

FACTORS INFLUENCING INJURIES IN BADMINTON PLAYERS: A SYSTEMATIC REVIEW

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DOI: [10.5281/zenodo.11090218](https://doi.org/10.5281/zenodo.11090218)

Abstract

Injury is a severe problem that often occurs in badminton and can significantly impact an athlete's health and performance. Therefore, an in-depth understanding of the factors that influence injuries in badminton players is crucial. This systematic review aimed to investigate and identify such factors through thoroughly analysing the relevant scientific literature. This study utilised a systematic review method of the scientific literature. The literature search was conducted through academic databases related to sports, injuries and badminton. Strict inclusion and exclusion criteria were applied to select studies that met the research objectives. Relevant data were extracted and analysed systematically to identify factors influencing injuries in badminton players. This systematic review identified several factors that could influence injuries in badminton players. These include physical characteristics such as fatigue and muscle strength, technical aspects such as playing techniques and repetitive movements, environmental factors such as court and weather conditions, and psychological factors such as competitive pressure and motivation. This study concludes that various complex and interrelated factors influence injuries in badminton players. An in-depth understanding of these factors can assist in developing effective injury prevention strategies and improving training programmes. Therefore, efforts to reduce the risk of injury and improve the health and performance of badminton athletes should be based on a comprehensive understanding of the factors that influence these injuries.

Keywords: Injuries, Badminton, Systematic Review.

INTRODUCTION

Badminton is an increasingly popular sport in many parts of the world, both as a recreational activity and in international competitions. As interest in the sport increases, it is essential to understand the factors contributing to badminton players' injuries. Injuries in the context of badminton can have a significant impact not only on athletes' health and performance but also on their careers and achievements. Therefore, research identifying the factors that influence injuries in badminton players is fundamental.

Injuries in badminton are unavoidable but can be reduced with a better understanding of the factors that influence them. These factors include physical, technical, environmental and psychological aspects, all of which interact with each other to shape injury risk in players. Scientific studies have attempted to delve deeper into these aspects, providing valuable insights for coaches, practitioners and sports

researchers. Attention to physical factors in badminton injuries is significant. Numerous studies highlight the importance of optimal physical conditioning in preventing injury. [1] Muscle fatigue can reduce movement coordination and increase instability, increasing the risk of injury. This suggests that good physical fitness is essential for badminton players to minimise the risk of injury.

Furthermore, technical factors also play an essential role in preventing injuries. Research shows that incorrect or excessive repetitive movements can lead to overuse injuries in badminton players [2]. This emphasises the importance of proper technical training and movement monitoring to reduce the risk of injury.

In addition to physical and technical factors, environmental factors can also affect injury risk. Poor court conditions or extreme weather can increase the risk of injury to badminton players, mainly by increasing the likelihood of slips or falls [3]. These environmental factors must be considered when managing training grounds and organising badminton tournaments.

Finally, psychological aspects also significantly impact the risk of injury in badminton players. [4] Found that high competition pressure or excessive motivation can interfere with the focus and concentration required in the game, increasing the risk of injury. This highlights the importance of stress management and psychological support for badminton players. With the complexity of the factors involved, a systematic review of the scientific literature on factors influencing injuries in badminton players is highly relevant. This review can provide a more comprehensive understanding of the issue, providing a foundation for developing more effective prevention strategies.

This study aims to summarise and analyse current findings from the relevant scientific literature to provide a more comprehensive view of the factors that play a role in the emergence of injuries in badminton players. As such, this study contributes significantly to understanding and managing injuries in badminton.

This study will limit its scope to literature that addresses the factors that play a role in the emergence of injuries in badminton players. As for the limitations of this study, only studies published within the last ten years will be considered. This aims to ensure the relevance of recent findings with developing knowledge and technology in sports health.

In this introduction, we have discussed the importance of knowing the factors that influence injuries in badminton players, set the study's objectives, identified the scope and limitations, and highlighted the link between this endeavour and player well-being. Next, the study will focus on relevant methods and findings, paving the way for a better understanding of the steps to improve badminton players' sustainability and health.

