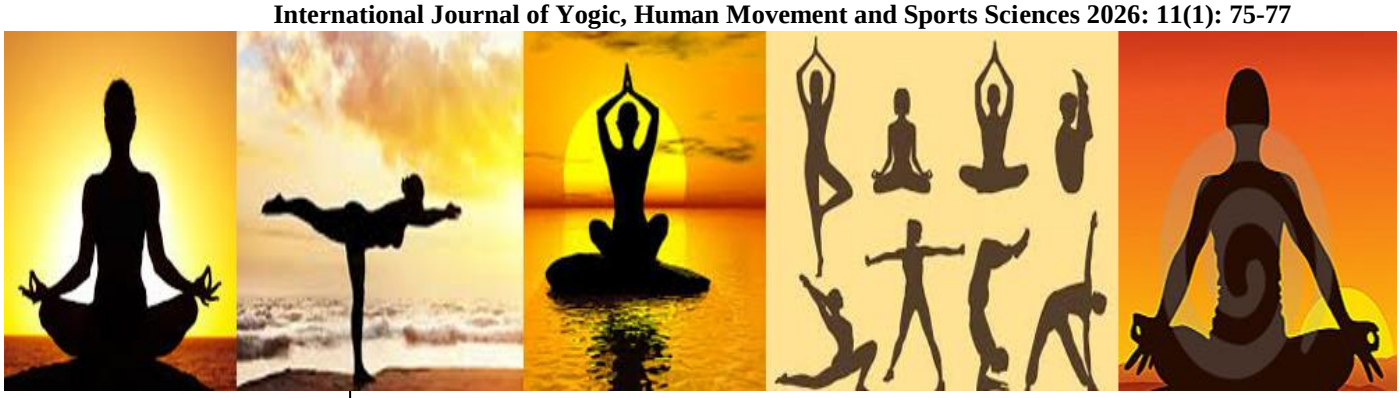

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Study of physiological variables among players of selected sports at Dr. Ram Manohar Lohia Avadh University, Ayodhya

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Abstract
The present study aimed to compare selected physiological variables namely resting heart rate, vital capacity, blood pressure, and maximal oxygen uptake (VO_2 max among players from four different sports disciplines: football, volleyball, cricket, and athletics. The sample consisted of 80 university-level male players (n = 20 per sport) from Dr. Ram Manohar Lohia Avadh University, Ayodhya. Physiological measurements were taken using standardized laboratory protocols. The results revealed significant inter-sport differences in cardiovascular and respiratory efficiency. Football and athletics players demonstrated superior VO_2 max and vital capacity compared to volleyball and cricket players. The findings underscore the importance of sport-specific physiological adaptations and provide insights for optimizing training strategies across disciplines.

Keywords: Physiological variables, VO_2 max, vital capacity, heart rate, blood pressure, university athletes

Introduction
Physiological variables are essential determinants of athletic performance and significantly influence success across many sports. Metrics like resting heart rate, vital capacity, blood pressure, and maximum oxygen uptake (VO_2 max) indicate the efficacy of the cardiovascular and respiratory systems, thus affecting endurance, recovery, and overall fitness. Every sport puts distinct physiological requirements on the body, resulting in sport-specific adaptations throughout time.

Studies demonstrate that aerobic sports, such as football and athletics, enhance cardiovascular endurance and pulmonary efficiency, while intermittent or skill-oriented sports like cricket and volleyball produce moderate physiological adaptations due to reduced aerobic demands (Astrand & Rodahl, 2003; Wilmore & Costill, 2004) [1, 6]. Singh *et al.* (2021) [4] assert that changes in training intensity and duration can lead to significant variances in VO_2 max and vital capacity across various sports disciplines, even among athletes of comparable age and background. Within Indian institutions, the physiological profile of athletes is a comparatively neglected domain. Dr. Ram Manohar Lohia Avadh University, Ayodhya, offers a diverse array of competitive sports programs, establishing it as an optimal setting for the examination of sport-specific physiological differences. Comprehending these distinctions is essential for enhancing training and recognizing athletes' strengths and possible areas for development. This study seeks to examine particular physiological variables resting heart rate, blood pressure, vital capacity, and VO_2 max among university athletes from various sports to elucidate sport-specific adaptations and performance characteristics.

