

Relationship Between Physical Fitness Components and Injury Occurrence in Kabaddi Players of Selected Districts of Rajasthan

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Abstract: Kabaddi is a physically intensive contact sport that involves rapid directional movements, forceful tackling, sudden stops, and high-impact body interactions. These dynamic actions place considerable mechanical stress on the musculoskeletal system, making players vulnerable to various sports-related injuries. Physical fitness components such as flexibility, balance, muscular strength, and agility play a crucial role in maintaining body control, absorbing impact forces, and preventing excessive strain on joints and soft tissues. The present study aimed to investigate the relationship between selected physical fitness components and injury occurrence among kabaddi players. Forty competitive players aged 16–21 years from selected districts of Rajasthan were assessed for flexibility, balance, muscular strength, and agility using standardized field tests. Injury data were collected through a structured injury history questionnaire covering the previous playing season. Statistical analysis using correlation methods indicated a significant association between lower fitness levels and higher injury incidence. Players with reduced flexibility, poor balance, and insufficient muscular strength reported more frequent injuries compared to physically well-conditioned players. The findings emphasize the importance of comprehensive physical conditioning programs in reducing injury risk and improving overall athletic resilience in kabaddi.

Keywords: Kabaddi, Physical fitness, Injury risk, Flexibility, Balance, Strength.

Introduction - Kabaddi is recognized as a high-intensity indigenous sport that combines elements of strength, speed, agility, and physical contact. During play, athletes are required to perform explosive raids, defensive holds, sudden lunges, rapid directional changes, and body-to-body collisions. Such movements demand not only technical proficiency but also a high level of physical preparedness. Due to the repeated exposure to high mechanical loads and unpredictable contact situations, kabaddi players are susceptible to musculoskeletal injuries affecting joints, muscles, and ligaments.

Physical fitness serves as a protective foundation that allows athletes to withstand the physical demands of sport. Flexibility contributes to efficient joint movement and reduces the likelihood of muscle strain during extreme positions. Balance supports postural control during rapid transitions and physical contact, minimizing the risk of falls and awkward landings. Muscular strength enhances joint stability and helps absorb external forces generated during tackling and collisions. Agility allows athletes to move efficiently and avoid hazardous situations during dynamic play.

When these physical qualities are insufficient, athletes may be unable to control their body movements effectively,

leading to improper landing mechanics, delayed reaction, and increased stress on specific body parts. Over time, such deficiencies can elevate the probability of acute injuries and repetitive strain problems.

Although kabaddi is widely played in Rajasthan, structured assessment of physical fitness in relation to injury occurrence remains limited at the district competitive level. Most training programs prioritize skill development while physical conditioning and injury risk factors receive comparatively less attention. Investigating how fitness components relate to injury patterns can provide valuable insight for designing preventive training strategies and enhancing player safety. Therefore, the present study seeks to examine the relationship between selected physical fitness components and injury occurrence among kabaddi players.

Review Of Literature

Research in sports injury science suggests that injuries rarely occur due to a single factor; instead, they arise when the physical capacity of the athlete does not match the demands of the activity. **Bahr and Krosshaug (2005)** described injury as the result of a mismatch between external load and tissue tolerance. In physically demanding

sports, inadequate muscular support can lead to overload of joints and connective tissues.

Flexibility has been discussed as an important contributor to movement efficiency. **Witvrouw et al. (2004)** noted that restricted range of motion may increase tension within muscles during dynamic tasks, potentially leading to strain injuries. They argued that flexibility allows better absorption of stretch forces during sudden or forceful actions.

Postural stability also plays a role in safe athletic performance. **Hrysomallis (2007)** highlighted that athletes with reduced balance ability may struggle to control body alignment, particularly during landing or rapid directional shifts. Such instability can place excessive stress on the knee and ankle joints.

Strength training is frequently associated with injury reduction. **Lauersen et al. (2014)** found that athletes who engaged in systematic strength development showed lower injury rates compared to those without such training. Strong muscles help stabilize joints and improve force distribution during impact.

