Our Heritage

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

A Study on Physical Aspects of Ellite Middle- And Long-Distance Runners

[1] Pedenla Bhutia, Dr. Adarsh Tiwari

[1] Research Scholar, Department of Physical Education, Sri Satya Sai University of Technology & Medical Sciences, Sehore, M.P.

ABSTRACT

The aim of this study was to determine the Physiological Aspects Distinction between Elite Middle and Long Distance Runners. This study was to 50 university men athletes, namely middle and long distance runners. The sample were selected from 56th National Inter State Sr Athletics Championships-2016 and 57th National Inter State Senior Athletics Championships 2017. 800 m runners' had greater weight, stature, hip breadth, upper arm length, fore arm length, thigh length, lower leg length, sum of five skin fold, thigh length - lower leg length index and hip breadth- stature index than 5000 m runners. 800 m runners' had lesser ponderal index than 5000 m runners. No differences were found between humerus biepic condyle diameter, femur biepic condyle diameter, ectomorphic rating, sitting height - stature index, upper arm length - lower arm length index and shoulder breadth - stature index of 800 m and 10000 m runners 5000 m runners' had greater upper arm length, lower leg length and mesomorphic rating than 10000 m runners.

KEYWORDS: Track and field, Physical variable, Middle distance runner, Long distance runner.

1.1 INTRODUCTION

The sport of athletics, includes running, walking, jumping and throwing etcetera. Running includes many events such as sprints, middle distance running and long distance running.

Track and field events are split into three broad categories: track events, field events, and events combined. Many athletes prefer to specialize in just one event (or type of event) with the intention of improving their results, although the goal of athletes with combined events is to become skilled in a variety of disciplines. Track events involve running over a defined distance on a running and obstacles can be mounted on the track in the case of hurdling and

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

steeplechase events. There are also relay races in which teams of athletes run and pass on a baton to their team member at the completion of a certain distance.

There are two kinds of events in the field: jumps and throws. Athletes are graded on the length or height of their jumps in jumping competitions. The score of distance jumping events is measured from a board or marker, and any competitor who reaches this mark is deemed to have fouled. An athlete has to clear his body in the height jumps over a crossbar without taking off the normal supports. While athletes leap vertically in the pole vault with purpose-built sticks, most jumping events are not helpful.

Sprinting events

100 meters,200 meters,400 meters ,100 meters Hurdles 110 meter Hurdles,4X 100 meters relay and 4X100 meters relay.

Middle distance events

800 meters,1500 meters,3000 meters and steeplechase.

Long distance events

5000 meters 10,000 meters 20000 meters, 25000 meters and 30000 meters.

Jumping events

Long jump, High jump, triple jump and pole vault

Throwing events

Throwing events will include the following shot put, discuss throw, Javaline throw and hammer throw.

Physical Fitness

Fitness is the condition that defined each person to live most effectively with their potential ability to function and depends on the physical, mental, emotional, social and spiritual components of fitness that are interdependent on each other.

Fitness is defined as having the necessary qualities; or a readiness or preparedness. These seem to imply that fitness is a preparation for something or that fitness has the necessary qualities for something.

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

Physical fitness is the natural outcome of a rich programme of physical education. It is the sum of the condition of one's body judge in terms of age, height, weight and chest expansion in terms of freedom from disease, constitutional affection or bodily in firming, full physical development, vigour, vitality and radiant health should be seen in one who is physically fit. In terms of usefulness physical fitness has been defined as "total functional capacity of an individual to perform a given test".

Physical fitness is a positive quality, extending on a scale from intense to well growth adult full of life. But it varies from individual to individual and in the same individual from time to time. Therefore physical fitness is a basic as well as a part of total fitness and it is a combination of physical qualities, social adaptability, emotional stability and mental efficiency.

Physical fitness is an inseparable component of total fitness for effective being. Fitness involves inter relationship between intellectuals and emotional as well as physical factors. Good health is a basic component of fitness that implies in addition to freedom from disease, sufficient strength, agility and endurance to meet the demands of daily living and sufficient reserves to withstand ordinary stamina and a healthy lifestyle are necessary to meet the vigorous demands of daily stress. Adequate nutrition and exercise, sufficient rest and relaxation, suitable work and appropriate medical and dental care are important in maintaining fitness. Physical fitness has frequently been defined as "the ability to carry out everyday tasks with vigor and altering, without conduce fatigue and with ample energy to enjoy tissue time pursuits and to meet confer seen emergencies."

