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## A comparative study of selected physiological variables among basketball, handball and football players

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### Abstract

**Objective:** To compare the physiological variables among Basketball, Handball and Football players, i.e. Vital Capacity, Breath Holding Capacity and Resting Heart Rate were considered as research variables.

**Methods:** The total numbers of 75 subjects (25 each from Basketball, Handball, and Football) were selected from different districts of Chhattisgarh. The age group ranged between 20 to 25 years. Who were attend the national level tournaments. While selecting the variables, the literature and the opinions of the experts, test conduction facilities, availabilities of the equipment's, etc. were taken into consideration. The physiological variables Vital Capacity, Breath Holding Capacity and Resting Heart Rate were taken into consideration. The data was collected for each variable. The players were consulted personally and their sincere co-operation shall be solicited subjects or players were called at Chhattisgarh. For testing necessary instruction was given to the subject prior to the administration of the test for each variable. As soon as the instructions were clearly understood by them, players were asked to complete the particular test.

**Results:** The result of the study reveals that there was a significant difference in the mean score of vital capacity among selected national level basketball, handball and football players. The result of the study reveals that there was an insignificant difference in the mean score of breath holding capacity among Selected national level basketball, handball and football players. The result of the study reveals that there was a significant difference in the mean score of Resting Heart Rate among Selected national level basketball, handball and football players.

**Keywords:** Vital capacity, breath holding capacity and resting heart rate

### Introduction

Physiology is the branch of biology dealing with the functions and activities of living organisms and their part, including all physical and chemical processes. Exercise Physiology is the study of how exercise changes the function and structure of the body. Exercise Physiology is what happens to the body as it exercises a single time, how these changes are brought about, what changes in function occur after repeated sessions of exercise and how these changes come to pass, and finally, what can be done to improve the body's response to exercise and its adaptation to training. It is the identification of physiological mechanisms underlying physical activity, the comprehensive delivery of treatment services concerned with the analysis, improvement, and maintenance of health and fitness, rehabilitation of heart disease and other chronic diseases and/or disabilities, and the professional guidance and counsel of athletes and others interested in athletics, sports training and human adaptability to acute and chronic exercise.

Physiology is the study of how human body functions Physiologists study the various characteristics of living things. Their studies range from the most basic unit of organism, the cell, to the more complex organs and organ systems such as the brain and respiratory systems. In physiology we study how different parts of organs of an organism work together to achieve a particular function in our body, for example, the digestion of food involves the action of hormones and other chemicals produced by the stomach, liver and pancreas, Muscle contraction occurs through the action of chemical massages produced by nerves that supply the muscles. If we learn how the body functions normally, then we can understand what happens when organs function abnormally and we can take care of our body.

Team sports include any sport which involves players working together towards a shared objective. A team sport is an activity in which a group of individuals, on the same team, work together to accomplish an ultimate goal which is usually to win. This can be done in a number of ways such as outscoring the opposing team. Team members set goals, make decisions, communicate, manage conflict, and solve problems in a supportive, trusting atmosphere in order to accomplish their objectives. This can be seen in sports such as, football, basketball, handball, hockey, volleyball, tennis, water polo, rowing, rugby, cricket and many others.

## Methodology

### Selection of Subjects

The total numbers of 75 subjects (25 each from Basketball, Handball, and Football) were selected from different districts of Chhattisgarh. The age group ranged between 20 to 25 years. Who were attend the national level tournaments.

### Selection of Variables

To compare the physiological variables among Basketball, Handball and Football players, i.e. Vital Capacity, Breath Holding Capacity and Resting Heart Rate were considered as research variables.

While selecting the variables, the literature and the opinions of the experts, test conduction facilities, availabilities of the equipment's, etc. were taken into consideration. The physiological variables Vital Capacity, Breath Holding Capacity and Resting Heart Rate were taken into consideration.

### Criterion Measures

The following Criterion measures were used in the study are shown as follows:

**Table 1:** Criterion Measures Used for Measuring the Selected Physiological Variables

SL. No.	Name of Variables	Tools/Test/Equipment Used	Unit
1.	Vital Capacity	Dry Spiro Meter	Liters
2.	Breath Holding Capacity	Manual Method	Seconds
3.	Resting Heart Rate	Manual Method	Numbers/Counts

### Administration of Test and Collecting of data

The data was collected for each variable. The players were consulted personally and their sincere co-operation shall be solicited subjects or players were called at Chhattisgarh. For testing necessary instruction was given to the subject prior to the administration of the test for each variable. As soon as the instructions were clearly understood by them, players were asked to complete the particular test.