Methodology
Participants
A total of 80 male university players aged between 18 to 25 years participated in the study. The subjects were equally divided into four groups based on their primary sport discipline:

- Football (n = 20)
- Volleyball (n = 20)
- Cricket (n = 20)
- Athletics (n = 20)

All participants were active members of their university teams and had a minimum of two years of training and competitive experience. Written informed consent was obtained from all participants before data collection.

Selection of Variables

The following physiological variables were selected for the study:

1. Resting Heart Rate (beats/min)
2. Systolic and Diastolic Blood Pressure (mmHg)
3. Vital Capacity (liters)
4. Maximal Oxygen Uptake (VO_2 max, ml/kg/min)

Tools and Instruments

Variable	Instrument/Method	Unit
Resting Heart Rate	Heart Rate Monitor (Polar H10)	beats/min
Blood Pressure	Mercury Sphygmomanometer	mmHg
Vital Capacity	Spirometer (Medico Model 390)	liters
VO_2 max	Cooper's 12-Minute Run Test	ml/kg/min

Procedure

1. **Resting Heart Rate and Blood Pressure:** Participants rested in a seated position for 10 minutes before measurements were taken in the morning (between 8:00-9:00 AM). Three readings were recorded, and the average value was used.
2. **Vital Capacity:** Measured using a calibrated spirometer. Participants performed a maximal inhalation followed by a forceful exhalation into the spirometer. The best of three attempts was recorded.
3. **VO_2 max (Cooper's 12-Minute Run Test):** Conducted on a 400-meter standard track. Participants were instructed to cover the maximum possible distance in 12 minutes. VO_2 max was estimated using the formula:

$$VO_2max = (Distance\ in\ meters - 504.9)/44.73$$

Data Analysis

Data were analyzed using one-way ANOVA to determine differences among groups. Descriptive statistics (Mean ±SD) were calculated, and Tukey's post-hoc test was applied when significant differences were observed. Statistical significance was set at $p<0.05$.

Results

Table 1: Descriptive Statistics of Physiological Variables among Sports Players

Variables	Football (n=20)	Volleyball (n=20)	Cricket (n=20)	Athletics (n=20)
Age (yrs)	20.5±1.6	20.8±1.8	21.0±1.7	20.3±1.5
Resting Heart Rate (bpm)	62.4±5.2	66.8±6.1	68.5±5.8	60.7±4.9
Systolic BP (mmHg)	118.2±7.1	120.3±6.8	122.6±7.5	115.5±6.9
Diastolic BP (mmHg)	75.4±5.5	76.2±5.8	78.0±6.1	73.1±5.3
Vital Capacity (L)	4.80±0.46	4.60±0.38	4.30±0.42	5.10±0.40
VO_2 max (ml/kg/min)	53.2±4.3	49.6±3.8	46.5±3.6	55.1±4.5

Table 2: One-Way ANOVA for Physiological Variables among Sports Players

Variable	Between Groups SS	df	Mean Square	F-value	Sig. (p)
Resting Heart Rate	458.2	3	152.7	4.92	0.004*
Systolic BP	240.5	3	80.1	1.63	0.19
Diastolic BP	102.3	3	34.1	1.03	0.38
Vital Capacity	2.47	3	0.82	5.74	0.002*
VO_2 max	418.9	3	139.6	8.12	0.0001*