Kennedy said that "physical fitness is the foundation of all our society's activities" if bodies will grow soft and inactive, if we fail to promote physical development, we must decide our ability to work and this has led to great stress on physical fitness and its role in the development of an individual's good personality, character, adaptation and performance.

Barrow has stated that fitness includes the mental, emotional social as well as the physical aspects and all these components of total fitness play a significant role for a full happy life. Further freedom from disease organic development, efficient movement, alertness of mind emotional maturing and social adjustment provide the frame work fitness.

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

Proper physical fitness practices lead to a healthy lifestyle. In general, physical living. The benefits of physical fitness are well documented in the literature and are no different for persons with mental retardation than the general population.

Health, social, personal, vocational benefits can be derived from proper physical fitness practices and more specifically, developing these healthy fitness practices should be fundamental to this populations lifestyle for a number of reasons. Focused on speed and movement training to enhance all areas of athlete performance, two programs goal is not simply to run fast, and recovering fast. Playing, fast consists of running fast, reacting fast, and recovering fast. The goal of playing fast is met by three objectives: improve speed, improve agility and improve conditioning.

Speed

Speed is the measure of how fast an athlete can sprint short distance. A high maximum speed by itself does not guarantee athletic success. However, coaches and athletes in all sports are quite aware that an individual may be capable of sprinting at 27 or more miles per hour and still back the explosive power to accelerate rapidly, change direction rapidly or get the entire body part moving rapidly. Quickness refers to an athlete's ability in the shortest possible time to execute precise movement. It also requires the nervous system's ability to process and generate rapid control and relaxation of the muscle fibers rapidly explosive movement of the entire body that occurs in this starting and accelerating phases of sprinting or changing a part of the body to start a new movement or quickly change direction, displaying the pace of an athlete.

Speed movement is complicated and involves an individual’s approach that event or rapidly changes direction, demonstrate an athlete’s quickness identifies the specific strength and weakness through careful testing, identifies the factors that are critical to sport and position, and identifies the training programmes needed to improve speed and quickness in short distance.

Speed is the one of the important physical fitness components without speed there is no sports and physical exercise. Speed of muscle contraction an innate quality, but speed of movement can be gained through movements. Speed is a valuable factor in games like football, basketball, hockey, handball, volleyball and track events.

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

Speed is a limb's movement speed, whether it's a runner's legs or the shot putter's head. Speed is an essential component of any sport and one of the following can be expressed: elastic strength (power), maximum speed and speed endurance.

Speed is a person's ability to execute high-speed motor motions in the shortest time. It is the same as the distance covered by the time unit. The speed factor is involved in most athletic skills like sprint running, some soccer skills, basketball, etc.

Flexibility

Flexibility is required to perform relatively easily everyday activities. We need versatility to get out of bed, raise kids, or sweep the floor. Perhaps due to a sedentary lifestyle, versatility continues to deteriorate with age. Despite adequate versatility, everyday activities become more difficult to carry out. We establish body movements and posture patterns over time, which can result in reduced joint strength and weakened body positions. Staying active and exercising regularly helps to prevent this loss of mobility, preserving flexibility as we age. Being flexible significantly reduces the risk of sporadic and chronic back pain.

Flexibility training should be included as a percentage of the regular fitness routines of your clients. Improved flexibility can improve performance in both aerobic training and muscle conditioning and in sport. There is scientific evidence that accident occurrence decreases when people have flexibility training in their practices due to the increased ability to move through a broader ROM unimpeded. The only exception to this would be an unnecessary or faulty ROM that could increase the likelihood of injury. Flexibility training allows customers to become more in tune with their body when used properly. It is an important form of relaxation that can help both physical and mental recovery.

Cardio Respiratory Endurance

Cardio respiratory endurance is the body's ability to sustain dynamic exercise, using large muscle groups, over time and at a moderate to high intensity level. During this exercise, the muscles must be supplied with fuel and oxygen by the circulatory and respiratory systems (the heart and lungs). Activities such as running, walking, swimming, and bicycling improve cardio respiratory endurance.

Cardio respiratory endurance is the ability of the heart, lungs and circulatory system to supply oxygen and nutrients to the working muscles efficiency. In other words it is known as

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

circulatory respiratory endurance. This is characterized by significant contractions of large muscle groups over a fairly long period of time, during which maximum adjustments of the circulatory respiratory system to the operation are needed, such as in the distance and swimming.