### Administration of the Test

#### 1) Vital Capacity

**Objective:** The purpose of this test to find out the maximum quantity of air that can be expired after a full inspiration.

**Equipment's:** Spirometer, Scoresheet, Mouth pieces and Nose clips.

**Description:** Vital capacity will be measured by Spirometer in liters. The Spirometer will be equipped with a good length of rubber hose. The Spirometer placed at a height where by all the subject can stand erect at the beginning of the test. The mouth piece will disinfected by an antiseptic solution after

use by each subject. The subjects will be asked to take a deep breath for test: There after the fullest possible inhalation, the subject exhale slowly and steadily bending forward over the nose till the air within his control will be expelled. Care will take to prevent air from escaping either through nose or around the edges of mouth piece and will also ensure that a second breath will not take by the subject during the test. In case of doubt the test will be repeated. Care will take to lower the drum without spilling the water, each time after use.

**Scoring:** The score will be taken from the dial of the Spirometer which will be recorded in liters

#### 2) Breath Hold Capacity

**Objective:** To measure the ability of the subjects to hold the breath for longer time.

**Equipment's:** A stop watch with calibration of 1/10 seconds, Score sheet and a pencil will be used to administer the test.

**Description:** The subject stands at ease and inhale and exhale deeply after which he holds his breath for a length of time possible to him. The index finger of the respondent serves as an indicator for the investigator to know the start and end of the recording time. The thumb and center finger will be used to hold the nose to avoid letting the air through the nostrils. The subjects will be requested not to let the air out by opening the mouth while recording the Breath holding time. The time of holding the breath till the subject let the air out will clocked by using the stop watch to the nearest one tenth of a second will be recorded as Breath holding time (Astrand and Rodahl, 1977).

**Scoring:** With the help of the stop watch, the best time-out of two trails will be recorded as the individuals score

#### 3) Resting Heart Rate

**Objective:** To measure the Resting Heart Rate.

**Equipment:** Stop Watch

**Description:** The Resting Heart Rate of each of the subjects was recorded between 6.00 A.M. and 7.00 A.M. Before recording the Resting Heart Rate, the subjects were instructed to remain lying on their bed. To record Resting Heart Rate, the pulse rate was recorded by palpation at the radial artery for one minute.

**Score:** The score was expressed in terms of number of pulse beats per minute.

## Results and Observation

**Table 2:** Descriptive Statistics of Vital Capacity (Liters) in Relation to Selected Basketball, Handball and Football Players

Groups	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Basketball	25	5.07	.54	.10830	4.25	6.12
Handball	25	4.35	.65	.13152	3.45	5.36
Football	25	4.46	.71	.14264	3.25	5.89
Total	75	4.62	.70	.08169	3.25	6.12

The above mentioned table no. 2 reflected that the mean and standard deviation of Vital capacity (Liters) in relation to national level basketball is 5.07 and .54. The mean and standard deviation of Vital capacity (Liters) in relation to

national level handball is 4.35 and 65. The mean and standard deviation of Vital capacity (Liters) in relation to national level football is 4.46 and .71.

**Table 3:** Analysis of variance of the means of players of selected basketball, handball and football players in relation to vital capacity

Source of Variance	Sum of Squares	DF	Mean Square	F
Between Groups	7.416	2	3.708	9.012*
Within Groups	29.624	72	.411	
Total	37.040	74		

Critical F-Value = 9.012

\*Significant at 0.05 level. Tab F .05 (2, 72) =3.12

It is evident from table no. 3 that F-value 9.012 which is significant at 0.05 level with degree freedom (2,72) calculated value is higher than tabulated value 3.12. It's indicated that there is significant difference in the mean score of vital capacity among selected basketball, handball and football players.

