Faculty of Medicine

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“Factors responsible for ankle injuries among basketball players”

Submitted by:

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance of this thesis entitled, **"Factors responsible for ankle injuries among basketball players"** Submitted by **Md. Asmanur Rahman Limon**, for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy (B.Sc. in PT).

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Declaration

I hereby declare that the research work entitled **"Factors responsible for ankle injuries among basketball players"** has been carried out by me as a part of my academic requirements.

This study is original and has not been submitted in any form to any other university or institution for any degree or diploma. All sources of information and data have been duly acknowledged and referenced.

I also declare that ethical approval was obtained and all participants gave informed consent before taking part in the study.

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Acronyms

BHPI	Bangladesh Health Professions Institute
CRP	Centre for the Rehabilitation of the Paralysed
BKSP	Bangladesh Krira Shikkha Protishtan
JU	Jahangirnagar University
DU	Dhaka University
VAS	Visual Analogue Scale
WHO	World Health Organization

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Abstract

Background: Basketball is a high-intensity sport that requires frequent jumping, rapid changes in direction, and physical contact all of which increase the risk of ankle injuries, especially among young athletes. Ankle sprains, ligament tears, and related injuries are common and often recurring issues that can significantly affect players' performance and career longevity. **Objective:** This study aimed to identify the risk factors associated with ankle injuries among basketball players and to examine their relationship with injury occurrence. **Methods:** A cross-sectional quantitative study was conducted among 100 basketball players from four institutions: BKSP, CRP, Jahangirnagar University, and Dhaka University. Data were collected using a structured 52-question questionnaire covering demographics, injury history, training habits, footwear, playing surfaces, protective equipment, and warm-up routines. SPSS software was used for statistical analysis, including Spearman's correlation and Chi-square tests. **Results:** The findings revealed that 35% of participants had a history of ankle injuries, with sprains being the most common (22%). A statistically significant correlation was found between ankle injuries and factors such as inadequate warm-up ($r = 0.921$, $p < 0.01$), type of footwear ($r = 0.555$, $p < 0.01$), use of protective equipment ($r = 0.482$, $p < 0.01$), and history of previous injury ($r = 0.511$, $p < 0.01$). Moreover, a significant negative correlation existed between playing experience ($r = -0.465$, $p < 0.01$) and daily playing hours ($r = -0.562$, $p < 0.01$) with the number of ankle injuries. Chi-square analysis also supported these associations. However, factors such as playing position, age, and playing surface did not show significant correlation with injury frequency. **Conclusion:** Ankle injuries among basketball players are influenced by multiple modifiable factors, including warm-up practices, footwear choices, use of protective gear, and previous injury history. Proper training, preventive strategies, and awareness programs are essential to reduce injury rates. The study highlights the urgent need for structured injury prevention interventions tailored to local athletic environments in Bangladesh.

Keywords:
Ankle injuries, Basketball, Risk factors, Warm-up, Protective equipment, Footwear, Bangladesh, Cross-sectional study

CHAPTER: I INTRODUCTION

1.1 Background

Basketball is a globally popular team sport that involves two teams of five players each, competing to score points by shooting a ball through the opponent's hoop, which is mounted 10 feet high on a backboard at each end of a rectangular court (Sikka & D, 2022). The game was invented by Dr. James Naismith in 1891 as an indoor activity to keep athletes fit during the winter months, using peach baskets as goals, which led to the sport's name (Naismith, 2022). Basketball is characterized by its high-scoring nature and complex rules, requiring players to possess a combination of physical attributes such as strength, speed, endurance, and coordination, as well as technical and tactical skills (Dako et al., 2024). The sport demands rapid acceleration and deceleration, agility, and repetitive actions like squatting, jumping, and landing, which contribute to common injury patterns, particularly in the lower extremities ("Basketball", 2022). Modern basketball also incorporates advanced analytics and technology, such as wearable sensors for motion tracking and data mining techniques for tactical analysis, to enhance player performance and predict game outcomes (Ren & Wang, 2021). The sport's strategic complexity and the necessity for teamwork and individual skill make it a dynamic and engaging game, both for participants and spectators worldwide (Sikka & D, 2022).

Ankle injuries are a prevalent concern in basketball due to the sport's dynamic and physically demanding nature, which involves frequent jumping, rapid direction changes, and contact with other players. These movements increase the risk of musculoskeletal injuries, particularly to the lower extremities, with ankle sprains being the most common type of injury reported among basketball players (Akoh et al., 2019). The high incidence of ankle injuries is attributed to several factors, including inadequate warm-up routines, poor physical fitness, and the quality of playing surfaces, which can exacerbate the risk of injury during high-intensity games (Liam, 2024). Additionally, the repetitive stress placed on the ankles during prolonged play, as well as the physiological demands of the sport, such as minutes per game and usage rate, contribute to the likelihood and severity of these injuries (Tummala et al., 2023). Previous injuries, particularly to the lower extremities, also increase the risk of subsequent ankle injuries, highlighting the importance of proper rehabilitation and preventive measures (Cumps

et al., 2007). Despite the common belief that shoe type might influence injury risk, studies have shown that the type of basketball shoe worn does not significantly impact the rate or severity of ankle injuries, suggesting that comfort and personal preference should guide shoe selection (Tansey et al., 2023). Effective prevention strategies include neuromuscular training, supportive footwear, and ensuring adequate recovery time, which can help mitigate the risk of ankle injuries and improve long-term outcomes for players (Akoh et al., 2019). Overall, understanding the multifaceted causes and risk factors associated with ankle injuries in basketball is crucial for developing targeted interventions to reduce their occurrence and impact on players' performance and career longevity (Aksović et al., 2024).

Basketball is considered a high-risk sport for ankle injuries due to several intrinsic and extrinsic factors that are more prevalent in this sport compared to others. The dynamic nature of basketball, which involves frequent jumping, rapid changes in direction, and high-intensity movements, significantly contributes to the risk of ankle injuries, particularly sprains, which are the most common type of injury in the sport (Antoranz et al., 2024). The incidence of ankle injuries in basketball is notably high, with studies reporting rates of 3.85 to 5.34 injuries per 1000 game exposures, highlighting the sport's inherent risk (McKay et al., 2001). Factors such as the number of games played, minutes per game, and usage rate are associated with an increased risk of ankle injuries, as they contribute to the physiological burden on players (Morikawa et al., 2023). Additionally, previous injuries to the lower extremities, such as the hip, hamstring, or quadriceps, further elevate the risk of sustaining ankle injuries (Tummala et al., 2023). The mechanism of injury often involves landing on an opponent's foot, which is a common occurrence in basketball due to the close physical proximity of players during games (Cumps et al., 2007). Moreover, inadequate warm-up, poor physical fitness, and improper footwear, such as shoes with air cells, have been identified as risk factors that exacerbate the likelihood of ankle injuries (Liam, 2024). The high incidence of ankle injuries in basketball is also influenced by the sport's popularity and the large number of participants, which increases the overall exposure to injury risk (Molinas et al., 2018). Preventive strategies, including neuromuscular training, proper warm-up routines, and the use of supportive footwear, are essential to mitigate these risks and reduce the incidence of ankle injuries in basketball players (Liam, 2024). Overall, the combination of high-intensity play, frequent physical contact, and specific

biomechanical demands makes basketball a sport with a particularly high risk for ankle injuries.

Ankle injuries are a prevalent concern for basketball players, both in the short and long term, impacting their performance and career longevity. In the short term, ankle injuries, particularly sprains, are the most common type of injury, accounting for a significant portion of game absences. For instance, in the NBA, ankle injuries occur at a rate of 4.06 to 5.34 per 1000 game exposures, with sprains being the predominant type, leading to absences ranging from 2 to 10 games (Tummala et al., 2023). The immediate impact of these injuries includes pain, swelling, and reduced mobility, which necessitate rest and rehabilitation to prevent further damage (Moore et al., 2021). Rehabilitation strategies such as neuromuscular training and protective measures like supportive footwear are crucial for recovery and prevention of recurrence ("Analysis of the Causes and Rehabilitation of Ankle Injuries in Basketball Players by Sports Rehabilitation in the Context of Sports-Medicine Integration", 2023). In the long term, the consequences of ankle injuries can be more severe, particularly if not managed properly. Chronic ankle instability is a common outcome, leading to repeated sprains and potentially more severe injuries like Achilles tendon ruptures, which have a high rate of failed return to play (Gross et al., 2019). The risk factors for these injuries include high minutes per game, usage rate, and a history of previous lower extremity injuries, which can exacerbate the severity and prolong recovery time (Morikawa et al., 2023). Moreover, the incidence of ankle injuries is higher in professional players compared to amateurs, indicating that the level of play and physical demands significantly influence injury rates (Molinas et al., 2018). Gender differences also play a role, with male players more prone to ankle injuries, while females are more susceptible to knee injuries (Molinas et al., 2018).

Ankle injuries are the most prevalent type of injury among basketball players, significantly impacting their performance and recovery. The most common ankle injuries include sprains, particularly lateral ligament complex tears, which account for a substantial portion of injuries sustained during play (Moore et al., 2021). Other notable injuries are high ankle sprains, deltoid ligament tears, and Achilles' tendon pathologies (Tummala et al., 2018). Factors contributing to these injuries include the physical demands of the sport, such as rapid direction changes and jumps, as well as risk factors like inadequate neuromuscular control and specific foot alignments (Akoh

et al., 2019). Effective management and prevention strategies, including neuromuscular training and proper footwear, are essential to mitigate these injuries (Akoh et al., 2019).

Ankle injuries in basketball are influenced by several risk factors, including previous injury history, physical conditioning, and environmental conditions. Studies indicate that players with a prior history of ankle injuries are significantly more likely to sustain further injuries, with odds ratios suggesting nearly fivefold increased risk (McKay et al., 2001). Additionally, factors such as inadequate warm-up, poor physical fitness, and high sports load contribute to injury susceptibility (Liam, 2024). The incidence of ankle injuries is notably high, with rates reported at approximately 4.06 per 1000 game-exposures in professional settings (Tummala et al., 2023) and 3.85 per 1000 participations in recreational play (McKay et al., 2001). Other contributing elements include the type of footwear, with shoes featuring air cells linked to higher injury rates (McKay et al., 2001), and the physiological burden from increased minutes per game and usage rates (Tummala et al., 2023). Effective prevention strategies emphasize neuromuscular training, proper warm-up routines, and awareness of injury risks (Akoh et al., 2019).