1.2 REVIEW OF LITERATURE

Schoenfeld (2016) notes that resistance training (RT) is usually associated with a hypertrophic response; furthermore, this is understood to decrease as RT and endurance training are performed together within the same programme. Changes in body shape in distance runners as a result **Barnes (2015)** notes that more motor vehicle recruiting is needed to produce higher forces but to resolve a decrease in force per motor unit as a consequence of a faster shortening rate. As **Piacentini(2013)** and team found improvement in recreational marathon runners at the race-pace but not at a slower and faster speed. Enhancements observed faster than slower speeds may also represent changes in engine unit recruiting as a consequence of STof ST have yet to be fully addressed in reports on this topic.

Ramirez (2014) gives a description of the training characteristics involved with the ST technique and running exercise being used concurrently as part of the study period. The ST procedures used were either RT or HRT, PT, ERT, or a variation of these techniques, which also included SpT in some situations.

Bertuzzi R(2013) listed the features of the subjects for the 24 studies which fulfilled the inclusion criteria. It comprises a minimum of 469 participants (male n= 352, female n= 96), aged between 17.3 and 44.8.

Aouaili et al. (2012) conducted a study of 33 top male players in volleyball. The study's goal was to investigate the relationship in elite volleyball players between physical and anthropometric profiles and vertical jump results.

Tiwari et al. (2012) contrasted the physical and physiological variables between basketball players ' inter-district and inter-state levels. 60 male basketball players were randomly selected as subjects from Uttar Pradesh (30 inter-district and 30 inter-state).

Mehtap Ozdirenc, et al. (2011) did a study to examine the effect on physical fitness in rural and urban children of environmental factors, lifestyle and leisure time activities. A cross-

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

sectional observational study was done in Turkey of 98 rural and 74 healthy urban children (aged 9 11 years).

Chatterjee et al. (2010) measured healthy Nepalese young women's vital ability and contrasted their values with healthy Indian counterparts. For this study, 42 Indians and 54 young non-smokers from Nepal, female students aged 18 to 20 were recruited.

Mujika I, Santisteban J and Castagna C (2009) conducted a survey to analyze the impact of 2 short-term in-season sprint and power training protocols on vertical counter-movement jump height (with or without arms), sprint speed (Sprint-15 m) and agility (Agility-15 m) in male elite junior soccer players.

1.3 METHODOLOGY

Procedure

Review of related literature had given us appropriates guidance in adopting an objective method of assessing the difference in physical and physiological characteristics of middle and long distance runners. In this chapter the selection of subjects, criteria measures, tools and techniques used in collecting data and statistical method applied for its interpretation are described.

Selection of Subjects:

This study was delimited to 50 university men athletes, namely middle and long distance runners. The sample were selected from

- 56th National Inter State Sr Athletics Championships-2016, held at Hyderabad, India on 28th June To 2nd July 2016 -Data of 6 athletes of 800m runners,8 athletes of 5000m runner and 11 athletes of 10000 m runners were collected, and
- 57th National Inter State Senior Athletics Championships 2017, 15 Jul, 2017 to 18 Jul, 2017 at Acharya Nagarjuna University, Guntur, Andhra Pradesh, India- Data of 8 athletes of 800m runners, 9 athletes of 5000m runner and 8 athletes of 10000 m runners were collected.

Sample:

For the purpose of this study three sample groups were formed.

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

1st group comprises of 14 elite 800 m runners, 2nd group comprises of 17 elite 5000 m runners and 3rd group comprises of 19 elite 10000 m runners.

Criteria Measures and Collection of Data:

Recording the variables as given below shall consist data in the form of various criterion measures selected for the study.

Physical Variables:

Weight in Kg., Height in cm, Length in cm, Breadth in cm, Diameters in cm, Muscles girth in cm, Skin folds measurements in mm, Somatotype in gradings.

Tools:

The following instruments were used to collect the relevant data.

Weighing machine, Stadiometer, Sitting height table, Steel measuring tape, Sliding caliper, Skin fold caliper, Stop watch, Spirometer etc.

The instruments were of standard quality; their accuracy was ensured by the manufacturer. International society for the advancement of Kinanthropometry's (ISAK) approved techniques were used for recording the various body measurements. The reliability was checked by test- retest methods and average co-efficient was found to be 0.96.