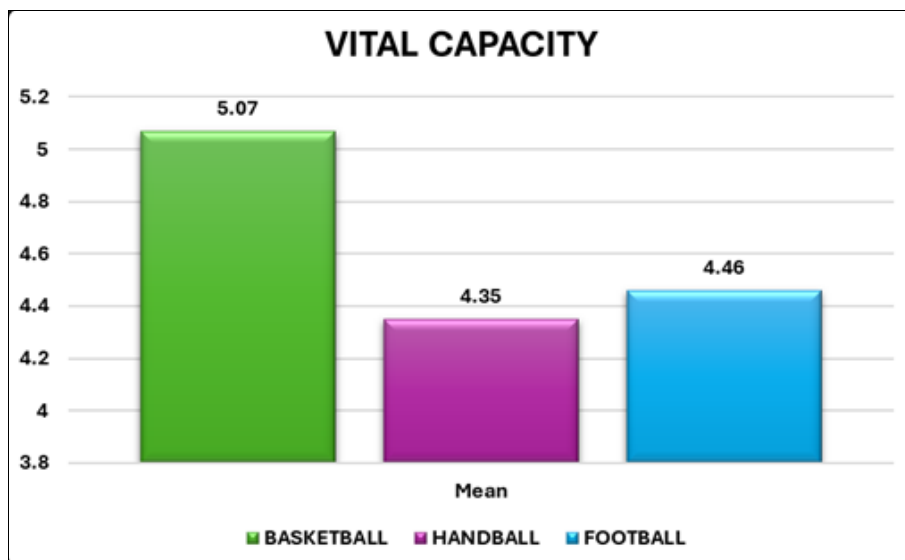
Since, F-ratio is found significant. Least Significance

Difference (L.S.D.) Post-Hoc test is employed to find out the paired mean difference among selected basketball, handball and football players. It has been shown in Table 4.

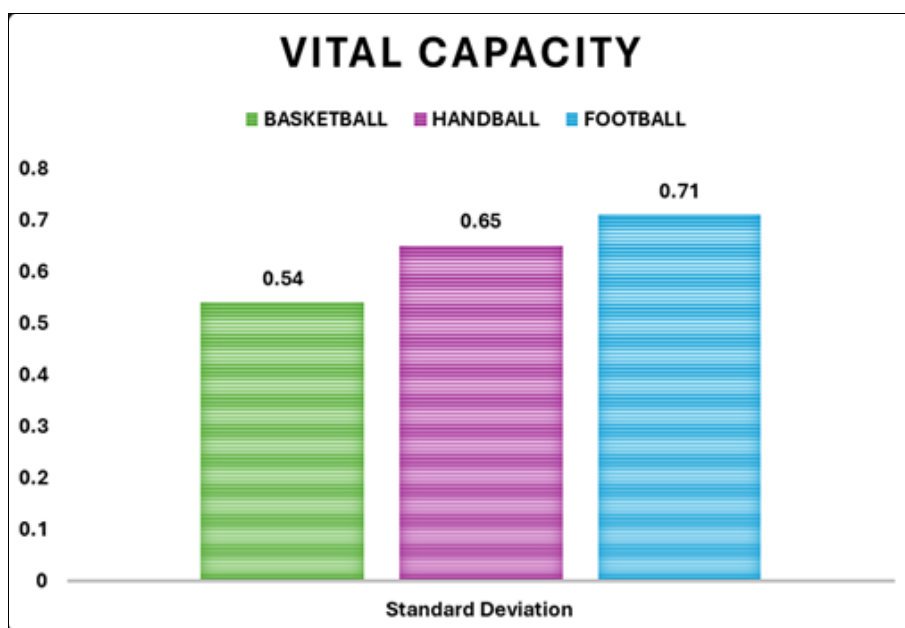
**Table 4:** Analysis of Least Significant Difference (LSD) post-hoc test among basketball, handball and football players in relation to vital capacity

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.
Basketball	Handball	71400*	18143	.000
	Football	60720*	18143	.001
Handball	Football	-10680	18143	.558

From the Table 4, it shows that there are significant differences on Vital Capacity when compared between: Basketball and Handball (0.000) and basketball and Football (0.001) since their significant values are less than 0.05 level of significance. And, it shows there is no significant on Vital Capacity difference when compared between: Handball and Football (0.558) since their significant values are more than 0.05 level of significance.