Ankle injuries are highly prevalent among basketball players across various levels, with the incidence increasing from amateur to professional levels. In professional basketball, ankle sprains account for over 20% of all injuries, leading to significant game absences, with a reported incidence of 4.06 injuries per 1000 game-exposures (Molinas et al., 2018). In contrast, amateur players experience ankle injuries at rates ranging from 18.3% to 52% of all basketball-related injuries, with male players being more affected (Molinas et al., 2018). The most common type of ankle injury across all levels is the sprain, influenced by factors such as game frequency, previous injuries, and inadequate preparation (Moore et al., 2021). Overall, the rising participation in basketball correlates with an increase in ankle injuries, highlighting the need for effective prevention and rehabilitation strategies (Akoh et al., 2019).

Existing research on ankle injuries in basketball reveals several gaps that warrant further investigation. While studies have identified high injury rates, particularly ankle sprains, and associated risk factors such as previous injuries and inadequate warm-up practices, there is a lack of comprehensive data on the long-term effects of these injuries on athletes' performance and quality of life (McKay et al., 2001). Additionally, the

influence of footwear and playing surfaces on injury rates remains underexplored, despite evidence suggesting that certain shoe designs may increase injury risk (McKay et al., 2001). Furthermore, while rehabilitation methods have been assessed, there is insufficient research on the effectiveness of integrated rehabilitation programs that combine physical and medical approaches ("Analysis of the Causes and Rehabilitation of Ankle Injuries in Basketball Players by Sports Rehabilitation in the Context of Sports-Medicine Integration", 2023). Lastly, the gender differences in injury prevalence and types, particularly the higher incidence of knee injuries among female players, require more focused studies to develop tailored prevention strategies (Cumps et al., 2007).

Identifying and understanding the risk factors of ankle injuries in basketball is crucial due to the high prevalence and significant impact of these injuries on players' performance and career longevity. Ankle injuries are among the most common and severe injuries in basketball, accounting for a substantial portion of time lost due to injury, as evidenced by studies in both professional and recreational settings (Tummala et al., 2023). The incidence of ankle injuries in professional basketball players is notably high, with factors such as minutes per game, usage rate, and previous lower extremity injuries significantly increasing the risk and severity of these injuries (Tummala et al., 2023). Additionally, intrinsic factors like previous ankle sprains, dominant leg, and extrinsic factors such as type of footwear and player position have been identified as significant risk factors (Moré-Pacheco et al., 2019). The mechanism of injury often involves landing on an opponent's foot, which is a common scenario in basketball due to the nature of the sport (Cumps et al., 2007). Understanding these risk factors is essential for developing effective prevention strategies, such as neuromuscular training, supportive footwear, and adequate recovery protocols, which can help reduce the incidence and severity of ankle injuries (Akoh et al., 2019). By addressing these risk factors, coaches and medical professionals can implement targeted interventions to protect athletes, thereby improving their performance and extending their careers in basketball (Liam, 2024).

1.2 Rationale

Ankle injuries are among the most common musculoskeletal injuries experienced by basketball players at all levels of play. The sport demands rapid changes in direction, frequent jumping and landing, and high levels of physical contact, all of which place significant stress on the lower extremities particularly the ankles. Despite the prevalence of ankle injuries, many athletes, coaches, and sports professionals may lack a comprehensive understanding of the various factors that contribute to these injuries.

This study is important because identifying and understanding the factors responsible for ankle injuries in basketball can lead to more effective prevention strategies, training modifications, and rehabilitation protocols. Such factors may include poor biomechanics, inadequate warm-up routines, previous injury history, lack of proper footwear, playing surface conditions, fatigue, and insufficient strength or stability in the ankle joint.

By investigating these factors, this research aims to provide evidence-based insights that can inform athletic training practices and contribute to the overall health, performance, and longevity of basketball players. Additionally, the findings of this study can be useful for coaches, sports medicine professionals, and policymakers who design training programs or implement injury prevention measures. Ultimately, the study seeks to reduce the incidence and severity of ankle injuries in basketball, promote safer sports participation, and enhance athletic performance through informed, data-driven recommendations.

1.3 Research Question

What are the risk factors of ankle injuries among basketball players?

1.4 Aim

To explore the risk factors of ankle injuries among basketball players.

1.5 Objectives

1.5.1 General objective

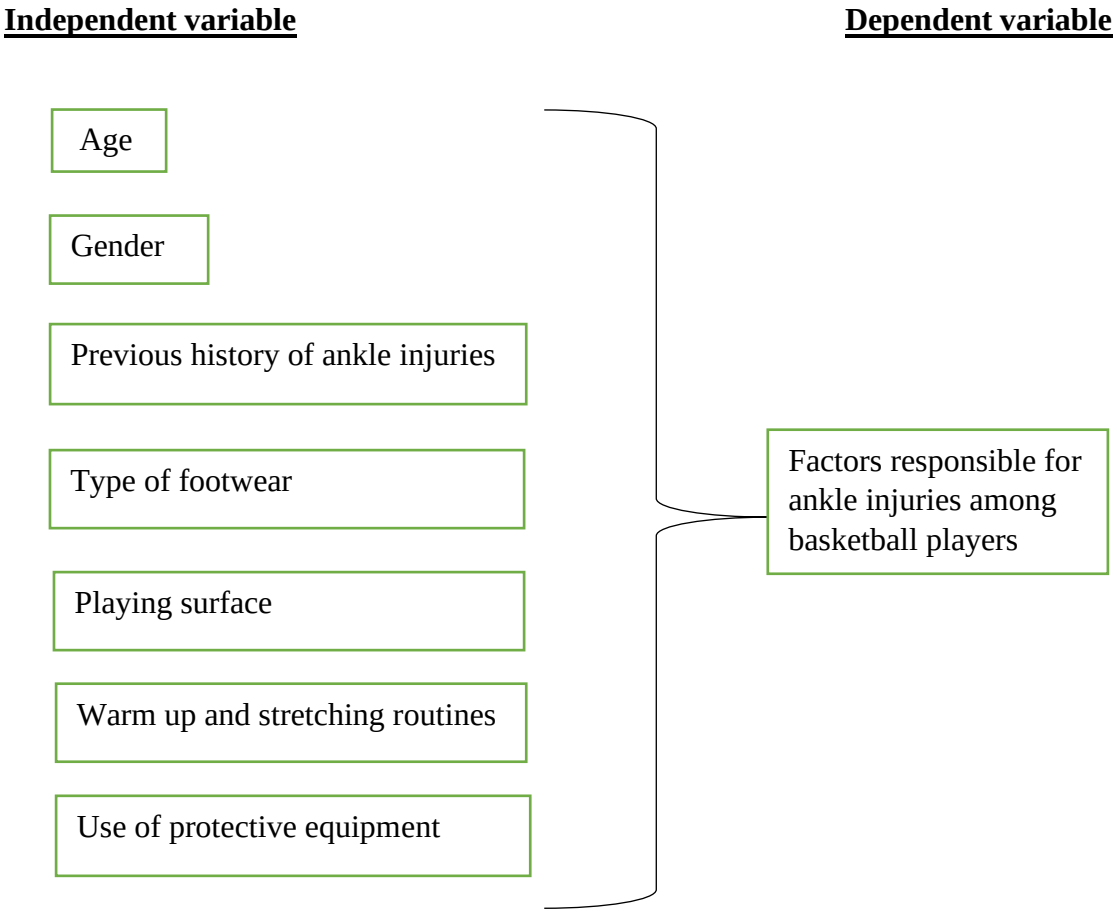
To identify common risk factors of ankle injuries among basketball players.

1.5.2 Specific objectives

- To explore demographic factors (e.g., age, sex, level of play) that may influence susceptibility to ankle injuries in basketball players.
- To identify the most common intrinsic and extrinsic risk factors (e.g., previous injuries, playing position, type of footwear, playing surface) that contribute to ankle injuries in basketball players.
- To know the determinants of warm-up routines on the risk of ankle injuries.
- To assess the impact of game time on the occurrence of ankle injuries.
- To determine the effectiveness of preventive equipment in reducing the risk of ankle injuries.

1.6 List of Variables

Conceptual Framework



1.7 Operational definition

Ankle Injuries

Ankle injuries refer to any damage or harm to the structures of the ankle joint, which include bones, ligaments, tendons, and muscles. These injuries are common in sports like basketball, where athletes frequently jump, land, change direction, and make quick movements.

Basketball

Basketball is a high-intensity team sport played between two teams of five players each. The main objective of the game is to score points by shooting a ball through the opponent's hoop or basket, which is mounted 10 feet high on a backboard at each end of the court. The team with the most points at the end of the game wins. Basketball involves a variety of physical movements such as running, jumping, passing, dribbling, and quick directional changes. Because of these actions, the sport requires a combination of speed, agility, strength, coordination, and endurance.

CHAPTER: II LITERATURE REVIEW

Ankle injuries are the most prevalent type of injury sustained by basketball players, with ankle sprains being the most common among them. These sprains often involve the lateral ligament complex, particularly the anterior talofibular ligament (ATFL), and are frequently caused by landing on an opponent's foot or sudden changes in direction during play (Moore et al., 2021). In addition to sprains, other common ankle injuries in basketball include syndesmotic sprains, Achilles' tendon injuries, and fractures such as the Jones fracture (Zellers & Silbernagel, 2019). The incidence of ankle injuries is notably high in professional settings, with studies reporting rates of 4.06 injuries per 1000 game-exposures in the NBA (Tummala et al., 2023). Risk factors for these injuries include longer playing schedules, previous lower extremity injuries, and inadequate neuromuscular control (Akoh et al., 2019). The prevalence of ankle injuries is also significant in collegiate and high school basketball, with a high recurrence rate, particularly among players who have experienced previous sprains (Nakayama et al., 2020). Rehabilitation and prevention strategies are crucial, focusing on neuromuscular training, proper footwear, and adequate recovery to mitigate the risk of recurrence and ensure a safe return to play (Gross et al., 2019). Despite the high incidence of ankle injuries, they are often treated conservatively, with most cases resulting in a time loss of less than seven days (Tummala et al., 2018). Overall, the management of ankle injuries in basketball requires a comprehensive approach that includes prevention, immediate treatment, and rehabilitation to address both acute and chronic conditions effectively.

