

The relation between sagittal spinal column curvature and volume of chest expansion in volleyball players

FATEMEH KARAMI

Research Scholar

Department of Studies in Physical Education and Sports Sciences
Sports Pavilion, University of Mysore, Mysore, India

C. VENKATESH, Ph.D.

Assistant Professor

Department of Studies in Physical Education and Sports Sciences
Sports Pavilion, University of Mysore, Mysore, India

Abstract

Background: *The aim of this study was To determine relation between sagittal spinal column curvature and volume of chest expansion in volleyball players.*

Methods: *Twenty five Iranian male from national teams volleyball players invited to trainings arranged. Players aged between 19-29 . All of the participants were enrolled in the physical examination as a part of their studies. First the athletes took the anthropometry Test, and then measured their spinal column curvature and volume of chest expansion. Finally the athlete's scores were collected. The lumbar spinal column curvature was measured using a flexible ruler and calculating area of thorax by tape measure which difference between full inhale and exhale.*

Results: *Results showed that negatively significant correlation between curvature of spinal column with volume of chest expansion in volleyball players.*

Conclusion: *The findings show that relation between maximum chest expansion and spinal curvatures is subject to higher levels of kyphosis and lordosis.*

Key words: spinal column curvature, volume of chest expansion, volleyball players

INTRODUCTION

Today, attending in international sport events would be a futile effort without applying scientific findings. Among important and substantial principles in training elite athletes is identifying body composition and congenital and acquired skills. Investigating anthropometric, physiological and physical characteristics are vital in reaching championships (White, 1990). It is clearly evident that specific physical features and anthropometric profiles determine whether a player is capable of participating in highest levels of a sport field or not (Borghuis et al, 2000; Reilly, Bangsbo & Franks, 2008; Sharrock et al, 2001). Reports of physiological and physical capacities of elite volleyball players along with other morphological and anthropometric features can provide a standard for coaches in the process of selecting competent players and appropriate exercise plans based on gender and age differences. In most of studies out of Iran, body composition, physiology, physical structure and anthropometry of volleyball players were considered descriptively, with no attention to individual differences. So, identifying individual differences of elite volleyball players and presenting a complete profile of body composition, physiology, physical structure and anthropometry of volleyball players can be the innovative aspects of this study. This helps coaches and officials in discovering talented persons and directing them towards championships. Meanwhile, coaches can arrange more appropriately and accurately specific trainings of volleyball players, control performance of players and implement necessary improving measures. Because the present study is about elite volleyball players, results will deliver good information about body composition, physiology and physical readiness in volleyball. This method is capable of increasing the output of talent selection systems, which finally contributes in preventing waste of time and energy and spending available facilities for competent persons. One factor which changes the normal composition of body is weakness in body muscles (Hall et al, 2007). Weakness in muscles makes a person to lose his normal body composition, so, there would appear physical

disorders due to changes in normal structure of bones. These weaknesses contribute to malfunction of other parts of body, such as improper function of circular system, respiration and etc. Moreover, this makes laziness in central and peripheral muscles, reduction in coordination of neural and muscular systems and lack of body composition and balance (Bouchard, 2000). Concerning specific nature of some sports and their need for some particular movements to catapult the performance of athletes, and also more professionalism in sport world, some muscles face over strengthening. This leads to weakening of neighbor muscles, improper composition and reduction of life cycle of athletes. Therefore, the present study tries to consider the relation between sagittal curves in vertebra column in volleyball players with body composition and volume of chest expansion.

MATERIALS AND METHODS

Subjects

Participants of study were 30 volleyball players invited to the first round of trainings arranged for national teams of Islamic republic of Iran in 2017. They were selected purposefully. All the participants were aware of objectives of study and presented written consent.

Measurement tools

The following instruments were employed in the present study:

1. Tape measure

This is used to measure distance between two specific points in Schober test and Delmas index. Validity of this device for evaluating distance and internal validity is 0.80.

2. Schober test

Schober test is a physical examination used in physical medicine and rehabilitation and rheumatology to measure the ability of a patient to flex the lower back. While the patient is in a standing position the examiner makes a mark approximately at the level of L5 (fifth lumbar vertebra). Two points are marked: 5 cm below and 10 cm above this point (for a total of 15 cm distance). Then the patient is asked to touch his/her toes while keeping the knees straight. If the distance of the two points do not increase by at least 5 cm (with the total distance greater than 20 cm), then this is a sign of restriction in the lumbar flexion.