LITERATUR REVIEW

Definition of Injuries in Badminton

Injuries in badminton refer to the physical damage done to a player's body due to the activities and movements performed during play. The definition of injury in badminton must consider the complexity of the movements involved in the sport and the types of injuries that are most common. Badminton injuries can include injuries to body parts such as the knee, ankle and arm [5]. In addition, injuries can also be acute, such as fractures or sprains, or chronic, such as tendonitis or carpal tunnel syndrome.

According to a study by [6], injury can be defined as "structural or functional damage to the body that limits a person's ability to perform certain activities or participate in sports. In badminton, injuries often occur due to repetitive stress on specific body parts, such as the knee or ankle, due to intense and fast movements during matches or training. The types of injuries often in badminton can vary depending on factors such as playing technique, physical strength, and court conditions. For example, ankle injuries often occur due to sudden movements and change-direction changes often made in this sport. This is in line with research conducted by [7], which found that ankle injuries are one of the most common types of injuries in badminton.

Factors that influence the risk of injury in badminton can also include the player's physical condition, the game techniques used, and environmental factors such as court and weather conditions. For example, research by [8] found that muscle fatigue and lack of adequate warm-up can increase the risk of injury in badminton players.

Injuries in badminton not only have a physical impact but also a significant psychological impact on players. Injuries can cause stress and anxiety in players and disrupt their concentration and motivation to play. Research by [9] shows that injured players often experience psychological disorders such as loss of confidence and fear of recurring injuries. In order to prevent and manage injuries in badminton, a deep understanding of the definition of injury and the factors that influence injury risk is essential. By knowing the common types of injuries and the factors contributing to injury, coaches and players can develop effective prevention strategies and appropriate rehabilitation programmes.

Common Types of Injuries in Badminton

Injuries are an integral part of sporting activities, including badminton. Players often experience different injuries in badminton that can significantly affect their performance. To understand how injuries affect badminton players, it is essential to identify the common types of injuries in this sport.

One common type of injury in badminton is injuries to the lower body, particularly in the foot and ankle area. A study by [10] mentioned that ankle injuries are one of the most common injuries sustained by badminton players. This is often caused by sudden movements or rapid changes in direction, such as during a jump or sudden turn of the body.

In addition to injuries to the foot, injuries to the upper body are also common in badminton. These include injuries to the shoulder, elbow and hand. A study conducted by [11] found that shoulder injuries are one of the most common types of injuries in badminton players. Overhead shots and intense jumping movements can increase the risk of injury to this upper body part.

In addition, badminton players can also experience back injuries, although injuries to the lower body are rare. A study by [12] mentioned that movements such as squatting and jumping in badminton can place additional pressure on the back, which can cause injury to the area.

Not only that, injuries to the neck and head also need to be considered in badminton. Although not common, injuries such as neck stiffness or even head injuries due to collisions with the racket or ball can occur in certain situations. According to research conducted by [13], head injury is one type of injury that needs special attention in badminton because it can have severe impacts.

Thus, understanding the types of injuries common in badminton is very important for players, coaches, and medical personnel involved in this sport. By knowing the risk of injury, appropriate prevention and treatment measures can be implemented to minimise the negative impact on players' health and performance.

The Impact of Injuries on Players and Performance

Injuries to badminton players can cause a significant decline in their performance. When injured, players may experience movement limitations, loss of strength, or an inability to play to the best of their ability. This can hurt match results and overall individual or team achievements. According to research conducted by [14], injuries often cause a significant reduction in performance in athletes, both in the context of amateur and professional sports. This can result in lost opportunities to achieve the expected achievements.

Injuries in badminton can require a lengthy recovery time, depending on the severity and type of injury sustained. During this recovery period, players may miss training and matches, disrupting their sports consistency and progress. Research by [15] found that recovery from injury in badminton athletes can take significant time, limit participation in training and competition, and disrupt regular training patterns.