The intensity and frequency of basketball training significantly contribute to the risk of ankle injuries, primarily due to the high physical demands and repetitive stress placed on the lower limbs. Basketball involves frequent jumping, rapid changes in direction, and sudden accelerations and decelerations, which can lead to fatigue and increase the likelihood of injuries, particularly to the ankle and knee joints (Antoranz et al., 2024). Ankle sprains are the most common injury in basketball, with risk factors including longer training schedules, inadequate neuromuscular control, and specific foot alignments (Akoh et al., 2019). The incidence of ankle injuries is notably high, with professional players experiencing a rate of 4.06 injuries per 1000 game-exposures, and these injuries often result in significant time loss from games (Tummala et al., 2023).

Training load is directly related to injury risk, as excessive or poorly managed training can lead to overuse injuries, highlighting the importance of balancing training intensity and recovery (Chan et al., 2024). The frequency of ankle injuries is also influenced by factors such as inadequate preparation and poor safety awareness during training and competition (Hu, 2017). Therefore, managing training intensity and frequency, alongside preventive strategies, is crucial in mitigating the risk of ankle injuries in basketball players.

The type of playing surface significantly influences the occurrence of ankle injuries, with various surfaces presenting different risks due to their unique physical properties. Artificial surfaces, such as artificial turf, have been associated with higher rates of foot and ankle injuries compared to natural grass. This is attributed to the higher frictional coefficients of artificial turf, which can increase the likelihood of non-contact injuries by affecting the cleat-surface interaction and player biomechanics ("Playing Surface and Injury Risk: Artificial Turf Vs. Natural Grass", 2023). Studies have shown that while advancements in artificial turf technology have reduced injury rates to levels closer to those on natural grass, foot and ankle injuries remain more prevalent on these surfaces (Ryann et al., 2023). The increased friction on artificial surfaces can lead to higher peak inversion velocities and internal rotation moments during movements such as sidestep cutting, which are risk factors for ankle sprains (Bocanegra & Fong, 2021). In contrast, wooden courts, often used in indoor sports like basketball, can result in greater impact forces at the toes and medial forefoot, potentially affecting foot loading and discomfort, although they do not necessarily increase perceived discomfort at the ankle (Kong et al., 2018). The variability in injury risk across different surfaces underscores the importance of considering surface-specific characteristics, such as friction and compliance, in injury prevention strategies. Moreover, the interaction between footwear and surface type is crucial, as improper cleat selection can exacerbate the risk of injury on high-friction surfaces (O'Connor & James, 2013). Overall, while artificial surfaces offer economic and functional benefits, they pose a higher risk for ankle injuries, necessitating careful consideration of surface conditions and footwear to mitigate these risks (Dragoo & Braun, 2010).

Footwear design and quality play a significant role in influencing the likelihood of ankle injuries among basketball players, although the impact varies depending on specific shoe features and player preferences. High-top shoes are traditionally believed to offer

better ankle support and reduce the risk of sprains by limiting ankle movement; however, studies have shown mixed results regarding their effectiveness. For instance, one study found no significant difference in ankle injury rates between high-top and low-top shoes among professional basketball players, suggesting that shoe type may not significantly impact injury risk or recovery outcomes (Tansey et al., 2023). Additionally, shoe modifications such as cushioning, midsole hardness, and collar height can influence lower limb biomechanics, with softer midsoles providing better impact attenuation and high collars improving ankle stability during dynamic movements like jumping and cutting (Lam et al., 2019). The use of ankle braces with low-cut shoes has also been shown to reduce inversion, suggesting a potential benefit in injury prevention (Commons & Low, 2015). Furthermore, the prevalence of ankle injuries in basketball is high, with sprains being the most common, and factors such as previous injuries, game exposure, and player workload contributing to injury risk (Molinas et al., 2018).

Ankle injuries in basketball are significantly influenced by various biomechanical factors associated with common movements such as landing, cutting, and jumping. Limited ankle dorsiflexion is a critical factor that alters lower extremity biomechanics during landing, leading to increased hip extension, knee external rotation, and patellofemoral joint contact force, which collectively heighten the risk of ankle injuries (Chen, 2024). The dynamic nature of basketball, characterized by high-intensity movements like pivoting and cutting, places substantial biomechanical stress on the lower limbs, increasing the risk of injuries to the ankle, knee, and hip joints (Wang, 2024). Specifically, landing mechanics are crucial, as landing on an opponent's foot is a major cause of ankle sprains, which are the most common acute injuries in basketball (Cumps et al., 2007). The incidence of ankle injuries is notably high in professional settings, with sprains accounting for over 20% of injuries, and these injuries often occur during both games and practice sessions (Molinas et al., 2018). Additionally, factors such as minutes per game, usage rate, and previous lower extremity injuries, including those to the hip, hamstring, or quadriceps, are associated with an increased risk of ankle injuries and longer recovery times (Tummala et al., 2023). Effective injury prevention strategies include neuromuscular training, supportive footwear, and adequate recovery, which are essential to mitigate the risk of ankle injuries (Akoh et al., 2019). Furthermore, fatigue exacerbates joint loading and reduces muscle efficiency,

increasing the risk of injury during high-impact movements like jumping (Wang, 2024). Rehabilitation programs that integrate sports medicine and focus on personalized, three-dimensional approaches have shown promise in improving recovery outcomes and reducing recurrence rates of ankle injuries ("Analysis of the Causes and Rehabilitation of Ankle Injuries in Basketball Players by Sports Rehabilitation in the Context of Sports-Medicine Integration", 2023).

Basketball players are predisposed to ankle injuries due to a combination of anatomical, physiological, and situational risk factors. A history of previous ankle injuries significantly increases the likelihood of future sprains, with players who have sustained prior ankle injuries being almost five times more likely to experience another injury (McKay et al., 2001). Ligament laxity, particularly in the lateral ankle ligaments, is another intrinsic risk factor that contributes to both acute and recurrent ankle sprains (Shahi et al., 2016). Additionally, inadequate neuromuscular control and cavovarus foot alignment have been identified as contributing factors to ankle injuries in basketball players (Akoh et al., 2019). Physiological factors such as greater height and increased minutes per game (MPG) also correlate with a higher risk of ankle injuries, as these factors increase the physiological burden on players (Tummala et al., 2023). The type of footwear, specifically shoes with air cells in the heel, has been associated with a higher incidence of ankle injuries, as they may not provide adequate support during high-impact activities like landing (McKay et al., 2001). Furthermore, the player's position on the court can influence injury risk, with certain positions like small forward being more susceptible due to the demands of the role (Moré-Pacheco et al., 2019). The mechanism of injury often involves landing on an opponent's foot, which is a common cause of ankle sprains in basketball (Cumps et al., 2007). Preventive measures such as proper stretching, wearing supportive footwear, and engaging in neuromuscular training can help mitigate these risks (McKay et al., 2001). Overall, a multifaceted approach that considers both intrinsic and extrinsic factors is essential for reducing the incidence of ankle injuries among basketball players.

Player position in basketball significantly influences the risk and type of ankle injuries experienced by athletes, primarily due to the distinct physical and biomechanical demands associated with each position. Guards, forwards, and centers exhibit different physical characteristics and movement patterns, which contribute to varying injury risks. Guards, typically smaller and quicker, engage in more rapid directional changes

and accelerations, increasing their susceptibility to ankle sprains due to the high lateral demands of their position (Svilar et al., 2018). Forwards, who often balance between agility and physicality, face a moderate risk of ankle injuries, as they are involved in both perimeter and post-play, requiring frequent jumping and landing, which are common mechanisms for ankle sprains (Cengizel & Cengizel, 2022). The biomechanical analysis of lower extremity movements in basketball highlights that abnormal movement strategies during jumping, landing, and cutting can lead to various lower extremity injuries, including those to the ankle (Taylor et al., 2019). Furthermore, the incidence of ankle injuries is notably higher during competition than training, emphasizing the role of game intensity and the physical demands placed on players during matches (Moreno-Pérez et al., 2021). Despite these differences, the most prevalent ankle injury across all positions is the sprain, which accounts for a significant portion of time-loss injuries in professional basketball (Molinas et al., 2018). Overall, understanding these positional differences is crucial for developing targeted injury prevention and rehabilitation strategies tailored to the specific demands of each playing position.

Fatigue and overuse significantly impact ankle injury rates during competitive basketball seasons, as evidenced by multiple studies. Ankle sprains are the most common injury in basketball, accounting for a substantial portion of injuries across various levels of play, from amateur to professional leagues (Akoh et al., 2019). The incidence of ankle injuries is notably high in professional settings, such as the NBA, where factors like minutes per game (MPG) and usage rate are associated with increased injury risk and time loss (Morikawa et al., 2023). These factors contribute to the physiological burden on players, exacerbating the likelihood of injuries. Overuse injuries, which are prevalent in basketball, often go underreported when using traditional time-loss methods, as demonstrated by the higher detection rates using the OSTRC Overuse Injury Questionnaire (Weiss et al., 2017). The prevalence of overuse injuries, including those affecting the ankle, is significant, with a reported rate of 6.4 per 1,000 hours of athlete exposure (Weiss et al., 2017). Fatigue from extended play and inadequate recovery periods further increase the risk of ankle injuries, as players often continue to participate despite minor injuries, leading to more severe conditions (Akoh et al., 2019). Additionally, the repetitive nature of basketball, involving frequent jumping and landing, contributes to the high incidence of ankle sprains, particularly

when players land on an opponent's foot (Cumps et al., 2007). The impact of fatigue is also evident in the increased injury rates during practice sessions, which account for a significant portion of injuries, highlighting the need for effective injury prevention strategies that address both acute and overuse injuries (Molinas et al., 2018). Overall, the interplay between fatigue, overuse, and the physical demands of basketball underscores the importance of comprehensive injury prevention programs that incorporate adequate rest, neuromuscular training, and proper load management to mitigate the risk of ankle injuries during competitive seasons (Akoh et al., 2019).