**Fig 1:** Mean difference of selected basketball, handball and football players in relation to vital capacity



**Fig 2:** Standard deviation difference of selected basketball, handball and football players in relation to vital capacity

**Table 5:** Descriptive statistics of breath holding capacity (seconds) in relation to selected basketball, handball and football players

Groups	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Basketball	25	59.80	8.25	1.65126	44.00	80.00
Handball	25	60.64	7.18	1.43745	44.00	80.00
Football	25	61.76	8.80	1.76095	48.00	78.00
Total	75	60.73	8.04	92849	44.00	80.00

The above mentioned Table 5 reflected that the mean and standard deviation of breath hold (seconds) in relation to selected basketball is 59.80 and 8.25.

The mean and standard deviation of breath hold (seconds) in relation to selected handball is 60.64 and 7.18. The mean and standard deviation of breath hold (seconds) in relation to selected football is 61.76 and 8.80.

It is evident from Table 6 that F-value 0.367 which is

insignificant at 0.05 level with degree freedom (2,72) calculated value is less than tabulated value 3.12. It's indicated that there is insignificant difference in the mean score of breath holding (seconds) among selected basketball, handball and football players.

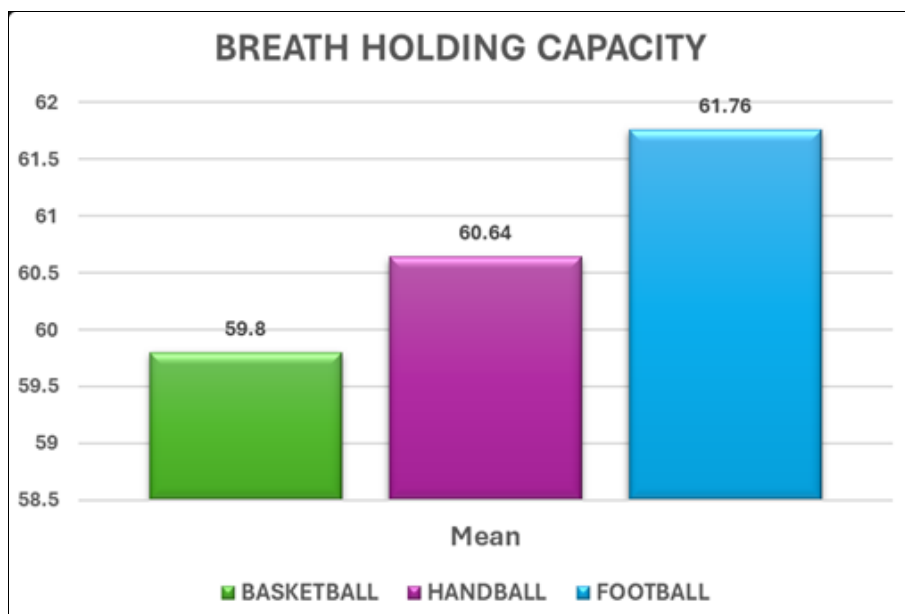
Since the F-value was found to be insignificant, the Post Hoc Test was not applied for inter-group comparison.

**Table 6:** Analysis of variance of the means of players of selected basketball, handball and football players in relation to breath holding capacity (Seconds)

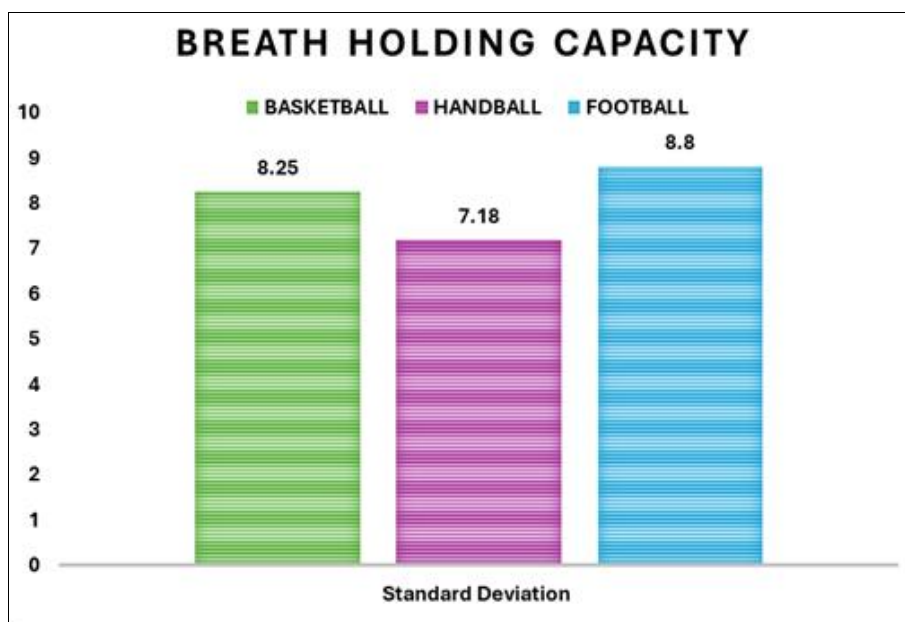
Source of Variance	Sum of Squares	DF	Mean Square	F
Between Groups	48.347	2	24.173	.367
Within Groups	4736.320	72	65.782	
Total	4784.667	74		