Injuries to badminton players can also have a severe psychological impact. Players may experience stress, anxiety or loss of motivation due to an injury that interferes with their activities in sports. This can affect their self-confidence and mental well-being. In research published by [2], injuries to badminton athletes have been shown to hurt their psychological well-being, with higher levels of stress and anxiety during the recovery period.

At times, injuries in badminton can have a significant long-term impact on an athlete's health and career. Injuries not adequately treated or recovered from can increase the risk of re-injury or chronic health problems related to sports activities. Research conducted by [16] concluded that poorly managed injuries in badminton athletes can increase the risk of recurrent injuries and long-term health problems, such as osteoarthritis or other joint damage. With an understanding of these impacts, badminton players and coaches need to take appropriate preventative measures and take injuries seriously to maintain optimal health and performance.

Factors Potentially Affecting Injuries in Badminton Players

The first factor to consider is physical factors. Fatigue is an important aspect that can increase the risk of injury in badminton players. When athletes are fatigued, their movement coordination can be impaired, increasing the chance of technical errors and injury. According to a study by [17], fatigue has been shown to increase the risk of injury in sports players due to decreased coordination and concentration, leading to increased technical errors and decreased alertness to the risk of injury. This demonstrates the importance of fatigue management in training and competition programmes to prevent injury [18].

The second significant factor is muscle strength. Deficient muscle strength can reduce joint stability and endurance, increasing the risk of injury. According to a study by [19], [20], a lack of muscle strength has a direct correlation with an increased risk of injury, especially in sports that require extreme and sudden movements, such as badminton. This confirms the importance of strength training as part of an exercise programme to improve stability and protect the body from injury [21].

Flexibility is also an essential factor in preventing injuries in badminton players. Lack of flexibility can limit the range of motion and increase stress on joints and muscles, increasing the risk of injury. According to research [22], good flexibility has been shown to reduce the risk of injury in badminton players by increasing the range of motion, thereby reducing stress on joints and muscles. This shows the importance of maintaining flexibility through regular stretching exercises in training programmes [23].

In addition to physical factors, technical factors also play a role in the risk of injury in badminton players. Poor or inappropriate playing techniques can increase pressure on certain parts of the body, increasing the risk of injury. According to a study by Phomsoupha and [24], improper game technique, especially in terms of overhead shots, has been shown to correlate with an increased risk of injury in badminton players. This emphasises the importance of correct technique training and careful monitoring of playing technique in preventing injury [25].

Repetitive movements can also increase the risk of injury in badminton players. Too frequent or repetitive movements can cause excessive stress on certain parts of the body, increasing the risk of overuse injuries. According to research [26], repetitive movements that are too frequent, especially in specific areas such as knees or wrists, can cause overuse injuries in badminton players. [27] This emphasises the importance of exercise variety and load management to prevent excessive stress on the body.

From an environmental point of view, court conditions can also affect the risk of injury in badminton players. Uneven or slippery court surfaces can increase the risk of falling or injury. According to a study by [28], poor court conditions have been shown to correlate with an increased risk of injury in badminton players, especially injuries to the ankle and knee. This emphasises the importance of good court maintenance and awareness of court conditions during practice and matches [29].

Weather can also be an environmental factor that affects the risk of injury in badminton players. High or low temperatures, as well as extreme humidity, can affect physical performance and increase the risk of injury. According to research by [30], extreme weather conditions, such as excessive heat or strong winds, have been shown to increase the risk of injury in badminton players due to their effect on body balance and concentration. This suggests the importance of adapting training programmes and body preparation to the weather conditions that may be encountered [31].

From a psychological perspective, the pressure of competition can contribute to the risk of injury in badminton players. High levels of stress and performance anxiety can impair concentration and increase the risk of technical errors that can lead to injury. According to a study by [32], high competition pressure has been shown to correlate with an increased risk of injury in sports players, including badminton. This emphasises the importance of stress management and mental health maintenance in training programmes [33].