Preventive strategies for reducing the risk of ankle injuries in basketball include taping, bracing, and strength training, each demonstrating varying degrees of effectiveness. Taping and bracing are widely used prophylactic measures that have been shown to significantly reduce the incidence of ankle sprains, particularly in athletes with a history of previous sprains. Studies indicate that braces, especially semi-rigid ones, are more effective than taping in preventing both initial and recurrent ankle sprains, without adversely affecting athletic performance (Zwiers et al., 2016). The use of high-top shoes and balance board training also contributes to reducing injury risk by enhancing proprioception and ankle strength (Thacker et al., 2002). Conditioning programs focusing on agility, balance, and flexibility are recommended as they decrease the likelihood of injuries (Thacker et al., 2002). Additionally, proprioceptive training has been shown to lower the incidence of ankle sprains in athletes with recurrent injuries to levels comparable to those without any history of sprains (Kaplan, 2011). While taping is effective, it is more costly compared to bracing, which offers a more economical option for long-term use (Olmsted et al., 2004). The combination of external supports like braces with neuromuscular training is suggested to achieve optimal preventive outcomes (Verhagen & Bay, 2010).

The psychological burden associated with high minutes per game and usage rates in professional settings, such as the NBA, has been linked to increased injury risk and time loss, suggesting that mental fatigue and stress from high performance demands may contribute to physical injuries (Tummala et al., 2023). These findings underscore the importance of addressing psychological factors in injury prevention strategies, as they play a crucial role in the occurrence and recurrence of ankle injuries in basketball players. Integrating psychological support and stress management into training programs could potentially mitigate these risks and enhance player safety and

performance ("Analysis of the Causes and Rehabilitation of Ankle Injuries in Basketball Players by Sports Rehabilitation in the Context of Sports-Medicine Integration", 2023).

The level of competition in basketball, ranging from amateur to professional, significantly influences the prevalence and severity of ankle injuries. Professional players, such as those in the NBA, experience a higher incidence of ankle injuries compared to other levels, with a rate of 4.06 injuries per 1000 game-exposures, primarily due to the increased physiological demands and higher intensity of play (Tummala et al., 2023). In contrast, collegiate players also face a high prevalence of ankle injuries, but these are often less severe, with most resulting in a time loss of less than seven days and being treated conservatively (Tummala et al., 2018). Amateur players, while still susceptible to ankle injuries, do not show significant differences in injury incidence compared to professional players, although the severity and recovery time can vary (Conde et al., 2021). The nature of the competition also plays a role; professional players often face more contact-related injuries during games, whereas amateur players might experience a mix of contact and non-contact injuries during both training and competition (Moreno-Pérez et al., 2021).Preventive measures and rehabilitation strategies are crucial across all levels, but the intensity and frequency of professional play necessitate more rigorous and targeted interventions to mitigate the risk and impact of ankle injuries (Cumps et al., 2007). Overall, while ankle injuries are prevalent across all levels of basketball, the severity and management strategies differ, highlighting the need for tailored prevention programs based on the level of competition (Bagehorn et al., 2024).

Warm-up and cool-down routines play a crucial role in the prevention of ankle injuries among basketball players by enhancing range of motion, balance, and neuromuscular performance. Studies have shown that specific warm-up routines, such as the combined warm-up involving single-leg stance and stretching exercises, significantly improve ankle dorsiflexion range of motion (ROM) and center of pressure displacement, which are critical for injury prevention in basketball players (Padua et al., 2019). Neuromuscular warm-ups, which include balance and proprioceptive exercises, have been found to reduce the incidence of lower extremity injuries, including ankle injuries, by improving joint position sense and postural control (Davis et al., 2021). The SHRed Injuries Basketball program, a neuromuscular training warm-up, demonstrated a 36%

reduction in ankle and knee injury rates among youth basketball players, highlighting the effectiveness of structured warm-up programs in injury prevention (Emery et al., 2021). Additionally, the use of foam rollers during warm-up has been shown to enhance ankle mobility and lower limb stability, further supporting the role of warm-up routines in reducing injury risk (Parra-Casado et al., 2024). Despite the clear benefits, challenges such as limited time, space, and knowledge about effective warm-up exercises persist among coaches and players, indicating a need for better education and implementation of evidence-based warm-up protocols (Munoz-Plaza et al., 2021).

CHAPTER: III METHODOLOGY

3.1 Study design

This study aimed to find out the factors responsible for ankle injuries among young basketball players at BKSP, CRP, Jahangirnagar University, Dhaka University. For this reason, a quantitative research model in the form of a cross-sectional design is used. Cross-sectional studies are chosen because they allow for the identification of a specific population at a certain moment in time. The cross-sectional research makes it simple to compare the outcomes of people of diverse ages, genders, and ethnicities. On the other hand, the quantitative research approach collects data objectively by using a large number of participants. The data is then converted to numbers for statistical analysis to make conclusions.

3.2 Study site

As this is a survey on factors responsible for ankle injuries among young basketball players at BKSP, CRP, Jahangirnagar University, Dhaka University, so study site was in BKSP, CRP, Jahangirnagar University, Dhaka University var. Samples were selected according to the inclusion criteria.

3.3 Study population

Populations were the basketball players of BKSP, CRP, Jahangirnagar University, Dhaka University of this study. A population is a well-defined group or class of individuals, things, or events that are the subject of the study. According to the investigator's defined criteria, the population shares a particular set of traits. A review of the literature and the objectives of the study are used to identify the study population's criteria. As the study's assumptions and theoretical foundation developed, selection criteria were progressively developed.

3.4 Sampling procedure

The sample size has been calculated as the estimation of sampling scientifically and had been selected as the standard number of the sample as a calculation guide. (Depends on inclusion & exclusion criteria).

Mathematical tools:

- n = required sample size
- Z = Z-value for 95% confidence level (1.96)
- P = estimated proportion (0.5, as the proportion is unknown)
- E = margin of error (0.05)

Here,

$$n = \frac{Z^2 \times P \times (1 - P)}{E^2}$$

$$= \frac{(1.96)^2 \times 0.5(1 - 0.5)}{(0.05)^2}$$

$$= \frac{3.8416 \times 0.25}{0.0025}$$

$$= \frac{0.9604}{0.0025}$$

$$= 384.16$$

3.4.1 Sample Size

So, the researcher aimed to focus his study by 384 samples following the calculation above initially. But as the study was done as a part of fourth professional academic research project and there were some limitations, so the researcher had to limit with 100 basketball players as sample.

There is no simple method for determining the ideal sample size because it is primarily dependent on the research being conducted and the researcher's understanding of the features of the relevant population. Because basketball players compete in a variety of national and international events throughout the year, samples were chosen using the convenience sampling approach, which selects individuals based on ease of study, cost, and speed.

3.4.2 Sampling technique

The convenience sampling method was used to choose the sample for this study. A convenience sample was a collection of people who (conveniently) meet the criteria for the study.

3.4.3 Inclusion criteria

• Only regular basketball players are selected.
• All ages of player are including.
• People who are regularly playing in CRP, JU, BKSP, DU.
• People who are willing to participate in this study.

3.4.4 Exclusion criteria

• Wheelchair basketball players will be excluded.
• People who are irregular will be excluded.
• People who will be not willing to participate in this study.

3.5. Data collection

One of the most important aspects of research is gathering data. The methods, materials used, duration, and technique of data collecting are all included in this study's data gathering.

3.5.1 Method of data collection

A systematic questionnaire with closed-ended questions was used to gather data. A questionnaire was employed since it remains a very effective and widely utilized method of gathering data in the medical field. The study's other goal was to determine the risk factors for ankle injuries among BKSP, CRP, DU, and JU basketball players. Therefore, questionnaires are the most effective way to identify these issues. A structured questionnaire's strength is its capacity to gather clear, easily counted responses, which produces quantitative data for study. A structured questionnaire is therefore the best method for gathering data.

3.5.2 Materials used for the research project

Consent form, questionnaire, pencil and eraser, pen, file, notebook, page, Laptop, SPSS (Statistical Package for the Social Sciences) software to analyze data.

3.5.3 Questionnaire

A questionnaire in English was utilized to collect data. The basketball players from BKSP, CRP, JU, and DU served as the study's samples. The questionnaire consisted of progressively constructed, closed-ended questions. There were fifty-four questions in the questionnaire. The questionnaire was designed to follow the trend found in the field data. In order to determine and accomplish the study's goals, it was attempted to gather a variety of data regarding basketball players' ankle injuries. These questions cover things like age, gender, basketball play specialization, injuries, their kind and severity, the kind of treatment received, risk factors, field requirements, and a basketball player's physical condition.

3.5.4 Duration of data collection

Data was collected within 4 weeks and the duration was February 2025. Data was collected carefully and maintain the confidentiality of the data. Each participant provided particular time to collect data. In general, each questionnaire took approximately 15-20 minutes to complete.

3.5.5 Procedure of data collection

Although there are a number of methods for gathering data, completing the questionnaire in front of the researcher made it simple and trustworthy.

3.6 Data analysis

Quantitative data was the survey's outcome. Bar graphs were used to represent the gathered data. A great deal of data was gathered through this survey. All of these findings provided a fundamental understanding of the causes of ankle injuries in basketball players. Descriptive statistics and percentage calculations were used to present the findings. The practice of methodically organizing and presenting data in order to find ideas is called data analysis. Determining the significance of the gathered data is the goal of data analysis.

The study employed descriptive statistics. Generally speaking, survey techniques are frequently used with descriptive statistics. The most often used descriptive tools, however, are the frequency polygon, bar graph, histogram, pie chart, and measures of central tendency and dispersion. Usually, nominal and ordinal data are presented using bar graphs. It displays the data as a sequence of vertical rectangles, each of which shows the total number of scores in a certain category.

3.7 Ethical consideration

- Researcher will follow the Institutional Review Board (IRB) guideline.
- Researcher will follow the WHO guideline.
- Researcher will follow the Bangladesh Research Council (BMRC) guideline.
- Strictly maintain the confidentiality.
- Informed consent will be taken.
- All participants will be informed about aim, objectives of the study prior to participation.
- Participants right and privileges will be ensured.
- No harmful act will be taken and the participants can withdraw themselves at any time.

