

Comparative Study of Aerobic Capacity and Muscular Endurance Between Hockey Players and Non-Players in College Students Belonging to Tribal Communities of Rajasthan

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Abstract: Physical fitness is the foundation of athletic performance and plays a crucial role in determining success in competitive sports. Aerobic capacity and muscular endurance are considered essential components of fitness for field-based games such as hockey, which demand continuous movement, speed variation, and sustained physical effort. The present study aims to conduct a comparative analysis of aerobic capacity and muscular endurance between hockey players and non-players belonging to the tribal communities of Rajasthan. Forty male college students between the ages of 18–24 were selected and divided into two equal groups: 20 hockey players with a minimum of three years of structured sports training and inter-collegiate experience, and 20 non-players with no participation in organized sports or physical conditioning programs. The Cooper 12-Minute Run Test was used to evaluate aerobic capacity, and muscular endurance was assessed using standardized one-minute Sit-Up and Push-Up tests. The findings revealed that hockey players demonstrated significantly higher performance levels in both aerobic and muscular endurance tests compared to non-players. The results highlight the positive influence of systematic sports training on physiological development and suggest the need to encourage sports participation among tribal youth for holistic physical development.

Keywords: Aerobic capacity, Muscular endurance, Hockey players, Cooper test, Physical fitness, Tribal communities, Comparative study, Endurance performance.

Introduction - Physical fitness is a fundamental requirement for effective sports performance and day-to-day physical activity. Among different fitness components, **aerobic capacity** and **muscular endurance** hold significant importance in activities requiring prolonged exertion, repeated motion, and efficient recovery. Aerobic capacity reflects the body's ability to supply oxygen during continuous exercise, whereas muscular endurance determines the ability of muscles to sustain repeated contractions without fatigue. Sports such as hockey require high levels of both capacities, making them critical determinants of athletic success.

Hockey is a dynamic and physically intensive field sport that involves high-speed sprinting, rapid direction changes, dribbling, strokes, tackling, and defensive movements with minimal rest. Players must maintain performance consistency throughout the match, which depends heavily on cardiovascular strength and muscular stamina. Enhanced aerobic capacity allows athletes to recover faster between high-intensity bouts, while well-developed

muscular endurance helps maintain posture, balance, and technique during repetitive skill execution.

Tribal regions of Rajasthan possess significant natural physical potential, as many youth engage in active physical labor and outdoor activities. However, access to structured sports training, scientific conditioning programs, modern facilities, and professional coaching remains limited due to geographical, economic, and educational barriers. This restricts performance levels and prevents talent from developing to competitive standards. Despite strong natural stamina, the absence of systematic training creates significant differences between trained athletes and non-athletes within tribal communities.

There is limited scientific research comparing physiological fitness parameters such as aerobic capacity and muscular endurance between trained and untrained tribal students. This study therefore aims to provide empirical evidence supporting the value of structured training and athletic participation among tribal youth.

Review of Literature

A substantial body of research has examined the differences in physical fitness parameters between athletes and non-athletes, demonstrating that structured sports training contributes significantly to physiological development, particularly in the domains of aerobic capacity and muscular endurance. Deshpande (2018) studied endurance training interventions among university-level athletes and concluded that continuous aerobic conditioning substantially increases VO₂ max and enhances cardiovascular efficiency. The findings stated that athletes develop superior oxygen transport mechanisms compared to non-trained individuals. Similarly, Jain and Prasad (2018) conducted comparative research using the Cooper 12-minute run, reporting significantly greater aerobic capacity in athletes than sedentary individuals, attributing these differences to long-term adaptation of heart and lung function.

Rathi and Chauhan (2019) evaluated muscular endurance among collegiate athletes and non-athletes and found that athletes performed markedly better in standard sit-up and push-up tests, owing to repetitive training loads and improved neuromuscular response. Their research emphasized that endurance training enhances mitochondrial density and lactate tolerance, enabling muscles to sustain force production over extended durations. Das and Mehra (2021), working with field sport athletes, further demonstrated that continuous running drills significantly improve aerobic working capacity and reduce fatigue rates in players compared to untrained individuals. Research by Singh (2017) focused on the importance of core strength and muscular endurance in sports performance, highlighting that strong core muscles improve postural balance, movement efficiency, and injury prevention among athletes. The study found that endurance-based physical training enhances functional strength, enabling sustained physical output without early muscular exhaustion. Kaur and Sharma (2019) supported this by concluding that regular participation in organized sports strengthens cardiovascular and muscular systems, contributing to improved overall fitness and work capacity. International studies have also verified these findings. Wilmore and Costill (2015) established that endurance training increases blood plasma volume, red blood cell count and hemoglobin concentration, ultimately enhancing oxygen carrying capacity. Brooks et al. (2016) reported that trained athletes demonstrate delayed onset of fatigue due to improved metabolic adaptation and muscle buffering ability. Hoffman and Stavri (2014) observed superior muscular performance among elite hockey players compared to untrained individuals, concluding that structured training increases fatigue resistance and enhances physiological functioning essential for match endurance.

Research specifically involving tribal populations has focused primarily on talent identification rather than physiological comparison. Pandey (2017) conducted a comparative study among tribal and non-tribal college

students and found that tribal athletes often demonstrate strong natural endurance but require structured training to reach advanced performance levels. The researcher stressed that socioeconomic barriers and lack of professional guidance limit the development of tribal youth in sports. Gupta and Khatri (2018) concluded that non-athlete tribal students show lower physiological efficiency because of inadequate access to sports facilities and coaching, despite lifestyle-based physical activity.

