

## RESPIRATORY FUNCTIONS OF VOLLEYBALL PLAYERS ACCORDING TO SPECIFIC PLAYING POSITIONS

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DOI: 10.26524/1338

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**ABSTRACT:** The purpose of the study was to compare the respiratory functions of volleyball players according to specific playing position. For this study, two hundred and forty male volleyball players (Blockers-68, Liberos-41, Setters-48, Spikers-83) of age ranging from 18-25 years were selected as subjects from various colleges and universities of North India. The purposive sampling technique was used to select the subjects. Respiratory functions were measured with computerized spirometer. One-way analysis of variance (ANOVA) was employed to compare the volleyball players among different playing positions. Following the detection of a significant main effect, Bonferroni's post-hoc analyses were performed to locate where specific mean differences were laid. Significance levels were set at  $p < 0.05$ . Results showed that there was no statistically significant difference observed for inspiratory capacity and vital capacity in the volleyball players among different playing positions. In case of inspiratory reserve volume and expiratory reserve volume, statistically significant difference was noticed in the volleyball players among different playing positions. Setters had significantly lower inspiratory reserve volume than the blockers and spikers. Expiratory reserve volume was highest in blockers and this was followed by spikers, liberos and setters respectively. These might be due to the variation in body height, body weight, sporting activity and specific playing position, which influence the respiratory functions.

**Keywords:** Respiratory functions, spirometer, volleyball players.

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### 1. INTRODUCTION

The physiological variables involved in sports performance have long been of interest to players, coaches, sport physiologists and sports scientists. From a physiological point of view, the respiratory function test, like other physiological tests must be of the utmost importance for measuring the fitness of an athlete [1]. An efficient respiratory system is required by the athlete for the increased energy demands, imposed by the rhythmic muscular efforts during exercise [2]. Physiologically, Volleyball is an intermittent sport that requires players to participate in frequent short bouts of high-intensity exercise, followed by periods of low-intensity activity [3, 4]. The high-intensity bouts of exercise, coupled with the total duration of the match (90 min), requires players to have well-developed aerobic and anaerobic alactic (ATP-CP) energy systems [4, 5]. High-intensity intermittent running has been shown to increase respiratory performance suggesting that intermittent exercise enhances the respiratory demand as well as it enhances the cardiac demand [6]. Respiratory function test is one of the most important tools to measure the levels of physical capacity of a population [7]. Physically fit athletes possess superior respiratory functions relative to less fit subjects [8, 9]. Respiratory functions increases by training depend upon the specific playing abilities, work style and the severity of the activity. In practice this sort of increase can be seen mainly types of games that require long-term durability performance.

Some studies showed that intense physical training made an impact for increasing the respiratory parameters [10-12]. Respiratory parameters vary from individual to individual and one of the important variables for establishing top class performance in volleyball as the game involves work of long duration. Increase in respiratory volumes and capacities depend on workloads of specific playing position or the intensity of the training programme and exercise. Therefore, the purpose of the study was to compare the respiratory functions of volleyball players according to specific playing positions.

## 2. MATERIALS AND METHODS

**2.1 Subjects:** The present study was conducted on two hundred and forty male volleyball players (Blockers-68, Liberos-41, Setters-48, Spikers-83) of age ranging from 18-25 years were selected as subjects from various colleges and universities of North India. The purposive sampling technique was used to select the subjects.

### 2.2 Methodology:

#### 2.2.1 Height and Weight:

Height measurements were taken by using the standard anthropometric rod (HG-72, Nexgen ergonomics, Canada) to the nearest 0.5 cm. Full attention given to make sure that players' body was fully upright and their mandible was parallel to the ground. Taken values recorded as „cm“. The subject's weights were measured with portable weighing machine to the nearest 0.5 kg. During measurements players were on bare feet and with underwear and measurements recorded as „kg“.

#### 2.2.2 Body Mass Index (BMI):

BMI was calculated by the formula of;  $\text{Body Mass Index} = \text{Weight}/\text{Height}^2$ .

#### 2.2.3 Measurements of Respiratory Functions:

Respiratory functions were measured with a computerized spirometer “Med-Spiror” following the procedures and predicted values recommended by the American Thoracic Society. Before recording the respiratory function tests, subjects were shown a demonstration of the tests. It was made sure that subject's vital capacity was measured when the subject was exhaling with maximal speed and effort. Consequently, a minimum of three readings were recorded of each test for every subject and the best of the three was considered for having reproducibility and validity of the recorded test. The Respiratory indices like, vital capacity (VC), expiratory reserve volume (ERV), inspiratory reserve volume (IRV) and inspiratory capacity (IC) were taken into consideration for this study.