3.8 Informed Consent

Consent from the participants must be obtained prior to conducting research with the respondents. Consent forms were provided to interested participants in this study, and the subjects were verbally briefed on the aim of the study and the consent forms. They were informed that they might opt out at any moment and that participation is entirely voluntary. Additionally, they were informed that confidentiality was upheld. Information may have been published in any writing or presentation, but it was not identified. Although the study's findings might not directly affect them, the physiotherapy population may benefit from it in the future. The study would not humiliate them. At any time, the researcher was available to answer any additional questions in regard to the study.

CHAPTER: IV RESULT

4.1 Socio-demographic information

4.1.1 Age of the participants

A total of 100 basketball players were enrolled in the study from Jahangirnagar University, BKSP, Dhaka University, and CRP. The study includes participants ages 19 years (1%, n=1), 20 years (4%, n=4), 21 years (5%, n=5), 22 years (17%, n=17), 23 years (16%, n=16), 24 years (8%, n=8), 25 years (24%, n=24), 26 years (12%, n=12), 27 years (2%, n=2), 28 years (2%, n=2), 29 years (1%, n=1), 30 years (3%, n=3), 31 years (2%, n=2), 32 years (1%, n=1), and 33 years (2%, n=2). Figure 1 illustrates the ages of all participants.

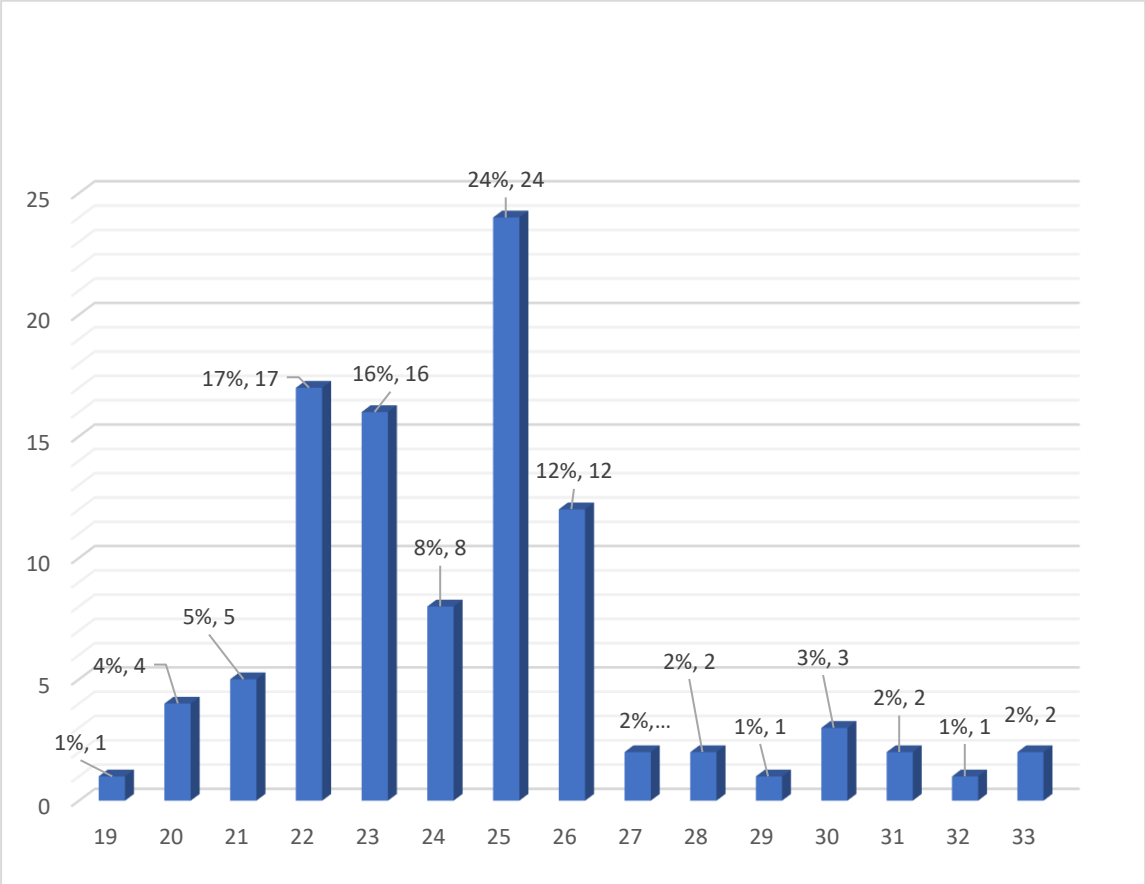


Figure 1: Age of the participants.

4.1.2 Gender of the participants

Among 100 basketball players, male basketball players are the dominating in this study. Male basketball players were 96% (n=90), female basketball players were 4% (n=4). Figure 2 indicates the gender of the participants.

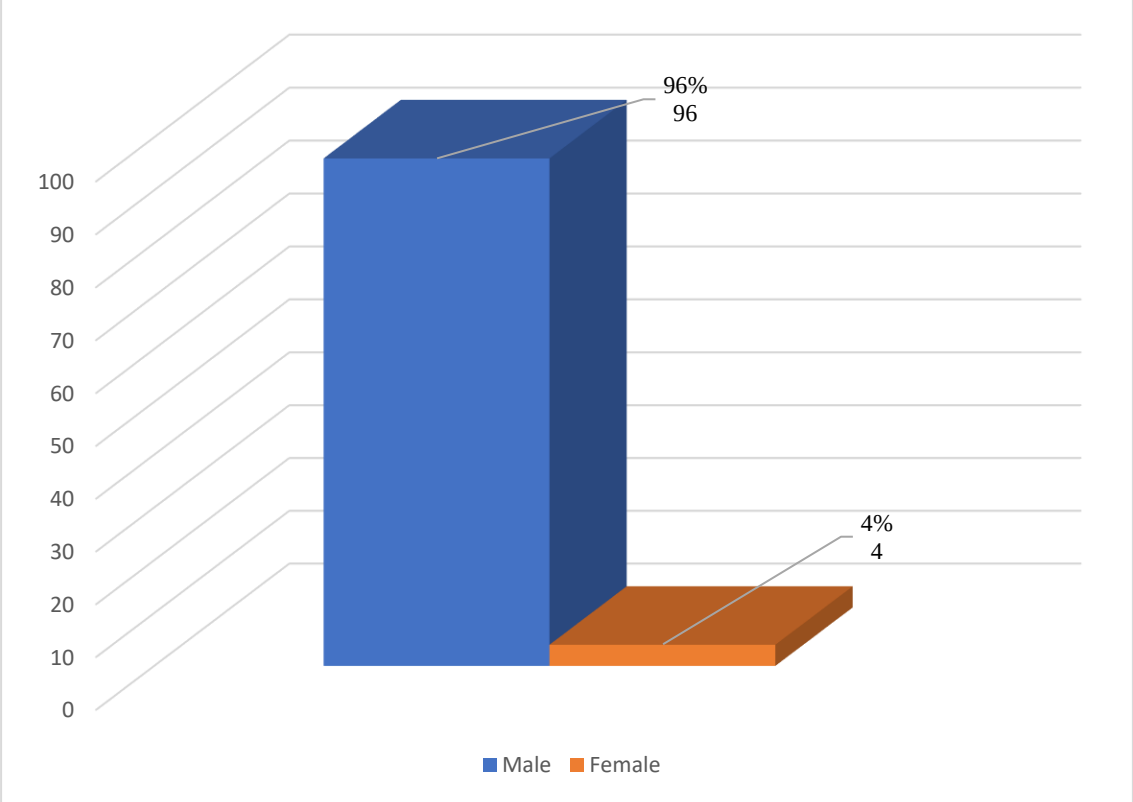


Figure 2: Gender of the participants.

4.1.3 Marital status

Of the 100 basketball players surveyed, 87% (n=87) were unmarried, while 13% (n=13) were married. Figure 3 illustrates the marital status.

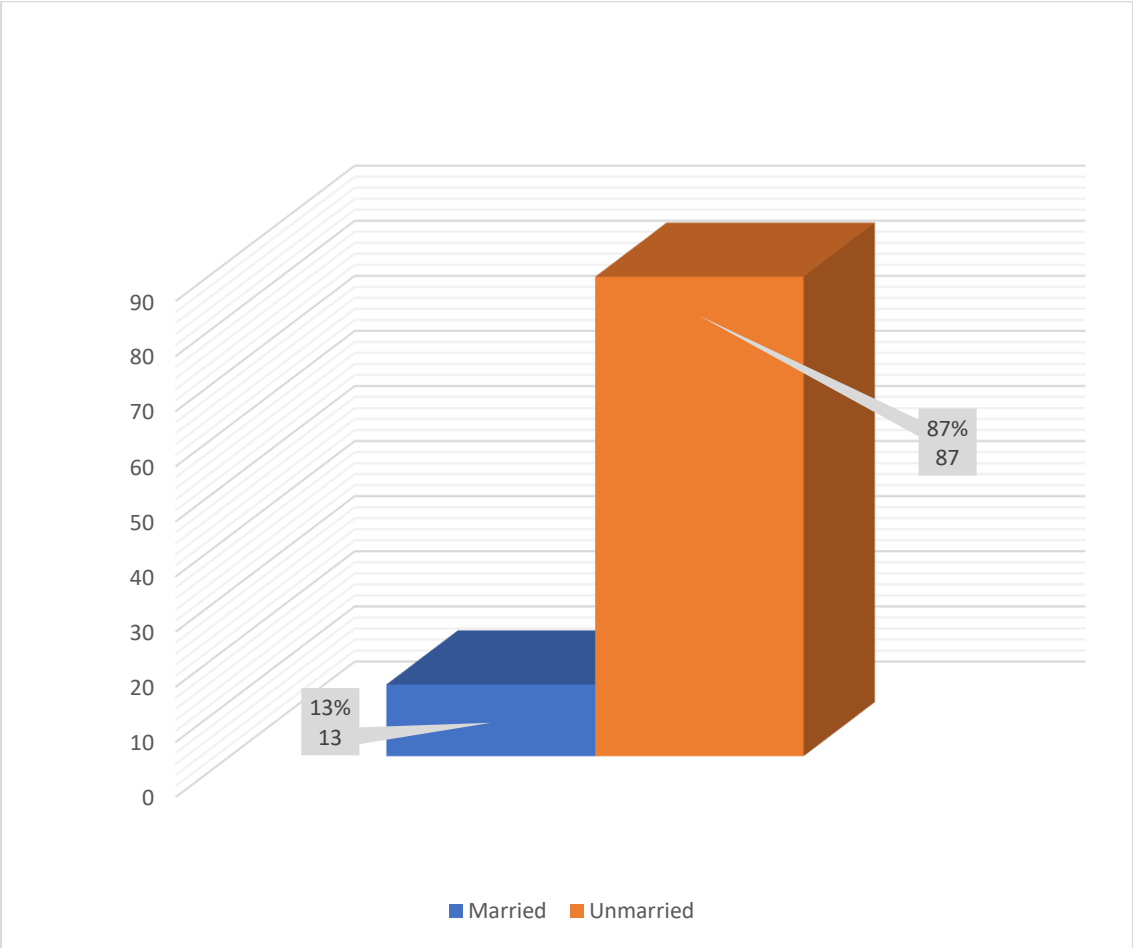


Figure 3: Marital status.