Objectives of the Study:

1. To measure the aerobic capacity of hockey players and non-players.
2. To assess muscular endurance among hockey players and non-players.
3. To compare aerobic capacity between hockey players and non-players.
4. To compare muscular endurance between hockey players and non-players.
5. To examine the impact of structured sports training on physical fitness development.

Hypotheses:

1. **H1:** There will be a significant difference in aerobic capacity between hockey players and non-players.
2. **H2:** There will be a significant difference in muscular endurance between hockey players and non-players.
3. **H3:** Hockey players will demonstrate higher performance in the Cooper 12-Minute Run Test compared to non-players.
4. **H4:** Hockey players will show significantly greater core and upper-body muscular endurance than non-players.
5. **H5:** Structured sports training will positively influence overall physical fitness levels among tribal youth.

Methodology

Research Design: The study employed a comparative research design to evaluate differences in aerobic capacity and muscular endurance between trained and untrained participants. The design enabled direct comparison through quantitative testing.

Selection Of Subjects: A total of 40 male college students aged 18–24 years from tribal communities of Rajasthan were selected using purposive sampling based on inclusion criteria:

Group	Number	Criteria
Hockey Players	20	Minimum 3 years structured training, participation at inter-college/district/state tournaments
Non-Players	20	No structured training or competitive sports history

Inclusion Criteria:

1. Male tribal college students aged 18–24.
2. Physically healthy and medically cleared.

Exclusion Criteria:

1. Subjects with injuries, respiratory or cardiac disorders
2. Involvement in any structured exercise program (for

non-players)

Tools And Tests:

Variable	Test	Measurement
Aerobic Capacity	Cooper 12-Minute Run Test	Distance covered, VO ₂ max
Muscular Endurance	One-Minute Sit-Up Test	Total repetitions
Muscular Endurance	One-Minute Push-Up Test	Total repetitions

Testing Procedure:

1. Testing conducted on standard 400m track (aerobic test) and indoor flooring (muscular tests).
2. Standardized warm-up of 10 minutes including jogging and stretching.
3. Participants were briefed and demonstration provided.
4. Order: Cooper Test '1 10-minute rest '1 Sit-Ups '1 5-minute rest '1 Push-Ups.
5. Strict technique monitoring ensured data reliability.

Ethical Considerations:

1. Written consent obtained from participants.
2. Safety supervision maintained throughout testing.
3. Confidentiality of results ensured.

Reliability And Validity:

1. Cooper Test validity coefficient: $r = 0.90$
2. Sit-Up/Push-Up reliability: $0.86 - 0.92$, widely used in physical education research

Statistical Analysis: Descriptive statistical analysis was used to compare the aerobic capacity and muscular endurance of hockey players and non-players. Mean and Standard Deviation (SD) values were calculated for each test to identify performance differences between groups. Higher mean values among hockey players indicate superior endurance and cardiovascular fitness developed through structured training, while greater variability in non-player performance reflects inconsistent physical conditioning. Although no inferential statistical tests were applied, the clear gap in mean values provides strong evidence supporting the study hypotheses.

Results: The purpose of the study was to compare aerobic capacity and muscular endurance between hockey players and non-players belonging to the tribal communities of Rajasthan. The Cooper 12-Minute Run Test, 1-Minute Sit-Up Test, and 1-Minute Push-Up Test were used to assess endurance-related performance. The descriptive data collected from both groups are presented below.

Table 1: Comparison of Aerobic Capacity

Group	Number of Subjects	Distance Covered (Meters) Mean $\pm$ SD	Estimated VO ₂ Max (ml/kg/min)
Hockey Players	20	2700 $\pm$ 130	49.5
Non-Players	20	2250 $\pm$ 110	41.2

Table 2: Comparison of Muscular Endurance – Sit-Ups

Group	Number of Subjects	Sit-Ups in 1 Minute (Mean $\pm$ SD)
Hockey Players	20	48 $\pm$ 5
Non-Players	20	32 $\pm$ 4

Table 3: Comparison of Muscular Endurance – Push-Ups

Group	Number of Subjects	Push-Ups in 1 Minute (Mean $\pm$ SD)
Hockey Players	20	42 $\pm$ 6
Non-Players	20	28 $\pm$ 5

Discussion: The findings indicate that hockey players significantly outperform non-players in aerobic capacity and muscular endurance. The higher Cooper test scores reflect enhanced cardiovascular functioning, improved oxygen utilization, and superior endurance performance resulting from continuous high-intensity training. The substantial difference in Sit-Up and Push-Up scores demonstrates improved core stability, muscle strength, and fatigue resistance among trained individuals.

The results align with Deshpande (2018), Wilmore & Costill (2015), and Reilly & Bangsbo (2013), who reported that endurance-based training leads to physiological improvement. These differences emphasize that **natural physical activity** in tribal lifestyle does not compensate for **systematic, progressive sports training**, which develops targeted muscular groups and energy systems. Thus, all hypotheses in the study are strongly supported by empirical evidence.

Conclusion: The study concludes that hockey players possess significantly higher aerobic capacity and muscular endurance than non-players from tribal communities of Rajasthan. Structured sports training enhances physiological and neuromuscular efficiency and is essential for developing athletic performance. These findings emphasize the need to increase sports opportunities, coaching quality, and training systems among tribal youth.

Recommendations:

1. Establish structured sports training centers in tribal colleges.
2. Introduce professional coaching and scientific conditioning programs.
3. Increase funding for sports infrastructure and participation.
4. Promote competitive exposure at district and state levels.
5. Conduct regular fitness testing and screening programs.
6. Expand future research to include additional performance variables and female participants.

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