Significant at $p<0.05$

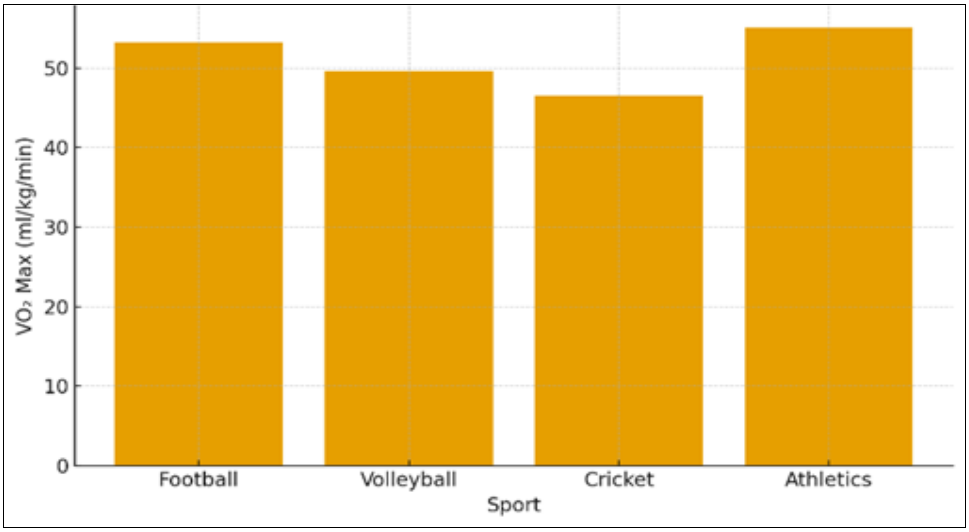

Fig 1: Comparison of VO_2 Max among different sports player

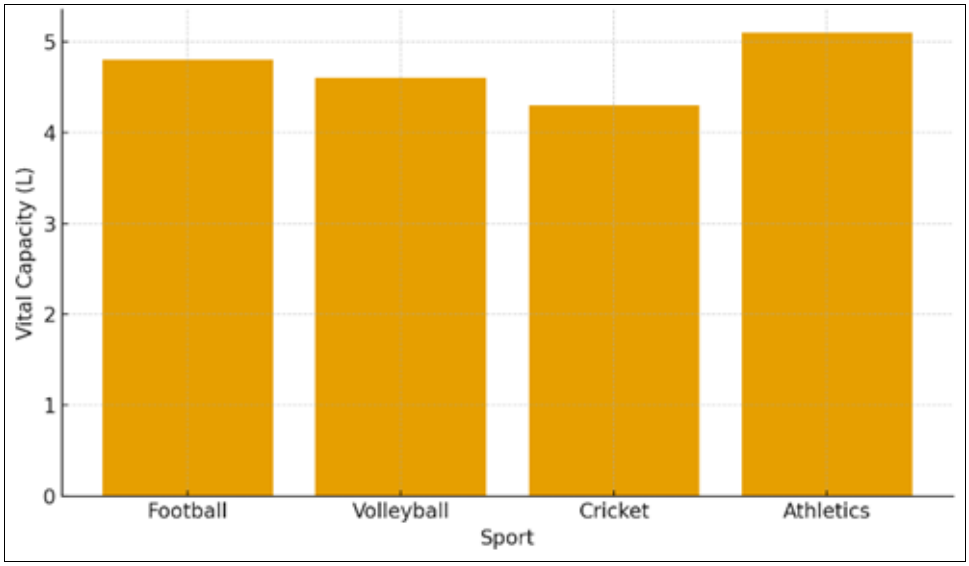

Fig 2: Comparison of vital capacity among different sports player

Discussion

This study's findings demonstrate that physiological characteristics vary substantially among university-level athletes across different sports. VO_2 max and vital capacity exhibited significant variances, indicating unique cardiorespiratory adaptations resulting from diverse energy system requirements. Football and athletics athletes demonstrated reduced resting heart rates and elevated VO_2 max, corroborating earlier research by Fox *et al.* (1993) [3], which indicated that endurance-oriented activities improve parasympathetic tone and cardiac efficiency. The sustained running, interval sprints, and aerobic requirements in football and track sports inherently promote cardiovascular efficiency.

In contrast, cricket players had more elevated resting heart rates and reduced VO_2 max values, perhaps attributable to the sports intermittent and less vigorous aerobic characteristics. Volleyball players, although performing explosive movements and moderate aerobic activity, had intermediate physiological responses, so validating the sports varied energy requirements.

The vital capacity was greatest in athletes (5.10 L), followed closely by football players (4.80 L), reflecting superior lung function due to prolonged aerobic training (Wilmore *et al.*, 2008) [7]. The disparities in blood pressure among groups were not statistically significant, consistent with Sharma *et al.* (2019) [5], who noted stable blood pressure values in trained athletes attributable to long-term autonomic adaptations. The results confirm that sport-specific training regimens produce quantifiable physiological differences, even within similar age and training experience cohorts. The results underscore the necessity for customized conditioning regimens that correspond to the metabolic and cardiovascular requirements of each activity.

Conclusion: The present study concludes that football and athletics players exhibit significantly superior cardiovascular and respiratory efficiency compared to volleyball and cricket players. VO_2 max and vital capacity emerged as the most distinguishing physiological indicators among sports disciplines. These differences can be attributed to sport-specific training intensity, duration, and energy system utilization. The study reinforces the importance of incorporating aerobic conditioning and respiratory training even in skill-dominant sports like cricket and volleyball for improved performance and endurance.

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