4.1.4 Level of education

Among 100 participants of basketball players, higher secondary level was 2% (n=2), under graduate participants were 72 % (n=72), graduated participants were 26% (n=26). Figure 3 demonstrates educational status.

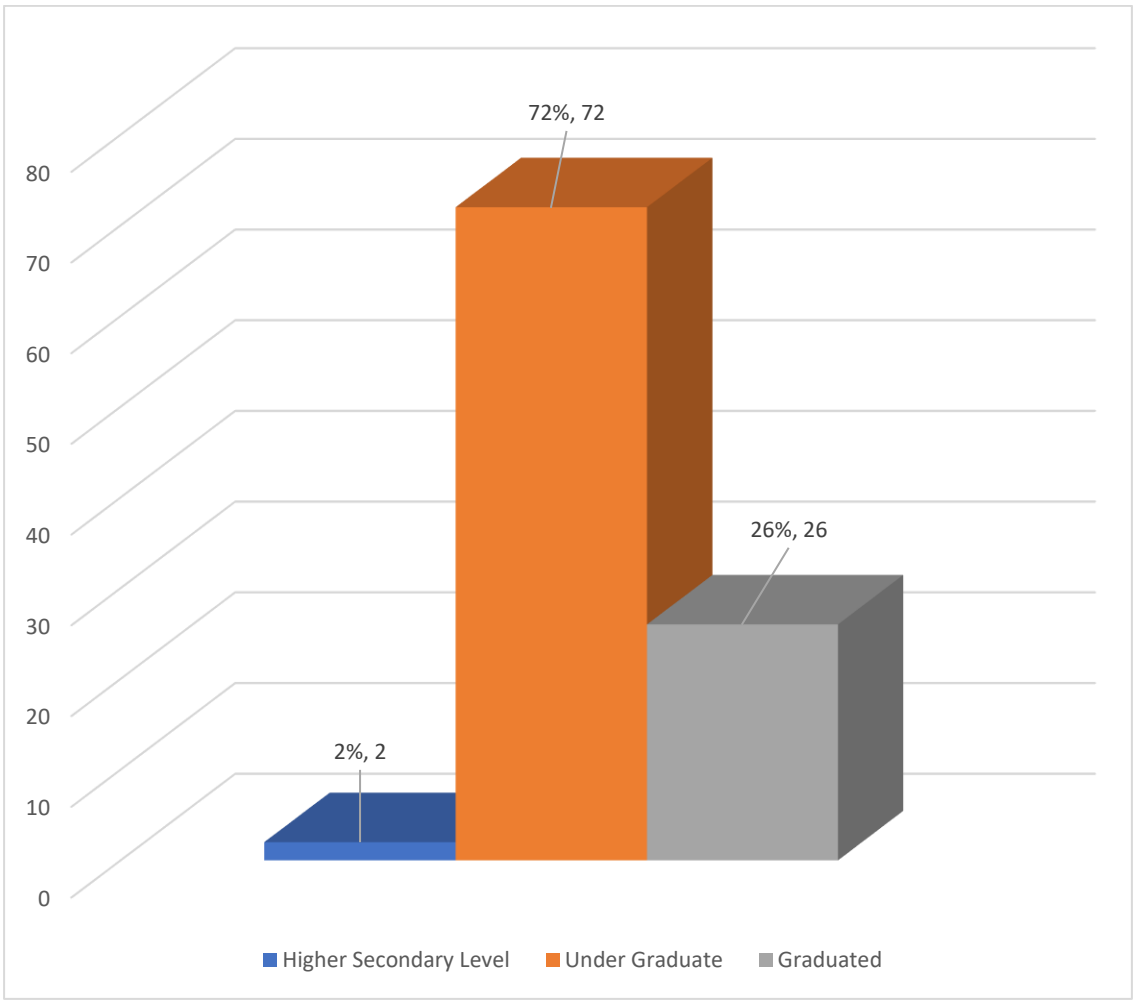


Figure 4: Educational status.

4.1.5 Living area

The living area of basketball players is shown in Figure 4, and out of 100 participants, 93% (n=93) lived in a semi-urban area, while only 7% (n=7) lived in an urban area.

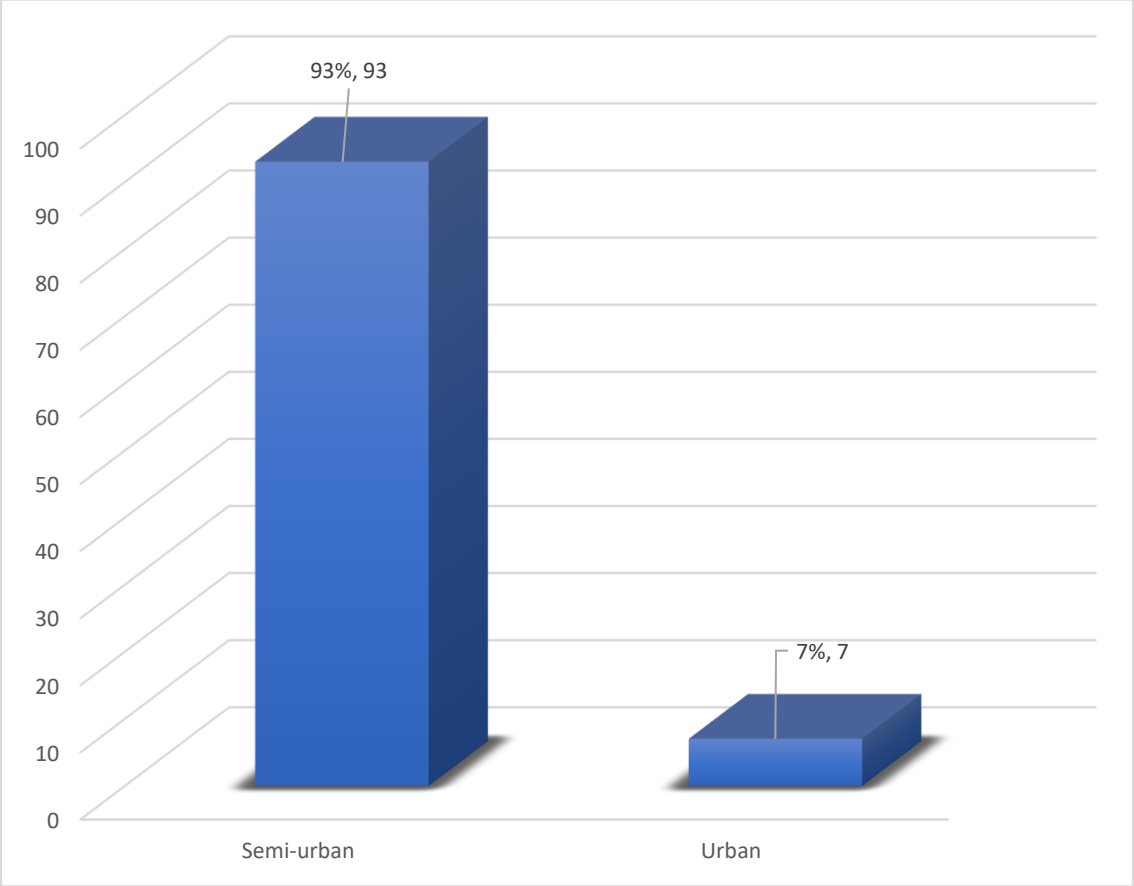


Figure 5: Living area.

4.1.6 Level of play

Out of 100 basketball players, 23% (n=23) were from Jahangirnagar University, 9% (n=9) from BKSP, 7% (n=7) from Dhaka University, and 61% (n=61) from CRP. Figure 6 demonstrate the level of play to this basketball players.