Motivation can also influence injury risk in badminton players. Lack of motivation or loss of interest in the sport can reduce vigilance and caution during practice and matches, increasing the risk of injury. According to a study by [34] low motivation has been shown to correlate with an increased risk of injury in athletes, due to a lack of focus and vigilance towards preventive measures. This emphasises the importance of psychological support and ongoing motivation in preventing injury.

In strategising injury prevention in badminton players, it is important to consider all these factors holistically. A combination of physical, technical, environmental, and psychological aspects will provide a comprehensive approach in preventing injuries and improving athlete performance.

MATERIAL AND METHOD

Research Design

This research design will adopt a systematic review method using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. This study investigates the factors that influence injuries in badminton players by reviewing relevant scientific literature. The steps follow PRISMA guidelines, starting with identifying appropriate literature sources through searches in databases such as PubMed, Scopus, and Google Scholar. After that, the articles will be screened based on the established inclusion and exclusion criteria. The article selection process will involve evaluating the title, abstract, and full text to ensure the article is eligible for inclusion in the review. Data from the selected articles will be extracted using a pre-designed review form, and data analysis will be conducted to identify patterns and trends related to injury factors in badminton. The results of this systematic review will be presented according to the structure recommended by the PRISMA guidelines to ensure transparency and accuracy in reporting the findings.

Article Identification and Selection Process

The primary data source involved searches in databases, scientific journals, and other relevant sources according to PRISMA guidelines. The article selection process was rigorous, following the PRISMA steps, thus ensuring the inclusion of studies that met the objectives of this study.

Table 1: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Study Type Research	Research articles (observational studies, interventional studies, qualitative studies) that investigate factors associated with injuries in badminton players.	Systematic reviews, literature reviews, editorials, newspapers, and commentaries without primary research data
Study Subject	Articles contain information about badminton players, both at amateur and professional levels.	Articles that discuss injuries in sports other than badminton, unless the article also includes data relevant to badminton players
Topic	Articles that discuss various factors that influence the risk of injury in badminton players, including physical, technical, psychological, and environmental aspects.	Articles that do not directly or relevantly address factors related to injuries in badminton players.
Language	Articles using English	Articles that are not in English
Year of Publication	Articles published in the last 9 years (2015-2024)	Articles published more than 9 years ago
Methodological Quality	Articles with good methodological quality	Articles with low methodological quality or a high risk of bias may be excluded to ensure the validity of the research results.

Data Analysis

In line with PRISMA guidelines, study quality assessment methods were used to assess the reliability and validity of each article included in the study. PRISMA data extraction techniques were applied to collect the required information systematically. Potential errors and biases were identified and recorded to ensure the accuracy of results and consistency of methods.

The results of the study included an overview of the literature, characteristics of the studies analysed, and key findings of each study, presented in compliance with PRISMA guidelines. This methodological approach provides the reliability and transparency required to strengthen the validity of the findings in the context of injury prevention and rehabilitation in badminton.