### 2.3 Statistical analysis:

Values are presented as mean values and SD. One-way analysis of variance (ANOVA) was employed to compare the volleyball players among different playing positions. Following the detection of a significant main effect, Bonferroni's post-hoc analyses were performed to locate where specific mean differences were laid. Data was analyzed using SPSS Version 16.0 (Statistical Package for the Social Sciences, version 16.0, SPSS Inc, Chicago, IL, USA).

### 3. RESULTS

**Table 3.1: demographic characteristics of volleyball players according to specific playing positions..**

Variables		Blockers (N=68)	Liberos (N=41)	Setters (N=48)	Spikers (N=83)
Height (cm)	Mean	186.66	174.65	177.66	186.24
	S.D.	7.03	5.49	4.81	6.436
Body Weight (kg)	Mean	75.14	63.95	69.06	74.39
	S.D.	7.21	7.33	8.59	8.41
Body Mass Index (kg/m <sup>2</sup> )	Mean	21.60	20.95	21.85	21.43
	S.D.	2.15	2.19	2.39	2.07

**Table 3.2: Difference among positions in respiratory functions of volleyball players.**

Variables		Blockers (N=68)	Liberos (N=41)	Setters (N=48)	Spikers (N=83)	F-Value
Vital Capacity (L)	Mean	4.71	4.39	4.45	4.61	1.44
	S.D.	0.86	0.76	1.04	0.85	
Inspiratory Reserve Volume (L)	Mean	2.18	2.01	1.85	2.17	5.04**
	S.D.	0.56	0.47	0.44	0.52	
Expiratory Reserve Volume (L)	Mean	1.69	1.66	1.45	1.69	3.87*
	S.D.	0.49	0.34	0.33	0.46	
Inspiratory Capacity(L)	Mean	3.05	2.92	2.87	2.92	2.13
	S.D.	0.41	0.38	0.37	0.45	

\* indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$

The respiratory functions of the volleyball players among different playing positions are given in table-3.2 and fig. 3.1. The post-hoc values of physiological variables of the volleyball players among different playing positions are presented in the table-3.3. No statistically significant difference was observed for inspiratory capacity and vital capacity in the volleyball players among different playing positions. Inspiratory reserve volume ( $F=5.04$ ) was significantly different in the volleyball players among different playing positions. In case of expiratory reserve volume ( $F=3.87$ ), statistically significant difference was noticed in the volleyball players among different playing positions.

**Table 3.3: Bonferroni's post-hoc values of positional differences in respiratory functions of the volleyball players.**

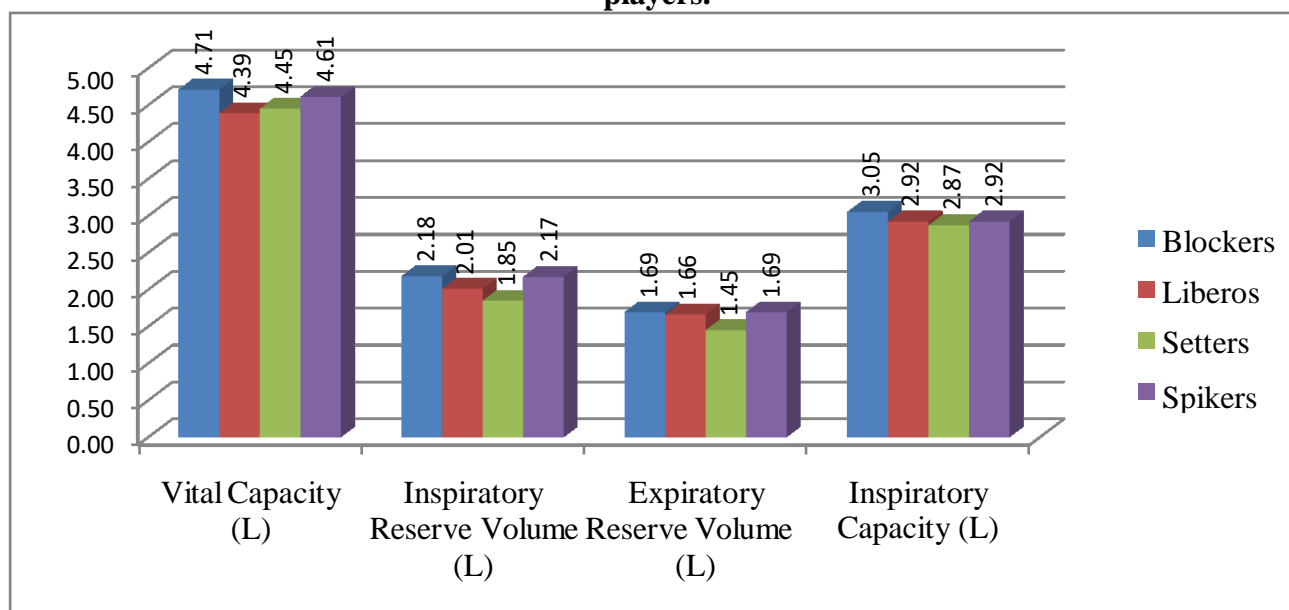
Variables	Mean Difference					
	Blocker Vs Liberos	Blockers Vs Setters	Blockers Vs Spikers	Liberos Vs Setters	Liberos Vs Spikers	Setters Vs Spikers
Expiratory Reserve Volume (L)	0.031	0.243*	0.0002	0.211*	0.032	0.243*