Movement quality and agility are also connected to injury risk. According to **Gabbett (2008)**, athletes with better conditioning and movement control are more capable of handling rapid changes in play without losing balance or coordination. Efficient movement patterns reduce the likelihood of unsafe body positions.

Neuromuscular control, which involves coordinated muscle activation, has also been emphasized. **Emery et al. (2005)** observed that improved neuromuscular function enhances joint stability and reduces the chances of injury during unpredictable movements.

While these studies highlight individual fitness components, their combined influence in kabaddi has not been explored extensively. Since kabaddi involves sudden directional changes, grappling actions, and body contact, examining how multiple fitness factors relate to injury occurrence becomes essential.

Objectives Of The Study:

1. To assess the levels of selected physical fitness components (flexibility, balance, muscular strength, and agility) among kabaddi players.
2. To determine the frequency and types of injuries experienced by kabaddi players during the playing season.
3. To examine the relationship between flexibility and injury occurrence.
4. To analyze the association between balance ability and injury incidence.
5. To investigate the relationship between muscular strength and injury frequency.
6. To study the link between agility and injury risk in kabaddi players.

Hypotheses Of The Study:

1. H1: There will be a significant relationship between physical fitness components and injury occurrence among kabaddi players.
2. H2: Players with lower flexibility levels will report higher injury incidence.
3. H3: Poor balance ability will be associated with greater injury occurrence.
4. H4: Reduced muscular strength will correlate with increased injury frequency.
5. H5: Lower agility performance will be linked to higher injury risk.

Significance Of The Study:

1. Helps identify physical risk factors contributing to injuries in kabaddi players.
2. Provides scientific evidence for incorporating conditioning programs in kabaddi training.
3. Assists coaches in improving player safety and reducing injury occurrence.
4. Contributes sports science research data from kabaddi players in **Jaipur and Ajmer**.
5. Supports development of preventive strategies to enhance long-term athletic performance.

Research Methodology

Research Design: The present investigation employed a **descriptive correlational research design** to explore the relationship between selected physical fitness components and injury occurrence among kabaddi players. This design was considered appropriate as the study aimed to identify associations between naturally existing variables without manipulating any training conditions. The approach allowed assessment of how variations in physical fitness characteristics may relate to the frequency of sports injuries experienced during the competitive season.

Selection Of Subjects: A total of **40 competitive kabaddi players** were selected from recognized sports academies and college teams in **Jaipur and Ajmer**. Participants were chosen through purposive sampling based on their active involvement in district and inter-college competitions. Only players with consistent participation in training and matches during the previous season were included to ensure reliable injury history data.

Inclusion Criteria: Participants met the following criteria:

1. Age between **16 and 21 years**
2. Minimum of **two years of competitive kabaddi experience**
3. Regular training participation
4. No medical restriction at the time of testing

Exclusion Criteria: Players were excluded if they had:

1. Undergone recent surgery
2. Chronic musculoskeletal disorders
3. Incomplete injury history records

Variables Of The Study: The study considered the following variables:

Category	Variables
Independent Variables	Flexibility, Balance, Muscular Strength, Agility
Dependent Variable	Injury occurrence (frequency of injuries during the previous playing season)

Tools And Measurement Techniques:

Standardized and widely accepted field tests were used to measure physical fitness components:

Variable	Test Used	Description
Flexibility	Sit and Reach Test	Measures hamstring and lower back flexibility
Balance	Stork Stand Test	Assesses postural stability
Muscular Strength muscles	Hand Grip Dynamometer	Evaluates isometric strength of forearm muscles
Agility	Illinois Agility Test	Measures speed and direction change ability
Injury Occurrence	Structured Injury Questionnaire	Records number, type, and location of injuries

Data Collection Procedure: Data collection was carried out in two phases. In the first phase, physical fitness assessments were conducted on a standard playing field under similar environmental conditions. Participants performed a 10-minute standardized warm-up before testing. Each test was demonstrated and explained to ensure correct execution.