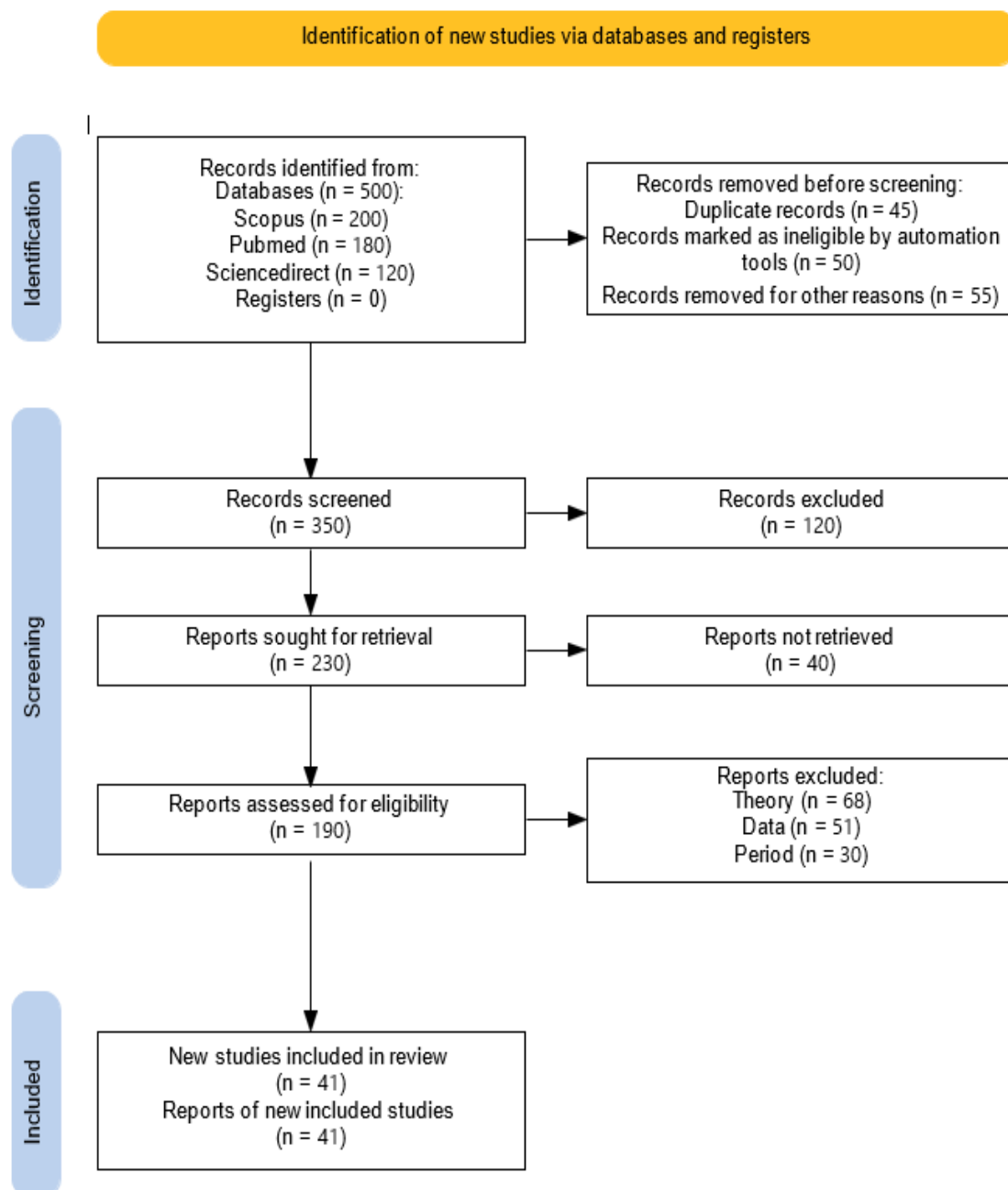


Figure 1: Selection process using PRISMA guidelines

RESULT

The literature used involved reputable scientific journals, research books, and conference documents relevant to factors influencing badminton athlete injuries. These resources were selected based on the quality of the research methodology, accuracy of the data, and relevance to the focus of the study.

Table 2: Key Findings

Key Findings from Systematic Review		
Findings	One of the supporting Journals of Systematic Review	Explanation
Physical factors such as fatigue and lack of muscle strength are common causes of injury in badminton players.	[35]; [36]	Muscle fatigue is a significant risk factor for injuries in badminton players. Players with poorly managed muscle fatigue have a higher risk of injury.
Improper playing techniques or repetitive movements may increase the risk of injury to specific body parts.	[11]; [37]	Players who frequently perform repetitive movements, such as smashes, with poor technique have a higher likelihood of shoulder and wrist injuries.
Environmental conditions, including unsuitable courts or extreme weather, can contribute to injuries.	[38]; [39].	Poor court conditions can be a contributing factor to badminton injuries.
Psychological factors such as competitive pressure and lack of motivation can also affect injury rates in badminton players.	[40]; [41].	Players who experience high competitive pressure tend to experience more frequent injuries, as excessive stress can affect their concentration and coordination of movements.