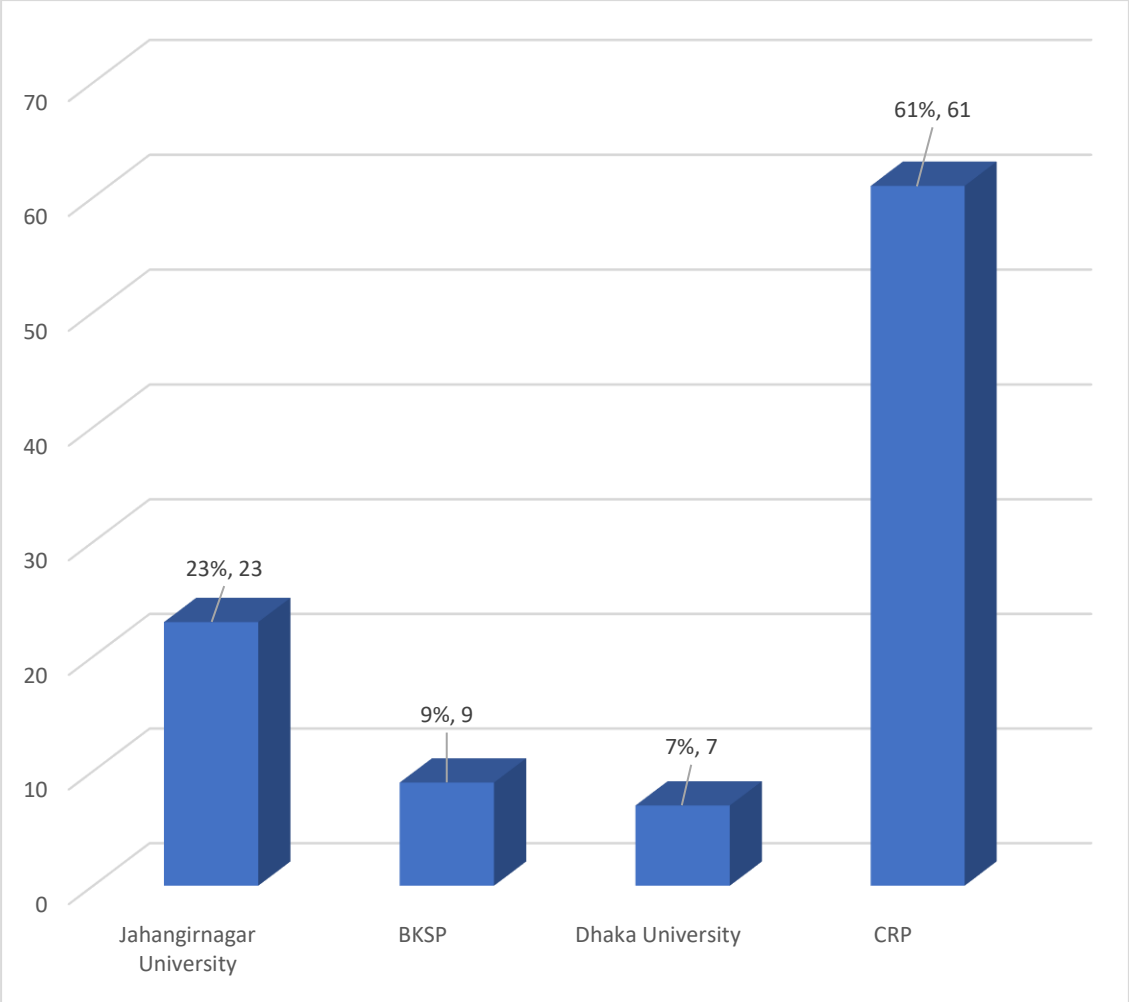


Figure 6: Level of play

4.2 Playing History

4.2.1 Playing position

Among 100 participants of basketball players, 19% (n=19) basketball players playing in the center,31% (n=31) players playing in power forward, 20% (n=20) players playing in small forward, 18% (n=18) players playing in point guard and 12% (n=12) players playing in shooting guard. Figure 7 demonstrate the playing position of the basketball players.

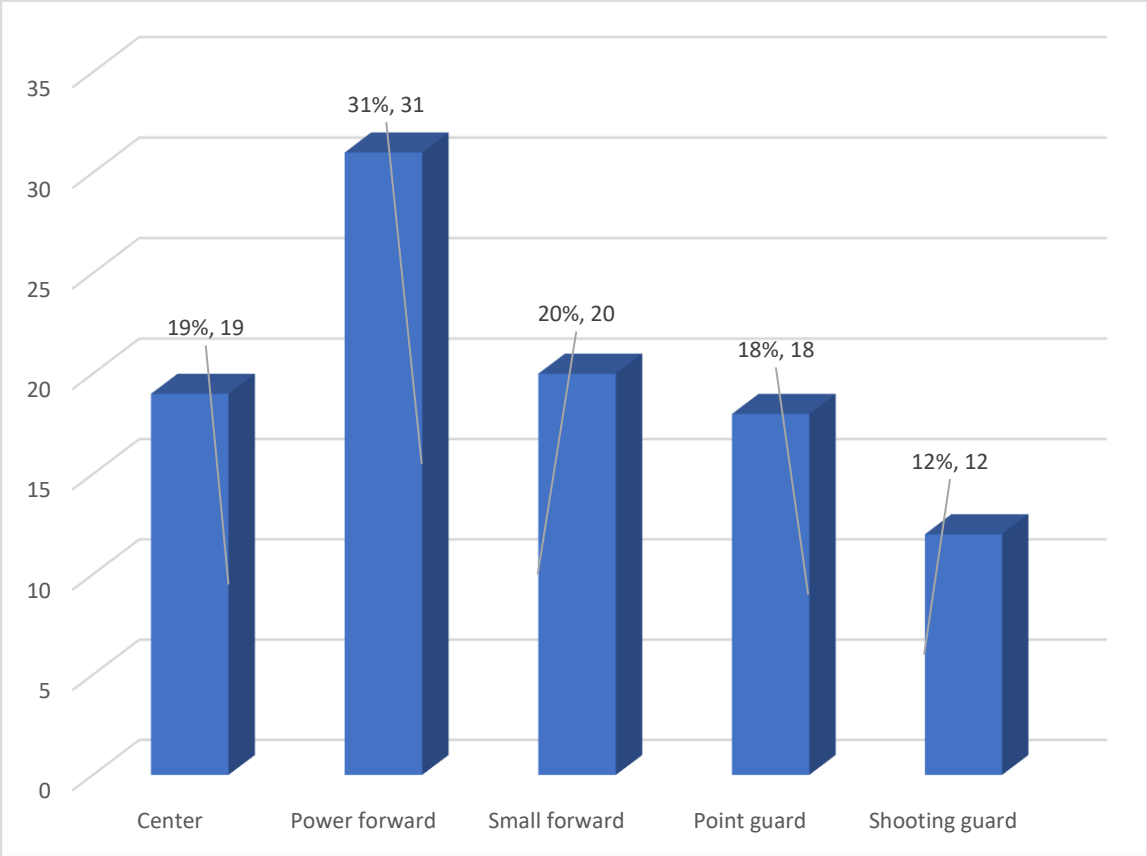


Figure 7: Playing position.

4.2.2 Experience of playing

Among 100 participants of basketball players, 20% (n=12) players playing basketball from 1 year, 37% (n=37) players playing basketball from 1 to 2 years, 27% (n=27) players playing basketball from 2 to 5 years, 16% (n=16) players playing basketball more than 5 years. Figure 8 demonstrate the players experience of playing basketball.

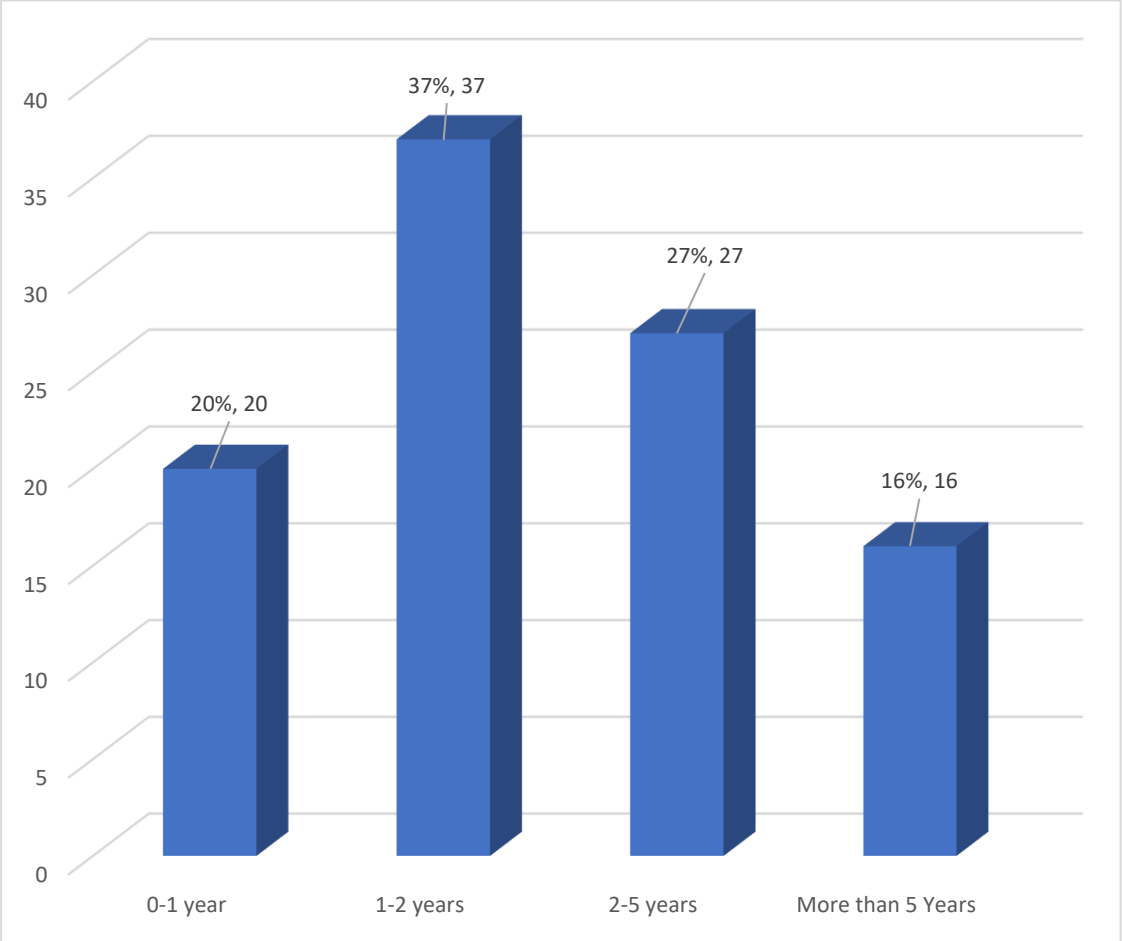


Figure 8: Experience of playing.

4.2.3 Playing hours on a day

Among 100 participants of basketball players, 32% (n=32) players playing basketball 1 to 2 hours in a day, 39% (n=39) players playing basketball 1 hour in a day, 26% (n=26) players playing basketball 2 to 4 hours in a day and only 3% (n=3) players playing basketball more than 4 hours in a day. Figure 9 demonstrate the players basketball playing hours.