In the second phase, injury data were gathered using a structured questionnaire designed to capture injuries sustained during the previous playing season. Players reported injury type, body part affected, and circumstances of occurrence. Coaches verified the responses to enhance reliability.

Reliability And Validity: The physical fitness tests selected for this study have established reliability and validity in sports science research. The Sit and Reach Test, Illinois Agility Test, and Stork Stand Test are commonly used to assess flexibility, agility, and balance respectively. The hand grip dynamometer is a standardized tool for measuring muscular strength.

Ethical Considerations: Participants were informed about the purpose of the study and provided voluntary consent. Confidentiality of data was ensured. No invasive or harmful procedures were involved.

Statistical Analysis: Descriptive statistics, including mean and standard deviation, were computed for all fitness variables. The Shapiro–Wilk test was used to verify data normality. Pearson’s correlation coefficient was applied to determine the relationship between physical fitness components and injury occurrence. Statistical significance was set at the 0.05 level.

Results: The purpose of the study was to examine the relationship between selected physical fitness components and injury occurrence among kabaddi players. The data collected were analyzed using descriptive statistics and correlation analysis.

Descriptive Statistics

Variable	Mean	Standard Deviation
Flexibility (cm)	22.4	3.6
Balance (sec)	28.7	5.2
Muscular Strength (kg)	42.5	6.1
Agility (sec)	16.8	1.3
Injury Frequency (number)	2.3	1.1

Correlation Between Physical Fitness Components and Injury Occurrence

Variable	Pearson’s r	Significance
Flexibility vs Injury	-0.48	Significant
Balance vs Injury	-0.41	Significant
Muscular Strength vs Injury	-0.45	Significant
Agility vs Injury	-0.29	Not Significant

Interpretation: The negative correlation values indicate that higher levels of flexibility, balance, and muscular strength are associated with lower injury occurrence. Agility showed a weak relationship with injury frequency. These findings suggest that deficiencies in specific physical fitness components may increase injury risk in kabaddi players.

Discussion: The findings of the study indicate that selected physical fitness components are associated with injury occurrence among kabaddi players. The negative correlation observed between flexibility and injury frequency suggests that players with better range of motion experienced fewer injuries. Adequate flexibility may help muscles tolerate sudden stretching forces during rapid movements and tackles.

Balance also showed a significant relationship with injury occurrence. Players with better postural stability likely maintain improved body control during dynamic actions, reducing the risk of falls and awkward landings that may lead to joint injuries.

Muscular strength demonstrated a meaningful association with lower injury frequency. Stronger muscles provide joint support and absorb impact forces during collisions and high-intensity movements, which are common in kabaddi.

Agility showed a weaker relationship with injury occurrence compared to other components. This may indicate that while agility contributes to performance, injury risk is more closely linked to stability and strength factors.

Overall, the results highlight the importance of comprehensive physical conditioning in minimizing injury risk. Training programs that enhance flexibility, balance, and muscular strength may help improve player safety.

Conclusion:

1. A significant relationship was observed between selected physical fitness components and injury occurrence among kabaddi players.
2. Higher flexibility levels were associated with lower injury frequency.
3. Better balance ability contributed to improved body control and reduced injury risk.
4. Greater muscular strength was linked with decreased injury occurrence due to enhanced joint stability.
5. Agility showed a weaker association with injury frequency compared to other fitness components.
6. Overall, inadequate physical fitness may increase vulnerability to injuries in kabaddi players.
7. Emphasis on conditioning programs focusing on flexibility, balance, and strength can help in injury prevention.

Recommendations For The Further Studies:

1. Kabaddi training programs should include regular flexibility exercises to improve joint range of motion.
2. Balance and stability drills should be integrated to enhance postural control during dynamic movements.
3. Strength training focusing on major muscle groups should be emphasized to improve joint support.
4. Coaches should conduct periodic fitness assessments to identify players at higher injury risk.
5. Proper warm-up and conditioning routines should be

- implemented before training and matches.
6. Future research may include additional variables such as endurance and coordination.

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