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COMPARISON OF VO_2 MAX AMONG HOCKEY FOOTBALL AND BASKETBALL PLAYERS

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ABSTRACT

Purpose: This study aimed to compare the maximal oxygen consumption (VO_2 max) among male college athletes specializing in Hockey, Basketball, and Football to determine if sport-specific demands led to significant differences in aerobic capacity. **Methods:** Forty-five healthy male students (age 20–24 years) from the Lakshmibai National Institute of Physical Education, NERC, were randomly selected (n=15 per sport). VO_2 max was estimated using the Åstrand Step Test, involving a six-minute stepping exercise on a 40cm bench at a rate of 30 steps per minute. Body weight and post-exercise heart rate were used to calculate aerobic capacity through the Åstrand-Ryhming nomogram. Data were analyzed using descriptive statistics and one-way ANOVA with significance level set at 0.05. **Results:** The mean VO_2 max values were **2.79 ± 0.56 L/min** for hockey players, **2.89 ± 0.60 L/min** for basketball players, and **2.87 ± 0.59 L/min** for football players. The ANOVA revealed no statistically significant differences between the groups ($F = 0.123$, $p = 0.885$). **Conclusion:** The findings indicate that VO_2 max levels were similar across all three sports within this specific population. This lack of differentiation is attributed to the subjects' shared residential environment, including identical daily routines, communal nutritional intake, and synchronized physical education training schedules, which likely resulted in a uniform baseline of cardiovascular fitness.

KEYWORDS: VO_2 max, Aerobic Capacity, Åstrand & Åstrand Step Test, Field Hockey, Basketball, Football.

INTRODUCTION

VO_2 max also known as aerobic capacity is an important element of success in sports achievement. VO_2 max is an important physiological basis of physical capacity that enhances metabolic activity to meet the demand of physical work. The metabolic process here means the chemical reactions occurring inside the body which includes breakdown of nutrients, release energy in the form of ATP and supply of this energy to muscles for contraction. So, it is said that metabolic process is transformation of chemical energy into mechanical energy. The aerobic capacity refers to the body's ability to take in oxygen, transport it through blood and use it in the muscles to produce energy. So, the aerobic capacity (VO_2 max) represents the general level of metabolic process in the body when oxygen is used for energy production. VO_2 max can be defined as maximum amount of oxygen an organism consumes per unit time during exercise with increase in intensity and which cannot be further increased with further rise in exercise intensity. Many authors consider VO_2 max as the best indicator of aerobic capacity of an organism. It is also the best indicator of physical capacity of an athlete, i.e. the functional capacities of cardiovascular and respiratory system. The basic unit for measuring VO_2 max is in liters or milliliters of oxygen per minute **(Ranković et al., 2010).**

The highest quantity of oxygen that a person can consume during vigorous activity is known as their VO_2 max, or maximal oxygen absorption, frequently employed as a measure of aerobic endurance. It is a

useful baseline for assessing our levels of aerobic fitness. To help us stay healthy throughout our lives, it is worthwhile to track in order to identify and maintain a good or better VO_2 max score **(Kim et al., 2016).** VO_2 max tends to decrease with age, although this reduction can be significantly slowed with regular exercise **(Fleg et al., 2005; Kim et al., 2016).** Two primary categories of VO_2 Max measurements exist: Absolute and Relative **(Kim et al., 2016).**

VO_2 max plays a very important role in field hockey because the game is physically demanding and involves repeated high-intensity movements such as sprinting, changing direction, and quick recovery. Since players constantly switch between intense activity and short rest periods, both aerobic and anaerobic energy systems are required. A higher VO_2 max helps players to keep performing at a high level for a longer time, recover more quickly between efforts, and maintain their speed and work rate throughout the match. This capacity can be effectively developed through endurance training methods like interval training and fartlek training **(Spencer et al., 2005).**