Statistical Procedure:

Reiterating the objective of the study we have to point out that we intend to investigate the differences in physical and physiological parameters of elite 800, 5000 and 10000 m runners of India for that the one way analysis of variance was used. Where significant differences were observed Scheffe's test was used to find out the ascending or descending order of means.

Level of Significance:

The significance of differences in physical and physiological parameters of elite middle and long distance runners was tested at 0.05 level.

1.4 DISCUSSION OF FINDINGS

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

Here we are discussing our findings in light of studies carried out by other researchers. We are also discussing the probable implications of the observed significant differences in the physical and physiological variables on the performance of studied groups.

Weight:

The total weight of 800 m runners is found to be significantly higher than 5000 m and 10000 m runners. Whereas the mean weight of 5000 m and 10000 m runners is not significantly different.

The 800 m running in track and field is a typical example of short time endurance activity. This endurance ability is needed for cyclic activities lasting from about 45 seconds to 2 minutes. Short time endurance depends to a significant extent on speed endurance and strength endurance, which is affected by different factors. Composition of muscles and volume of muscles are two of them. Therefore greater weight of *BOO* m runners will provide better speed endurance and strength endurance for better performance in the competition. In long distance running, the sources of energy production (ATP) is through the break down mainly of carbohydrates and fats and rarely of protein.

Energy production through fat and protein is the cause of decrease in muscles thickness. Therefore 5000 m and 10000 m runners mean weight is less in comparison of 800 m runners.

Stature:

The mean stature of 800 m runners is found to be significantly higher than 5000 m and 10000 m runners. Whereas the mean stature of 5000 m and 10000 m athletes is not significantly different.

There is direct relationship between leg length and both stride length and stride frequency. A sprinter with shorter legs has naturally shorter strides, which brings the foot back to the ground sooner. Generally shorter the leg, shorter the stride and greater the frequency. In case of 800 m running, stride length is longer and stride frequency is lower than the sprint event. But in 5000 m and 10000 m running stride length is medium and stride frequency is smaller than 800 m running.

Therefore, 800 m runners mean stature is greater than 5000 m and 10000 m runners.

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

Sitting height:

The mean sitting height of 800 m runners is found to be significantly higher than 10000 m runners. Whereas the mean sitting height of runners of 800 m and 5000 m and also between the mean sitting height of runners of 5000 m and 1000 m is not significantly different.

The force applied on the lower limbs during the race is not maximal; the natural greater length of the lower extremities will help to provide them with the greater stride. As 800 m running is a speedy event in comparison to 5000 m and 10000 m running, therefore greater mean sitting heights of 800 m runners have additional advantage in comparison of 5000 m and 10000 m runners.

Shoulder and Hip breadth:

It is found that the mean shoulder and hip width of 800 m runners is significantly higher than 10000 m runners, and the mean hip width of 800 m runners is also significantly higher than 5000 m runners. Whereas the mean shoulder width of runners of 800 m and 5000 m and the mean shoulder and hip width of runners of 5000 m and 10000 m is not significantly different.

Larger shoulder and hip width of 800 m athletes provides greater muscle mass and boney area, giving the athlete greater strength to execute powerful arm and leg movement, contributing greater energy to their running, increasing their pace. The prerequisite for long-distance runners is to save energy for a prolonged period of competition, and their arm and leg actions lead to strength and movement, and lower shoulder and hip width are observed with the race distance

Upper arm and Fore arm length:

It is found that the mean upper arm and forearm length of 800 m runners is significantly higher than 5000 m and 10000 m runners, and it is also observed that the mean upper arm length of 5000 m runners is significantly higher than 10000 m runners, whereas the mean forearm length of 5000 m and 10000 m runners is not significantly different.

800 m runners' prerequisite is speed. Greater upper and fore arm length of middle distance runners' provides greater range of movement and momentum, which favors in maintaining their speed. As the distance of race increases, the requirement of maintaining running movement for longer time also increases. Therefore long distance athlete had to comprise for speed and power, so they avoid wider movement of upper and fore arm to save the

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

energy for prolonged period of running time. Thus with increase in the distance of race the arm length decreases.

Thigh and lower leg length:

It is found that the mean thigh and lower leg length of 800 m runners is significantly higher than 5000 m and 10000 m runners, and it is also observed that the mean lower leg length of 5000 m runners is significantly higher than 10000 m runners, whereas the mean thigh length of 5000 m and 10000 m runners is not significantly different.