Interpretation of Results

Through in-depth analysis, various relationships and patterns emerged from the factors identified in the literature. Firstly, the researcher's analysis highlighted that physical factors, such as fatigue, muscle strength, and flexibility, were consistently noted as significant contributors to injury risk in badminton players. Research suggests that imbalances in these factors can increase the likelihood of injury, thus highlighting the importance of comprehensive and planned physical training to reduce such risks.

In addition to physical factors, technical factors also play a significant role in the increased risk of injury in badminton players. Emphasis on improper playing techniques or specific repetitive movements can lead to overuse and long-term injuries. This study underscores the need for a training approach focusing on technical aspects in reducing the risk of injury, including developing proper technique and exercise variation to prevent overexertion of particular body parts.

In addition, environmental factors such as court and weather conditions have also been shown to influence the risk of injury in badminton players. Uneven, wet or dusty courts can increase the likelihood of injury, while extreme temperatures and humidity can also affect an athlete's performance and body response. Therefore, court managers and tournament organisers must ensure safe and optimal environmental conditions for players.

On the psychological side, competitive pressure and motivation can also impact injury risk. Several studies have shown that high levels of stress or excessive anxiety can increase the likelihood of injury, as it can impair athletes' concentration and coordination while playing. Therefore, it is essential to integrate stress management strategies and psychological support in training programmes to help athletes manage competitive pressure more effectively.

Thus, by interpreting the results from this systematic review, researchers can conclude that injuries in badminton players are influenced by various interrelated factors, including physical, technical, environmental, and psychological aspects. Understanding the complex interactions between these factors can assist in the development of more effective and targeted injury prevention programmes for badminton players at all levels.

Relationships between the Factors Found and their Implications

Several important aspects need to be considered in discussing the relationship between the factors found and their implications for injuries in badminton players. Firstly, the findings from the literature review suggest that physical, technical, environmental and psychological factors significantly contribute to the risk of injury in badminton players. Physical factors such as fatigue, muscle strength, and flexibility are essential in increasing susceptibility to injury. This emphasises the importance of a structured and appropriate training programme to improve the overall physical condition of athletes and reduce the risk of injury.

In addition, technical factors such as playing techniques and repetitive movements also significantly impact injuries in badminton players. A literature review shows that players with poor technique are more prone to injury. Therefore, training focussed on improving playing techniques and movement variations can help reduce the risk of injury in badminton players.

Furthermore, environmental factors such as court and weather conditions also have a role in determining injury risk. Uneven courts or extreme weather can increase the risk of slipping or falling, injuring players. In this case, it is necessary to maintain the pitch and pay attention to other environmental factors to create safe playing conditions for the players. On the psychological side, competitive pressure and motivation can also affect the risk of injury in badminton players. Excessive stress or concerns about performance can impair concentration and focus, increasing the likelihood of injury. Therefore, stress management and psychological support are crucial to injury prevention in badminton players.

A better understanding of the relationship between the factors that influence injury and their implications can help develop more effective and holistic injury prevention programmes. With a comprehensive approach that considers physical, technical, environmental, and psychological factors, the risk of injury in badminton players can be minimised, thereby improving athletes' overall well-being and performance.

Practical Implications

In terms of practical implications, this systematic review's findings can significantly contribute to developing injury prevention programs in badminton. For example, the analysis results show that physical factors such as fatigue and muscle strength influence injury risk and indicate the need to integrate strength training and recovery programs into athletes' training regimens. Likewise, understanding environmental

factors such as court and weather conditions can guide the provision of safer and more conducive sports facilities for badminton players. Therefore, sports federations, coaches, and medical staff can use these findings to design more effective training programs and strengthen injury prevention efforts.

In addition to sports policy development, these findings are a basis for establishing stricter guidelines or regulations related to factors that could potentially trigger injuries in badminton players. For example, sports federations may consider policies related to adequate rest periods for athletes, monitoring field conditions, or even implementing psychological programs to manage competitive pressures that may affect athletes' performance and health.