As in Basketball, VO_2 max plays helps players maintain energy, recover quickly between intense efforts, and stay consistent throughout the game. Although many of the actions involved in Basketball like sprinting, jumping, and quick change of direction mostly rely on anaerobic energy, but the aerobic system supports all these efforts by helping restore energy and remove fatigue. Having higher VO_2 max allow players to perform continuous repeated high-intensity movements for longer duration without any major drop in performance. Therefore, both aerobic and anaerobic fitness both are essential for overall endurance and success in basketball **(K. Narazaki, 2009).**

In football performance, VO_2 max plays a key role as it reflects how efficiently a player can use oxygen to sustain effort during a match. Regular training methods like interval training can significantly improve VO_2 max leading to better endurance and overall fitness required during match. Therefore, coaches often use VO_2 max test to design for an effective training program and identify players who need extra conditioning **(Helgerud et al., 2001).**

METHODS

Selection of Subjects

Forty-five healthy college male students were randomly selected from Hockey, Basketball and Football (15 players from each game) of Lakshmibai National Institue of Physical Education, NERC, Guwahati to participate in this study. Age of the subjects were between 20-24 years.

Selection of Variable

VO_2 max (Maximal Oxygen Consumption) was selected by the researcher as variable for the present study.

Criterion measures

VO_2 max was determined by Åstrand & Åstrand Nomogram where body weight and heart rate was also measured after stepping.

Åstrand & Åstrand Nomogram

A workload, by bench stepping that would elicit a heart rate of between 125 and 170 beats per minute. The bench height is 40cm for males. The subject steps up and down on the platform of the tool at a rate of 30 steps per minute for 6 minutes. Subject started the test initially from standing position. The rhythm of the step was up-up, down-down. Stepping was started either with left leg or right leg and was continued throughout the test. The steps were counted when subject's both feet were placed on the platform of the tool. The participant continued stepping for a total duration of 6 minutes. The stepping pace was maintained as evenly as possible throughout the test. The subject immediately sat down on completion of the test and total number of pulse rate was counted for 15 seconds. Subjects' body weight was measured with weighing machine. Estimation of the subject's VO_2 max was done based on their pulse rate response to the exercise and body weight of the subject using the nomogram. The weight of the subject from weight scale of male is then joined with pulse rate value of the subject from pulse rate scale of male through a straight line. The line intersecting the VO_2 max scale at the point represents the VO_2 max of the subject **(Astrand & Ryhming, 2026).**

Statistical Analysis

To determine the comparison of VO_2 max of three different games, one-way ANOVA was used, the data analyzed with help of SPSS and the level of significance was set at 0.05.

RESULTS AND FINDINGS OF THE STUDY

The data collection of VO_2 max were treated by using descriptive analysis to find out the means, standard deviation and standard error as shown in table 1.

Table 1: Descriptive table of VO_2 max of male players of different games.

Game	N	Mean	SD	Std. Error	Min.	Max.
Hockey	15	2.79	0.56	0.15	1.8	3.8
Basketball	15	2.89	0.60	0.16	2.2	4.1
Football	15	2.87	0.59	0.15	1.9	3.9

Table 1 revealed the Descriptive statistics i.e. mean, standard deviation, standard error, minimum and maximum of male players of different games.

Table 2: Comparison of VO_2 max of male players of different games.

Analysis of Variance (ANOVA)					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.084	2	.042	.123	.885
Within Groups	14.368	42	.342		
Total	14.452	44			

Table 2 revealed that no significant differences were found among Hockey, Basketball and Football players of VO_2 Max because p value 0.885 ($p > 0.05$) was higher than 0.05. Therefore, VO_2 Max of Basketball, Football and Hockey players were found similar. The mean differences are graphically shown in figure 1

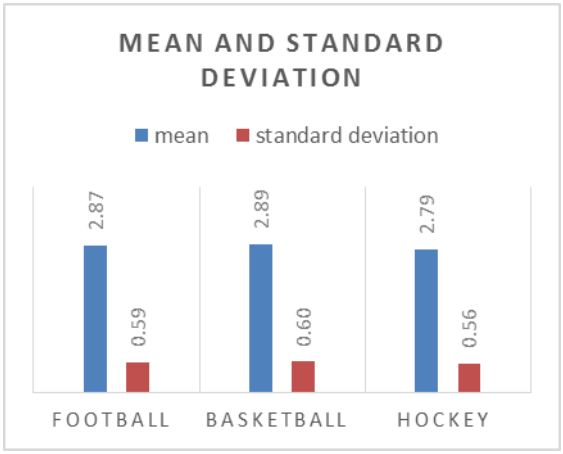

Figure 1: Graphical representation of mean of Hockey, Basketball and Football players.