Biceps and Calf muscles girth:

The mean girth of the biceps muscles and the girth of the calf muscles of 800 m runners were found to be significantly higher than 10,000 m runners. Whereas the mean biceps and calf muscle circumference of 800 m and 5000 m runners and the mean biceps and calf muscle circumference of 5000 m and 10000 m runners is not significantly different.

Requirement of 800 m runners is speed, which can be sustained through greater muscular power, therefore the muscle cross sectional area (muscle girth) increases with shortening of running distance. Greater muscular mass also adds weight to the body, which requires addition 81 energy to be carried for longer distances. Thus long distance athletes had lesser muscular mass.

Sum of five skin fold and Endomorphic rating:

It is found that the mean sum of five skin fold of 800 m runners is significantly higher than 5000 m and 10000 m runners, as well as the mean endomorphic score of 800 m runners is significantly higher than 10000 m runners. Whereas the mean number of five skin folds and endomorphic ratings of runners of 5000 m and 10000 m, and the mean endomorphic ratings of 800 m and 5000 m runners is not significantly different.

Humerus and Femur biepic condyle diameter:

It is observed that the significant difference does not exist in the mean humerus and Femur biepic condyle diameter of three groups (800 m, 5000 m and 10000 m runner groups), which is not supportive of our hypothesis i.e. there is insignificant difference in humerus and Femur biepic condyle diameter of three groups.

Mesomorphic rating:

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

It is found that the mean mesomorphic rating of 800 m runners is significantly higher than 10000 m runners, and also the mean mesomorphic rating of 5000 m runners is significantly higher than 10000 m runners, whereas the mean mesomorphic rating of 800 m and 5000 m runners is not significantly different.

The analysis carried out by Carter (1970) supports our findings. He found that on mesomorphy, the 800-1500 m runners were half a unit higher than 5000-10000 m runners and marathon runners, while on the third component, the 5000-10000 m were half a unit higher than the other two groups.

Greater mesomorphy rating of 800 m athletes provides greater muscle mass and bony area, giving the athlete greater strength to perform powerful arm movement, adding more energy to their running, which in turn increases their speed. The requirement for long distance runners is energy savings for extended race times, thus their arm actions lead in power and movement, thus less mesomorphic rating is observed with that race distance.

Ectomorphic rating and Sitting height- Stature index:

It is found that the significant difference does not exist in the mean ectomorphic rating and sitting height - stature index of three groups (800 m, 5000 m and 10000 m runner groups), which is not supportive of our hypothesis i.e. there is insignificant difference in ectomorphic rating and sitting height - stature index of three groups.

Ponderal index:

It is found that the mean ponderal index of 5000 m runners is significantly higher than 800 m runners and also the mean ponderal index of 10000 m runners is significantly higher than 800 m runners, whereas the mean ponderaI index of 5000 m and 10000 m runners is not significantly different.

Thigh length -Lower leg length index:

The mean thigh length-lower leg length index of 800 m runners is significantly higher than 5000 m and 10000 m runners are observed. While the mean thigh length 5000 m lower leg length index and 10000 m runners is not significantly different.

Upper arm length- Lower arm length index:

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

It is found that there is no significant difference in the mean upper arm length — lower arm length index of three groups (800 m, 5000 m and 10000 m runner groups), which does not support our hypothesis, i.e. the upper arm length - lower arm length index of three groups is not significantly different.

Hip breadth- Stature index:

The mean hip length-stature index of 800 m runners is reported to be significantly higher than 5000 m and 10000 m runners. Whereas the 5000 m and 10000 m runners mean hip breadth-stature index runners is not significantly different. Greater stature with narrow hip proportions renders the athlete with greater speed and range of actions.

Shoulder breadth -Stature index:

It is found that there is no significant difference in the mean shoulder breadth stature index of three groups (800 m, 5000 m and 10000 m runner groups), which does not help our hypothesis, i.e. the shoulder breadth three group stature index runners are not significantly different.

These discussion of various research studies in light of our findings is leading us to conclude that the observed significant differences in the various physical variables of middle and long distance runners are decisive determinants of the performance limits binding these runners which is confirming the fact that competitive sports demands event specific physical stature.

Thus our findings are setting guideline for coaches and up coming athletes for comparing their physical structure with the elite middle and long distance runners of our country. If their structure is inline with the high performers then they may also achieve their status, subject to the optimization of other factors.

