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COMPARATIVE ANALYSIS OF CARDIOVASCULAR ENDURANCE AMONG PLAYERS OF HANDBALL, WRESTLING AND HOCKEY

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ABSTRACT

Cardiovascular endurance plays a critical role in athletic performance, particularly in high-intensity, intermittent sports such as handball, wrestling, and hockey. This study aims to evaluate and compare the cardiovascular endurance capacities of athletes participating in these three sports to identify the physiological demands and training implications associated with each discipline. By employing standardized field tests and analyzing inter-group differences, this research provides valuable insights into sport-specific conditioning requirements and the development of endurance training protocols. Results indicate significant variations in cardiovascular endurance among the groups, with hockey players demonstrating superior aerobic capacity, followed by handball players and wrestlers. The findings suggest the need for targeted endurance training strategies tailored to each sport's unique demands.

Keywords: cardiovascular endurance, aerobic capacity, handball, wrestling, hockey, VO2 max, physical conditioning

1. INTRODUCTION

Cardiovascular endurance, often referred to as aerobic capacity, is a fundamental component of physical fitness that determines an athlete's ability to sustain prolonged physical activity. It reflects the efficiency of the cardiovascular and respiratory systems in supplying oxygen to working muscles during exercise. In the context of competitive sports, superior cardiovascular endurance is linked to enhanced performance, quicker recovery, and reduced fatigue, particularly in sports characterized by continuous movement and high-intensity bouts.

Handball, wrestling, and hockey are popular sports that vary considerably in their physiological demands, training structures, and game play dynamics. Handball involves fast-paced offensive and defensive actions with frequent sprinting and directional changes. Wrestling, by contrast, is an anaerobic-dominant sport characterized by intense bursts of strength and muscular endurance, requiring short yet highly taxing efforts. Hockey, particularly field hockey, combines aerobic endurance with bursts of speed, agility, and prolonged engagement across two halves.

Understanding the cardiovascular endurance profiles of athletes in these sports offers valuable implications for coaching, training periodization, and performance optimization. Although existing research has investigated endurance in isolated sports, comparative studies among handball, wrestling, and hockey athletes remain limited. This study addresses this gap by systematically comparing cardiovascular endurance levels across these three sporting domains. The objectives of the Study are given below-

1. To measure the cardiovascular endurance of players in handball, wrestling, and hockey using standardized fitness tests. 2. To compare the aerobic capacity among the three groups to determine sport-specific differences. 3. To identify possible factors contributing to endurance variations and recommend conditioning protocols based on findings.

2. METHODOLOGY

A total of 90 male university-level athletes aged 18–25 years participated in the study. The sample was divided into three equal groups: 30 handball players, 30 wrestlers, and 30 hockey players. All participants were actively involved in regular training and had represented their institutions at inter-university competitions.

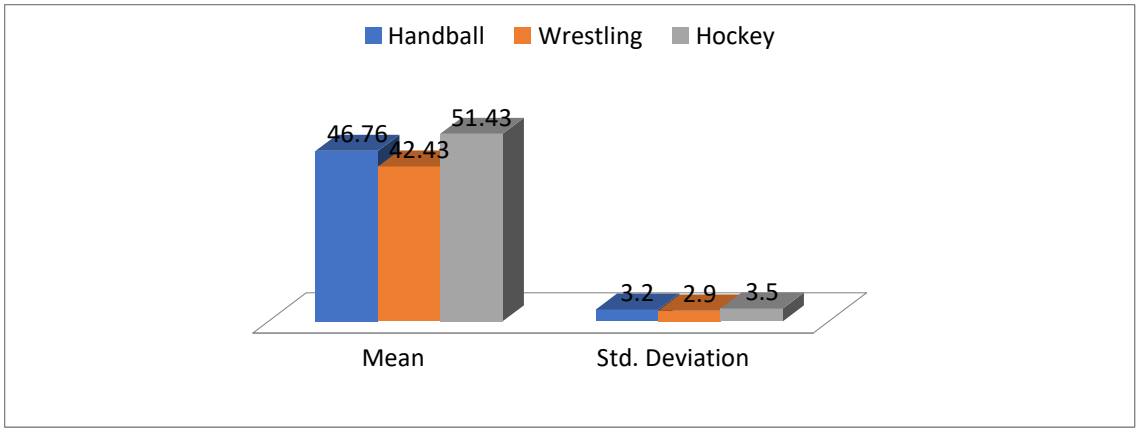
Testing Procedure: Cardiovascular endurance was assessed using the Cooper 12-Minute Run Test, a widely recognized field test for estimating VO2 max. Participants were instructed to run continuously for 12 minutes, and the total distance covered was recorded in meters. The VO2 max values were calculated using the formula:

VO2 max (ml/kg/min) = (Distance in meters - 504.9) / 44.73

Data Analysis: The collected data were subjected to descriptive and inferential statistical analyses. Mean, standard deviation, and one-way ANOVA were employed to compare the VO2 max values across the three groups. A post hoc Tukey test was used to identify significant pairwise differences.

3. RESULTS

Sports	VO2max mean	Standard Deviation
Handball	46.76	3.2
Wrestling	42.43	2.9
Hockey	51.43	3.5



The results indicate that hockey players demonstrated the highest mean VO2 max values, followed by handball players, and wrestlers recorded the lowest. The one-way ANOVA showed a statistically significant difference in cardiovascular endurance among the three groups ($p < 0.05$). Post hoc analysis revealed significant differences between hockey and wrestling players and between hockey and handball players, while the difference between handball and wrestling was moderate but still significant.

4. DISCUSSION

The findings underscore the differential cardiovascular demands of the three sports under investigation. Hockey players, with the highest VO2 max scores, reflect the sport's requirement for sustained aerobic output over prolonged match durations. The continuous nature of hockey game play, combined with frequent high-speed movements, may explain the superior endurance levels observed.

Handball players ranked second in cardiovascular performance. Although the game includes frequent bursts of high-intensity action, the intermittent pauses and substitution patterns slightly reduce continuous aerobic load, resulting in lower VO2 max scores compared to hockey.

Wrestlers showed the lowest cardiovascular endurance. Given the anaerobic nature of wrestling, where bouts last only a few minutes and rely more on strength and power than endurance, this finding aligns with existing literature. However, it highlights the potential for endurance enhancement as a supplementary component of wrestling training to support recovery and improve overall conditioning.

These results reinforce the importance of tailoring conditioning programs to the unique demands of each sport. Coaches and strength and conditioning professionals should integrate endurance-focused training for handball and hockey players, while wrestling coaches may incorporate moderate aerobic conditioning to enhance recovery between bouts and reduce fatigue accumulation.

Furthermore, these insights can guide talent identification and sport specialization decisions. Athletes with naturally high aerobic capacities may be better suited for endurance-dominant sports like hockey, while those with strength and power attributes may excel in wrestling.

5. CONCLUSION

This study provides a comparative evaluation of cardiovascular endurance among university-level athletes in handball, wrestling, and hockey. The data demonstrate that hockey players possess significantly higher aerobic capacities, followed by handball players and then

wrestlers. These findings emphasize the need for sport-specific training adaptations and underscore the role of cardiovascular fitness in enhancing competitive performance.

Future research should examine larger, more diverse populations and incorporate additional physiological metrics such as heart rate variability, lactate threshold, and recovery indices. Longitudinal studies may also help assess the impact of sport-specific training on endurance development over time.

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