maximal Oxygen Consumption (VO<sub>2</sub> max)

It is the term used to define the level of oxygen consumption beyond which no further increase in O<sub>2</sub> consumption occurs with further increase in the severity of exercise. It is also defined as the highest oxygen uptake an individual can achieve during exercise while breathing air at sea level. VO<sub>2</sub> max of a normal individual is limited by the degree to which cardiac output can increase and not by the ventilatory capacity or oxygen diffusion capacity of the lungs. VO<sub>2</sub> max is the maximum capacity to transport and utilize oxygen during incremental exercise (Harvard step test) (The derivation is V- volume per time, O<sub>2</sub>-oxygen, max-maximum). It is also known as aerobic capacity, which reflects physical fitness of a person. Because oxygen consumption is linearly related to energy expenditure, when oxygen consumption is measured, it implies measuring an individual's maximal capacity to do work aerobically. The VO<sub>2</sub> will be calculated by sub maximal exercise heart rate using the Uth-Sorensen-Overgaard-Pedersen estimation: (HR<sub>sub</sub>)

$$VO_2 \text{ MAX} = 15 \times \frac{HR \text{ max} - HR \text{ rest}}{HR \text{ rest}}$$

Where HR is the heart rate

Table 1: Classification of Bala in Ayurveda

Charaka Samhita <sup>4</sup>	Dalhana <sup>5</sup>	Sushruta Samhita <sup>6</sup>
1. Sahaja	1. Upchaya Lakshana Bala	1. Śaririka Bala or Deha Bala
2. Kalaja	2. Shakti Lakshna Bala	2. Indriya Bala,
3. Yuktikritta		3. Mano Bala
		4. Atma Bala.

Table 2: Comparison between the Sharirika Bala and Physical Fitness

Sharirika Bala	Physical fitness
Determines the karma samarthya	Helpful for/ Governs the efficiency to work
Can be enhanced by Ahara, Vyayama, Oushada etc	Can be enhanced by Nutritious food, Exercises and drugs
Helps in Roga anutpadana	Helps in disease prevention by enhancing the immunity
Related to all the doshas, Dhatus etc	Related to all the body tissues and systems

Table 3: The Factors influencing Sharirika Bala and Physical Fitness

Sharirika Bala	Physical fitness
Vaya, Desha, Kala	Age, Place of living/ birth, Season
Prakruti	Genetics
Vyayama/ Satata Abhyasa	Exercises/ skills
Ahara- Snigdha, Picchila, Guru , Madhura etc	Nutritious food
Oushada- Balya Dashemani, Shramahara Dashemani, Shukravardhaka Dashemani, Vayasthapana Dashemani, Rasayana and Vajikarana Dravyas	Drugs- Anabolic steroids, Creatinin etc

Table 4: Similarities between Vyayama and Exercise

Vyayama	Exercise
Increases bala	Strengthens the body
Agnivruddikara	Enhances metabolic activity
Vibhakthagaganagratvam	Increases muscle mass, shapes it well
Laghavam	Provides lightness to body and mind
Karma samarthyam	The capacity to work increases

**DISCUSSION**

Here is an effort made to correlate the Sharirika Bala with Physical fitness under the different components made and tabulated below.

**Sharirika Bala and Physical fitness**

The comparison between the Sharirika Bala and Physical fitness are enumerated below Table 2.

**The factors influencing the Sharirika Bala and Physical fitness**

The factors influencing Sharirika Bala and Physical fitness are enlisted in Table 3.

**Vyayama and Exercise**

The Vyayama and Exercise are having many similarities in their actions are enlisted below, Table 4

**Vyayama laxanas and Physical fitness parameters**

The Physical fitness parameters like Duration of Exercise, Exhaustion, Physical fitness index, VO<sub>2</sub> MAX and Heart rate are the indicators of Vyayama laxanas, viz karma samarthyas, swedagama i.e. perspiration, Shrama sahisnuta, Shwasa vrutti i.e. increased respiration respectively. These are related to the physical fitness i.e. Sharirika Bala as well as the cardio respiratory fitness.

**Modified Harward Step Test**

Tests like treadmill. Ergometers etc, requires human resources, are expensive, difficult to perform at any place so the Modified Harward Step Test is apt test to assess the physical fitness i.e. shaririaka Bala with less aids can be done at any place.

**Physical fitness index and VO<sub>2</sub> MAX role in the assessment of Sharirika Bala**

Calculation of Physical fitness index is done with minimal instrumentation. It is an appropriate method to analyze the fitness as it focuses on the exercise duration so it also gives an idea about the endurance capacity of an individual. Hence PFI acts as a tool to assess the sharirika Bala. VO<sub>2</sub> Max is the Maximum amount of oxygen consumed during the exercise. Many procedures are there to measure the VO<sub>2</sub> MAX directly, but they are expensive, requires more instrumentation and human resources. So the Uth-Sorensen-Overgaard-Pedersen estimation is apt to determine the VO<sub>2</sub> max with minimal aids and cost effective also. Exercise duration is one more

parameter is easy to note and to determine the physical fitness i.e. Sharirika Bala. Hence along with these three methods HR, BP etc are incorporated to assess the physical fitness i.e. Shaririaka Bala.

**CONCLUSION**

Bala is a unique concept of Ayurveda. Shaririaka Bala indicates the Physical Fitness. Contemporary science has developed many tools to quantify the Physical fitness. Assessment of PFI and VO<sub>2</sub> max through Modified Harward Step Test is an easy way of assessing the Sharirika Bala. This test can be used to evaluate the Balya karma of Ayurvedic formulations.

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