Critical F-Value = .367

\*Significant at 0.05 level. Tab F .05(2, 72) =3.12



**Fig 3:** Mean difference of selected basketball, handball and football players in relation to breath holding capacity



**Fig 4:** Standard deviation difference of selected basketball, handball and football players in relation to breath holding capacity

**Table 6:** descriptive statistics of resting heart rate (numbers/counts) in relation to selected basketball, handball and football players

Groups	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Basketball	25	64.32	1.31	26281	62.00	68.00
Handball	25	67.64	1.65	33106	64.00	70.00
Football	25	64.84	3.71	74315	52.00	69.00
Total	75	65.60	2.84	32825	52.00	70.00

The above mentioned Table 6 reflected that the mean and standard deviation of resting heart rate (Numbers/Counts) in relation to selected basketball is 64.32 and 1.31. The mean and standard deviation of resting heart rate (Numbers/Counts) in relation to selected handball is 67.64 and 1.65. The mean and standard deviation of resting heart rate (Numbers/Counts) in relation to selected football is 64.84 and 3.71.

**Table 7:** Analysis of variance of the means of players of selected basketball, handball and football players in relation to resting heart rate (numbers/counts)

Source of Variance	Sum of Squares	DF	Mean Square	F
Between Groups	159.440	2	79.720	13.088*
Within Groups	438.560	72	6.091	
Total	598.000	74		

Critical F-Value = 13.088

\*Significant at 0.05 level. Tab F .05(2, 72) =3.12

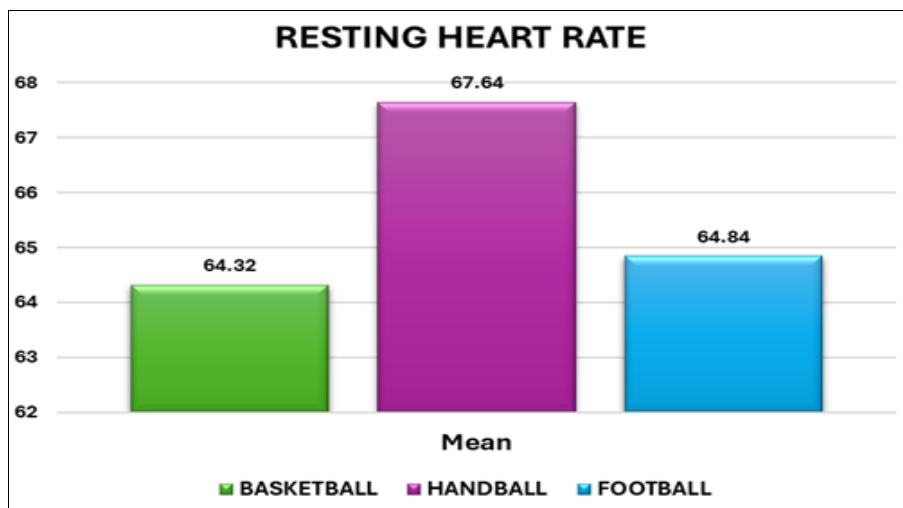
It is evident from Table 7 that F-value 13.088 which is significant at 0.05 level with degree freedom (2,72) calculated value is higher than tabulated value 3.12. It's indicated that there is significant difference in the mean score of resting heart rate (numbers/counts) among selected basketball, handball and football players.

Since, F-ratio is found significant. Least Significance Difference (L.S.D.) Post-Hoc test is employed to find out the paired mean difference among selected basketball, handball and football players. It has been shown in Table 8.