3. Delmas ruler

Delmas ruler, being similar to caliper, is made in Iran, Center of research and studies of physical education of Ministry of Education. This ruler is applied to measure height of spinal cords in an erect position. This ruler is exclusively used to measure distance between C1 and S1, and is capable of setting to one meter. This ruler is a scaled drawer-shaped tool. Its handles are in touch with body.

4. Volume of chest expansion

The amount of stretch of thorax is one factor which is affective in the amount of entering air to lungs. People with congenital abnormalities in chest, sternum and ribs generally face with inappropriate breathing conditions, while people with big thorax and more thoracic area would have higher volumes of breathes. To determine fullness of lungs, physical maneuvers with no bodily attacks can be applied, which in fact is a kind of measuring dimensions of human's body. The most common method of calculating area of thorax is by tape measure, in which difference of this area between full inhale and exhale is considered as maximum performance of breathing apparatus.



5. Weight and height

To determine weight and height of participants, a digital scale (Soehnle, made in West Germany) equipped with an index for measuring height was applied. Accuracy of height index was 0.5 cm and for scale was 0.01 kg. First, bascule is set on zero and then the testers are asked to stand in center of bascule with balanced feet. After that, they are asked to look forward and tester records the final score after three seconds of pause. To measure weight, testers stand on scale barefoot and with lightest clothes. To specify height, a stable measure tape hung on the wall and a line gauge were utilized. For this, tested stands barefoot, weight is distributed equally, head is parallel to horizontal line, and after a normal exhale, the height of tested is measured from sole to the highest point of head.

Procedures Design

Statistical society consisted of national athletes of volleyball in Iran. Volleyball players, having two years of participating in national & international competitions were recruited in this study. None of them have records of operation in spinal cords, chronic backache, deformity, asthma, smoking, special disease or fracture. To determine sample volume, 30 persons were selected using convenient and purposeful method for every sport field. First, an invitation was sent to all persons, and tester explained method of testing and physical examination. The tastes were assured about confidentiality. the method of study is comparative-causative. Moreover, it is applicational in purpose and retrospective in time. The reason of using this method was identifying age and task differences in terms of body composition as well as physiological, physical and anthropometric characteristics. The angle of lumbar lordosis was measured with a flexible ruler via Youdas (1996) method . The subject remained in the normal standing posture while lordatic angle was measured. The flexible curve was pressed against the spinous processes of the lumbosacral spine, and the points that intersected the adhesive markers were recorded. The points that intersected L1 and S2 were marked, and a line was drawn between them. These two measurements were used to calculate Theta (θ), an index

of lordosis, (Figure 1), using the following formula: $\Theta = 4[\text{Arctan}2H/L]$
 Θ = The index of lordosis, L = the length of the curve and H= the height of the curve.



Youdas JW, Garrett TR, Harmsen S, et al. Lumbar lordosis and pelvic inclination of asymptomatic adults. *Phys Ther.* 1996;76:1066–1081.

Statistical Tests of the Study

In these process to find the incidence and prevalence of injuries data will be summarized, and statistical techniques i.e. Mean, Standard

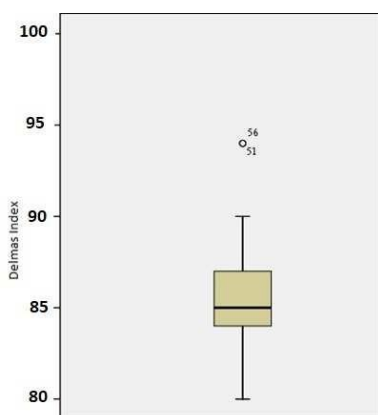
Deviation, Percentage, t-ratio will be used to comprise the data and to classify the kind and character, position, side, reason of damage, season, work out, position etc. likewise appropriate statistical software like Microsoft office excel and SPSS will be used for the analysis of data.