<b>Inspiratory Reserve Volume (L)</b>	0.170	0.326*	0.013	0.156	0.156	0.313*
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\* indicates  $p < 0.05$

Post-hoc analysis revealed that setters had significantly lower expiratory reserve volume than the blockers, spikers and liberos. Inspiratory reserve volume was highest in blockers and this was followed by spikers, liberos and setters respectively. Post-hoc analysis revealed that setters had significantly lower inspiratory reserve volume than the blockers and spikers.

**Fig. 3.1: Mean respiratory functions among different playing positions of the volleyball players.**



#### 4. DISCUSSION

The current study was designed to compare the respiratory functions, including vital capacity (VC), expiratory reserve volume (ERV), inspiratory reserve volume (IRV) and inspiratory capacity (IC) of volleyball players according to playing positions. This study has examined whether doing sports and specific playing position of sports had an impact on respiratory functions in players who are in the same age group. Results of the study indicated that no statistically significant difference was observed for inspiratory capacity and vital capacity in the volleyball players among different playing positions. On the other hand significant differences were reported in inspiratory reserve volume and expiratory reserve volume among different playing positions of volleyball players. The results of the present study are in contrast to those of Hagberg (1988) [13], and are in line with the findings reported by Cordain (1990) [14]. The vital capacity of volleyball players in the present study is greater than the Nigerian athletes studied by the Adegoke and Arogundade (2002) [15], but lower than that of elite European road cyclists (5.91 L) studied by the Vrijens et al. (1982), and top South African squash players (6.32 L) [16]. These differences may be the result of differences in the sporting activity and levels of training. In this study post-hoc analysis revealed that setters had significantly lower expiratory reserve volume than the blockers, spikers and liberos and Inspiratory reserve volume was significantly different in the volleyball players among different playing positions. Expiratory reserve volume was highest in blockers and this was followed by spikers, liberos and setters respectively. Greater values of expiratory reserve volume among the blockers and spikers could be explained due to better strengthening of respiratory muscles as a result of strenuous physical training and sporting activity. According to this study it was found out that specific playing position of volleyball players had an impact on respiratory functions. We can consider that during the volleyball game, Blockers and spikers do not repeat running movements as

well as liberos and setters, mostly they repeat jumping movements and there might be differences in physiological characteristics of the subjects in the subject group. This indicated that training has a positive impact on the respiratory functions. Results from the present study strongly suggest that the intensity or severity of the specific position engaged in by the players probably determines the extent of strengthening of the respiratory muscles which result in the increase in the respiratory functions. There might be increase in the maximal shortening of the inspiratory muscles as an effect of training, which has been shown to improve the respiratory function parameters [17].

## 5. CONCLUSION

On the basis of findings, the conclusion made in this study that there were significant differences among playing positions of volleyball players for inspiratory reserve volume and expiratory reserve volume. Therefore this study suggest that sports activity, playing position and training may cause an increase in the respiratory functions which could be due to increased development of respiratory musculature incidental to physical training or exercise. Furthermore, the differences that were found in the respiratory functions between different playing positions have shown that playing positions of volleyball players has an impact on respiratory capacity.

## 5. ACKNOWLEDGEMENTS

Sincere thanks to Team-Managers and Coaches who extended their enthusiastic co-operation in collecting the necessary data and to all those volleyball players without whom this research was not possible. We acknowledge the immense help received from the scholars whose articles are cited and included in references of this paper. We are also grateful to authors/editors/publishers of all those articles, journals and books from where the literature for this paper has been reviewed and discussed.

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