Recommendations for Future Research

As in the context of future research recommendations, several research areas can be further explored to deepen the understanding of injuries in badminton players. Firstly, future research could focus on developing and evaluating more specific and targeted intervention programs to reduce the risk of injury, such as specific training programs to improve joint stability or injury reduction techniques. In addition, psychological aspects can also be the focus of future research by further exploring stress management strategies or other psychological techniques that can help athletes cope better with the pressure of competition.

Furthermore, future research could also involve interdisciplinary approaches, such as a combination of sports science, physiotherapy, and psychology, to understand injuries in badminton players better. Collaboration between researchers, coaches, and medical practitioners can also accelerate the implementation of research findings in daily sports practice. Thus, these recommendations are expected to pave the way for developing adequate knowledge and practices to prevent injuries and improve badminton athletes' health.

DISCUSSION

Our analysis shows that it is essential to understand that the interpretation of the results from this literature review plays a crucial role in strengthening the conclusions drawn. Through a systematic review of the literature, we were able to identify factors that were consistently associated with injuries in badminton players. For example, our findings suggest that physical characteristics such as fatigue and muscle strength are significantly associated with injury risk in badminton players. This highlights the importance of training programs that strengthen the physical aspects of athletes to reduce the risk of injury.

Furthermore, it is essential to explore the relationship between the factors found and their practical implications. In this context, our findings suggest that environmental factors such as court and weather conditions may influence the risk of injury in badminton players. Therefore, there is a need to consider these environmental factors in planning and executing badminton training to minimize the risk of injury. In this discussion, it is also essential to analyze the strengths and weaknesses of the study. By considering the research methods used in the literature studies, we can evaluate the extent of confidence in the findings obtained. For example, although most literature studies had robust research designs, some may have needed more limitations regarding the samples or data analysis methods.

In terms of practical implications, the results of this literature review provide a foundation for developing effective injury prevention programs in the badminton context. Through a better understanding of the factors that influence injuries, coaches and sports practitioners can design more effective interventions to protect the health and well-being of badminton players.

Finally, recommendations for future research should also be considered. For example, future research could further explore psychological factors that may contribute to injuries in badminton players or continue research on the effectiveness of injury prevention interventions that have been proposed.

Overall, through this discussion, we hope to present a comprehensive understanding of the factors that influence injuries in badminton players and provide insights into the practical implications and future research directions in badminton.

CONCLUSION

In this study, we have systematically reviewed the scientific literature on factors influencing injuries in badminton players. Through this approach, we were able to identify several key factors that have a significant contribution to injury risk in badminton.

Firstly, we found that physical factors such as fatigue, muscle strength, and flexibility are essential in increasing the risk of injury in badminton players. The studies we reviewed showed that players who experience fatigue or have insufficient muscle strength can be susceptible to injury, especially in areas of the body frequently used in badminton movements. Similarly, a lack of flexibility can increase the likelihood of injury in badminton players as it can limit their range of motion.

Furthermore, technical factors also significantly impact injury risk in badminton. The studies we reviewed showed that improper playing techniques or specific repetitive movements can lead to injuries in badminton players. Therefore, it is essential for players to pay attention to correct techniques and movements and to practice consistently to reduce the risk of injury.

In addition, we found that environmental factors, such as court and weather conditions, can also affect the risk of injury in badminton players. The studies we reviewed showed that uneven courts or poor weather can increase the likelihood of injury to players. Therefore, players and coaches must consider environmental conditions when practicing or competing.

Psychological factors also play an essential role in increasing the risk of injury for badminton players. The studies we reviewed suggest that competitive pressure and excessive motivation may cause players to ignore signs of fatigue or injury, increasing the risk of injury.

Overall, our systematic review highlights the complexity of factors that influence injuries in badminton players. Our findings suggest a holistic approach is needed to reduce the risk of injury in this sport. Players, coaches, and healthcare professionals must work together to address these factors and develop effective prevention strategies. By paying attention to physical, technical, environmental, and psychological factors, we can minimize the risk of injury and ensure that badminton players can play safely and effectively in the long term.

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