1.5 CONCLUSIONS:

Our findings is leading us to conclude that the observed significant differences in the various physical variables of elite middle and long distance runners are decisive determinants of the performance limits binding these athletes. This is conforming the fact that competitive sport demands event specific physical structure.

The findings of this study had led us to draw the following conclusions:

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

800 m runners' had greater weight, stature, hip breadth, upper arm length, fore arm length, thigh length, lower leg length, sum of five skin fold, thigh length - lower leg length index and hip breadth- stature index than 5000 m runners. 800 m runners' had lesser ponderal index than 5000 m runners.

No differences were found between sitting height, shoulder breadth, biceps muscles girth, calf muscles girth, humerus biepic condyle diameter, femur biepic condyle diameter, endomorphic rating, mesomorphic rating, ectomorphic rating, sitting height - stature index, upper arm length - lower arm length index and shoulder breadth - stature index of 800 m runners and 5000 m runners.

800 m of runners had a higher mean weight, size, sitting height, shoulder width, hip width, upper arm length, forearm length, thigh length, lower leg length, biceps muscle girth, calf muscle girth, sum of five skin folds, endomorphic rating, mesomorphic rating, thigh length - lower leg length index and hip width - stature index of 10000 m of runners. 800 m runners' had lesser ponderal index than 10000 m runners.

No differences were found between humerus biepic condyle diameter, femur biepic condyle diameter, ectomorphic rating, sitting height - stature index, upper arm length - lower arm length index and shoulder breadth - stature index of 800 m and 10000 m runners 5000 m runners' had greater upper arm length, lower leg length and mesomorphic rating than 10000 m runners.

No differences were found between mean weight, stature, sitting height, shoulder breadth, hip breadth, fore arm length, thigh length, biceps muscles girth, calf muscles girth, sum of five skin fold, humerus biepic condyle diameter, femur biepic condyle diameter, endomorphic rating, ectomorphic rating, sitting height- stature index, ponderal index, thigh length - lower leg length index, upper arm length - lower arm length index, hip breadth - stature index and shoulder breadth -stature index of 5000m and 10000 m runners.

1.6 REFERENCES

1. Schoenfeld BJ, Ogborn D, Krieger JW. Effects of resistance training frequency on measures of muscle hypertrophy: a systematic review and meta-analysis. Sports Med. 2016;46(11):1689–1697

ISSN: 0474-9030

Vol-68-Issue-1-January-2020

2. Barnes KR, Kilding AE. Running economy: measurement, norms, and determining factors. Sports Med Open. 2015;1(1):8–15

3. Piacentini MF, De Ioannon G, Comotto S, et al. Concurrent strength and endurance training effects on running economy in master endurance runners. J Strength Cond Res. 2013;27(8):2295–2303

4. Ramirez-Campillo, Rodrigo, et al. "Effects of different plyometric training frequencies on components of physical fitness in amateur female soccer players." Frontiers in physiology 9 (2018): 934.

5. Bertuzzi R, Pasqua LA, Bueno S, et al. Strength-training with whole-body vibration in long-distance runners: a randomized trial. Int J Sports Med. 2013;34(10):917–923

6. Tiwari Lalit Mohan, Manoj Singh and Bhagwat Singh (2012), Comparative Study of Selected Physical and Physiological Variables of Male Basketball Players at Different Levels of Competition. Asian Review of Social Sciences (ARSS), Volume 1. No. 1 January-June

7. Chatterjee, P.Das, P. Debnath, P. and Banerjee, K.A.(2010), A Comparative Study of Vital Capacity of Indian and Nepalese Young Female, Journal of Physical Education and Sports Management, 1(2) : 25-27.

8. Billat V, Binsse V, Petit B, Koralsztein Jp., 1998. Laboratories Des Sciences du Sport, University Paris V, France. Studied on High- level runners are able to maintain a VO2 steady state below V02 max in an all-out run over their critical velocity.

9. Blagrove RC, Howatson G, Hayes PR. Test-retest reliability of physiological parameters in elite junior distance runners following allometric scaling. Eur J Sport Sci. 2017; pp 1–10.

10. Carter J.E.L., 1984. Physical Structure of Olympic Athletes. Part II: inanthropometry of Olympic Atheletes. Medicine and Sport Science, Vol. 18. S Karger, Basel.