Statistical analysis

To determine the normal distribution of variables Kolmogorav-Smirnov test (KS) as used. statistical techniques i.e. Mean, Standard Deviation, Percentage, t-ratio will be used to comprise the data and to classify the kind and character. The statistical methods used for data analysis were independent t-test and Pearson correlation. The level of significance in all statistical tests was considered as $\alpha = 0.05$.

Mean of height, weight and age of volleyball players

Age (year)	Weight (kg)	Height (cm)
23/90	70/17	186/21



Kolmogorov normal distribution test for volleyball player's Delmas

Hypothesis: There is a significant relation between curvature of spinal column and volume of chest expansion among volleyball players.

Table 1: results of Pearson correlation coefficient (relation between curvature of spinal column and volume of chest expansion among volleyball players)

Measured item	frequency	r	Level of significance
curvature of spinal column and volume of chest expansion	30	-0/39	0/03

RESULTS

According to results, observed r at $\alpha = 0.05$ represents a negatively significant correlation between curvature of spinal column with volume of chest expansion in volleyball players. (Table 1).

DISCUSSION

The sagittal curvature at the surface of the sagittal, known as lordosis and kyphosis, forms the entire postural of the individual and provides equilibrium for body's center of gravity. Abnormal curvature at sagittal surface has a destructive effect on the joints of the lumbar spine, knees and legs. Watson says that the curvature of the spine tends to match and coordinate. Naturally, age and its evolutionary changes affect the entire system of the system, that is, muscles, tendons, ligaments and bones. In addition, improper working conditions contribute to increasing body orientation towards these changes. Lumbar lordosis has the largest share of sagittal balance (Whyte et. al. , 2015). The results of this study indicate that there is no significant difference between the volume of chest expansion of elite Volleyball players and non-athletes. Volleyball exercises do not play a role in maximizing maximum oxygen consumption due to the use of an anaerobic energy system. On the other hand, we know that the high oxygen consumption of individuals shows their endurance capacity, which is achieved using a high repetition practice and low resistance. Therefore, VO_{2max} and, as a result, aerobic capacity have not increased in a low-repetition practice, as highlighted in Volleyball training exercises, it is expected that there is no significant difference between Volleyball players. Research by Lee (2001) and Haladay (2015) are consistent with the results of this research. Haladay attributes the reason for the lack of improvement in VO_{2max} , despite the increase in heart rate during exercise exercises, to the relatively

low VO₂ obtained by this form of exercise. On the other hand, one of the reasons for the oxygen equivalence of these players may be the existence of basic endurance training at the beginning of the competition season. The findings of this study are consistent with Ghorbani (2007), suggesting that spinal cords of athletes haven't natural curvature. The study of Volleyball players indicates that Volleyball players have more curvature. As previously mentioned, the probable cause of this can be lumbar lordosis in Volleyball players. The degree of statistical similarity observed in spine measurements is helpful in showing more effectiveness of Volleyball. The relationship between spinal curvature and pulmonary capacity have used the term patient. In fact, it should be said that those who have severe congenital spinal anomalies are negatively affected by these abnormalities in terms of respiratory system. On the other hand, the present study examined the spinal cord curvature at the sagittal surface and measured three cervical, chest and lumbar curvatures, while most studies have examined scoliosis and have reported that scoliosis has reduced lung capacity. The degree of curvature and degree of kyphosis and lordosis on respiratory capacity is still a matter of question. Moreover, assuming that the study has been done to study the cervical curvature and has integrated the cervical curvature with other curves, therefore, the low neck lordosis may affect on this relationship. This finding is inconsistent with findings of Peters, Leach, and Crohn research. The possible causes of this inconsistency include the different types of subjects, the measurement of other respiratory factors such as vital capacity, FVC, sex of subjects, and the test method and measurements. Also, the findings of the study are consistent with the findings of Rajabi et al. (2009), which have identified the nature of sport field in the amount of spinal curvature.

CONCLUSION

It seems that relation between maximum chest expansion and spinal curvatures is subject to higher levels of kyphosis and lordosis. Considering sensitivity of subject, it is desirable to use accurate computer techniques to examine it. Moreover, having the knowledge of high body fat of Volleyball players, it can be helpful to determine

the minimum and maximum body fat in Volleyball players and use it to establish a diet regime for losing weight.

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