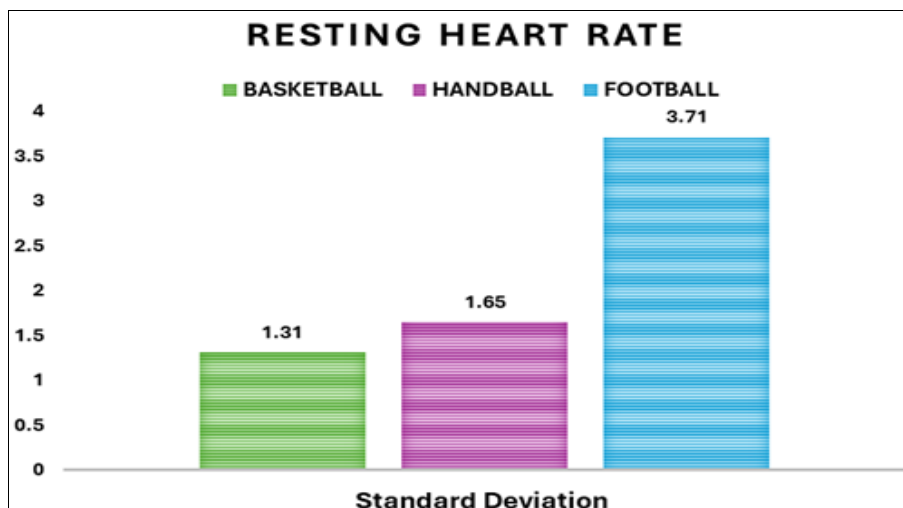
**Table 8:** Analysis of least significant difference (LSD) post-hoc test among basketball, handball and football players in relation to resting heart rate

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.
Basketball	Handball	-3.32000*	.69806	.000
	Football	-.52000	.69806	.459
Handball	Football	2.80000*	.69806	.000

From the Table 8 it shows that there are significant differences on resting heart rate when compared between: Basketball and Handball (.000) and handball and Football (.000) since their significant values are less than 0.05 level of significance. And, it shows there is no significant on resting heart rate difference when compared between: basketball and Football (.459) since their significant values are more than 0.05 level of significance.



**Fig 5:** Mean difference of selected national level basketball, handball and football players in relation to resting heart rate



**Fig 6:** Standard deviation difference of selected basketball, handball and football players in relation to resting heart rate



### Discussion of the Findings

Based on the outcome of the present study the following conclusion was drawn.

- The result of the study reveals that there was a significant difference in the mean score of vital capacity among selected national level basketball, handball and football players. The reported mean scores and standard deviation of Vital capacity (Liters) in relation to national level basketball is 5.07 and .54. The mean and standard deviation of Vital capacity (Liters) in relation to national level handball is 4.35 and .65. The mean and standard deviation of Vital capacity (Liters) in relation to national level football is 4.46 and .71.
- The result of the study reveals that there was an insignificant difference in the mean score of Breath Holding Capacity among Selected national level basketball, handball and football players. The reported mean scores and standard deviation of breath hold capacity (seconds) in relation to selected basketball is 59.80 and 8.25. The mean and standard deviation of breath hold capacity (seconds) in relation to selected handball is 60.64 and 7.18. The mean and standard deviation of breath hold capacity (seconds) in relation to selected football is 61.76 and 8.80.
- The result of the study reveals that there was a significant difference in the mean score of Resting Heart Rate among Selected national level basketball, handball and football players. The reported mean scores and standard deviation of resting heart rate (Numbers/Counts) in relation to selected basketball is 64.32 and 1.31. The mean and standard deviation of resting heart rate (Numbers/Counts) in relation to selected handball is 67.64 and 1.65. The mean and standard deviation of resting heart rate (Numbers/Counts) in relation to selected football is 64.84 and 3.71.

### Conclusion

The comparative study on the selected physiological variables among basketball, handball, and football players revealed significant differences in vital capacity and resting heart rate, while no significant differences were found in breath-holding capacity. Basketball players exhibited the highest vital capacity, followed by football and handball players, highlighting sport-specific physiological demands. Similarly, resting heart rate varied significantly between these groups, with handball players showing the highest rates. These findings emphasize the importance of tailored training regimens to meet the distinct physiological needs of athletes in different sports, particularly in enhancing cardiovascular fitness and respiratory function.

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