DISCUSSION OF FINDINGS

In this study, the researcher evaluated the VO_2 Max among Hockey, Basketball and Football players and further investigated whether VO_2 Max differed among Hockey, Basketball and Football players. From the outcomes of the study, it was revealed that there was no significant difference among Hockey, Basketball and Football players may be because of the condition that in all three games, due to college routine and similar rest time and activities, they have similar homeostasis level. It is also to be noted that no students in the three different games does extra practice other than the college routine.

Other reasons for the no significant differences may be because of the similar diet and nutrition intake of the students of three different games basically from the hostel mess. It is also to be noted that no student's intake proper diet and nutrition according to the requirement of their particular games which might have negatively affected the performance of the students in three different games. Some reason may be because of the condition that they are students of the residential college which might have affected the circadian rhythm of the students due to which their training schedule might have impaired. Other reason may be because the students belong to physical education college, in which they are actively involved in different games which results in having similar fitness level.

Age group of all the selected subjects ranged from 19-21 years and they had more or less same fat percentage. Also, the students had to go for similar endurance training program which results in similar fitness level causing no significant differences found among the three different games. They had performed similar conditioning program throughout the year.

Result of this study was supported by a study on maximal oxygen consumption on different games Football, Hockey, Basketball and Handball players **(Bhagat & Thambal Singh, 2019).** In their study, insignificant differences of VO_2 Max between Football & Hockey and Handball & Basketball players were found. The insignificant differences of VO_2 Max might be due to similar nature or characteristics between the games of Football & Hockey, and Basketball & Handball in terms of movements, physical qualities, skills, psycho-physiological work intensities, strategies, similar dimension of the playing area, similar duration of game, system of play, training methods etc. Also, significant differences of VO_2 Max were found between Football & Basketball, Football & Handball, Hockey & Basketball, and Hockey & Handball players. The significant difference of VO_2 Max among the games might be due to the differences in nature of the games, dimension of the playing areas, duration the play, training and competition demands, physical and physiological demands etc.

Similarly in a study on comparison of selected physical and performance characteristics in University-Level Male Basketball, Football and Volleyball Players **(Koç et al., 2020)**, there were significant differences between the teams in Cooper test. Volleyball players had a higher cooper distance average than other sports teams. Max VO_2 of volleyball players was quite high compared to the other teams. Similarly, a was study conducted where 59 university level male players with age range 20-25, with variables taken from basketball, football and volleyball players, it was found that the highest Max VO_2 was within the football players **(Kumar Mishra et al., 2015)**. In a study with university-level male volleyball and football players found that the cardiovascular endurance of football players was higher than in volleyball players **(Bag et al., 2015)**. The above results

differ from each other. The reason for this may be that in their study, the students were not selected according to the team specific physical fitness criteria or their training was insufficient.

CONCLUSION

The primary objective of this study was to compare the VO_2 Max levels among university level male Hockey, Basketball, and Football players. On the basis of findings using statistical technique ANOVA, the following conclusions are drawn.

1. There was no statistically significant difference found in the VO_2 Max levels ($F=0.123$, $p>0.05$) among Hockey, Basketball and Football players.
2. The null hypothesis was failed to reject, confirming that the aerobic capacity across these three different games was similar within this specific population with Hockey players having mean of 2.79 ml/kg/min, Basketball players having mean of 2.89 and Football players having mean of 2.87.
3. The lack of variance is likely due to similar living conditions like routine, diet, and training among residential physical education students, which minimized sport-specific differences.

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