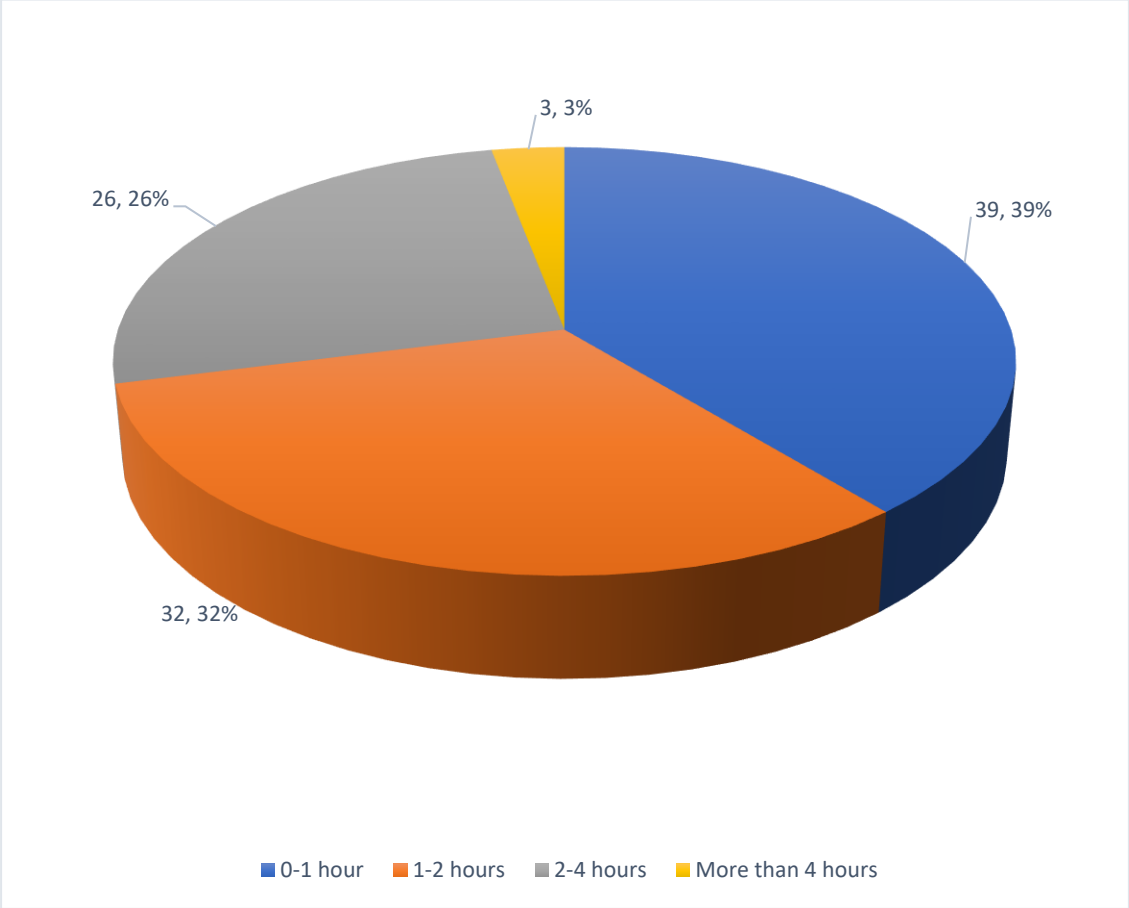


Figure 9: Playing hours.

4.2.4 Playing season

Among 100 participants of basketball players, 34% (n=34) players playing basketball around a year, majority of the players about 66% (n=66) playing basketball in a specific season. Figure 10 demonstrate the players playing season.

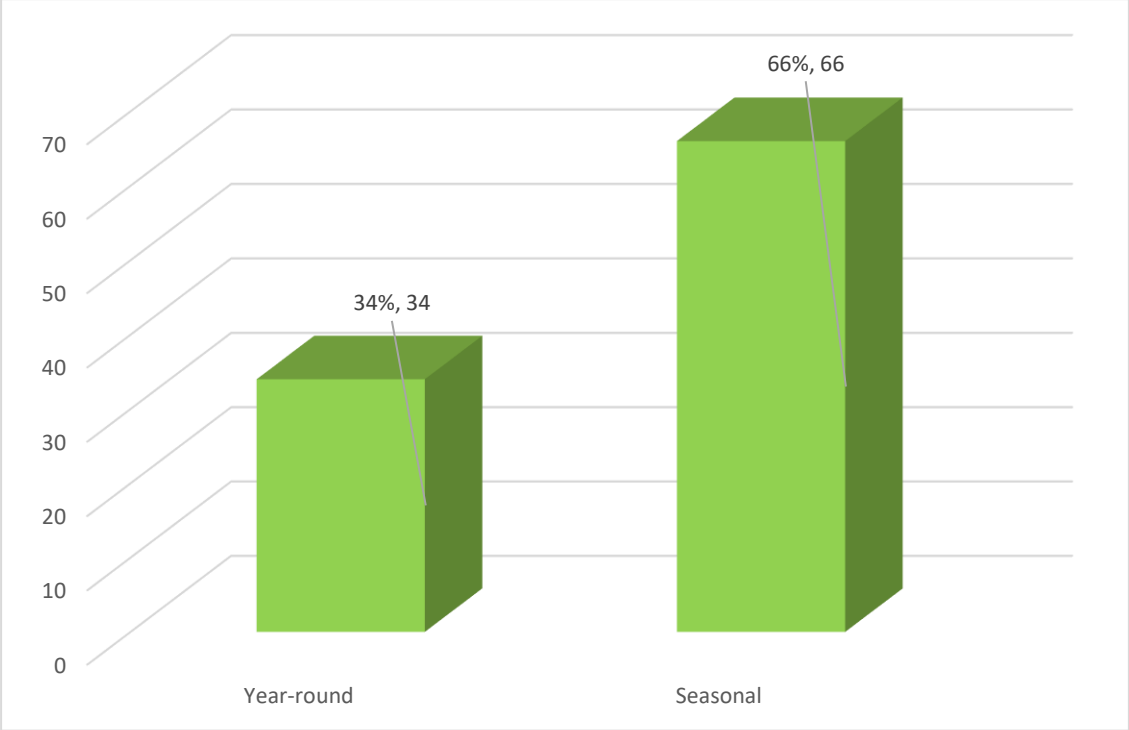


Figure 10: Playing season.

4.2.5 Ground Surface

Among 100 participants of basketball players, 7% (n=7) players playing basketball in a hardwood court surface, only 1% (n=1) players playing basketball in an asphalt surface. There is a huge number of players like 92% (n=92) playing basketball in a concrete surface. Figure 11 demonstrate the playing surface.

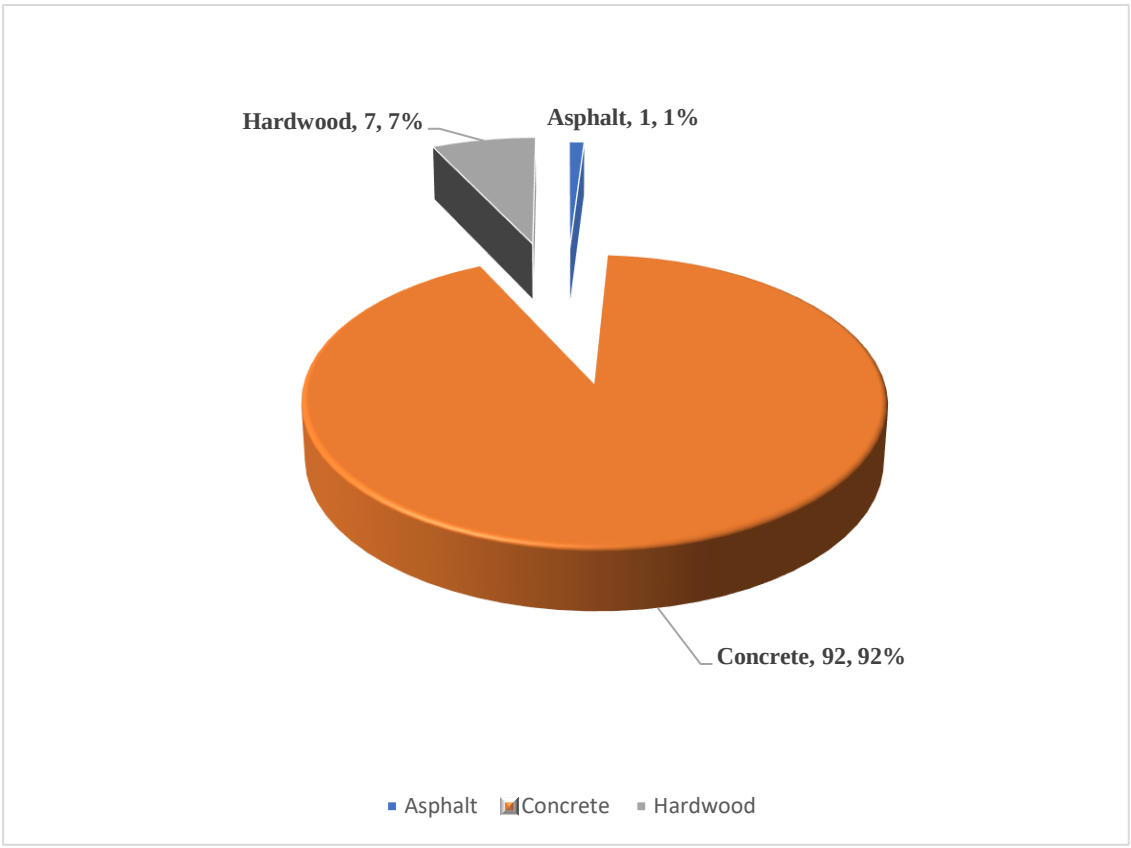


Figure 11: Basketball playing surface.

4.3 Injury history

4.3.1 Previous history of ankle injuries

Among 100 participants of basketball players, 86% (n=86) players are noted the previous history of ankle injuries and 14% (n=14) player are out of the previous history of ankle injuries. Figure 12 demonstrate the playing previous history of ankle injuries.

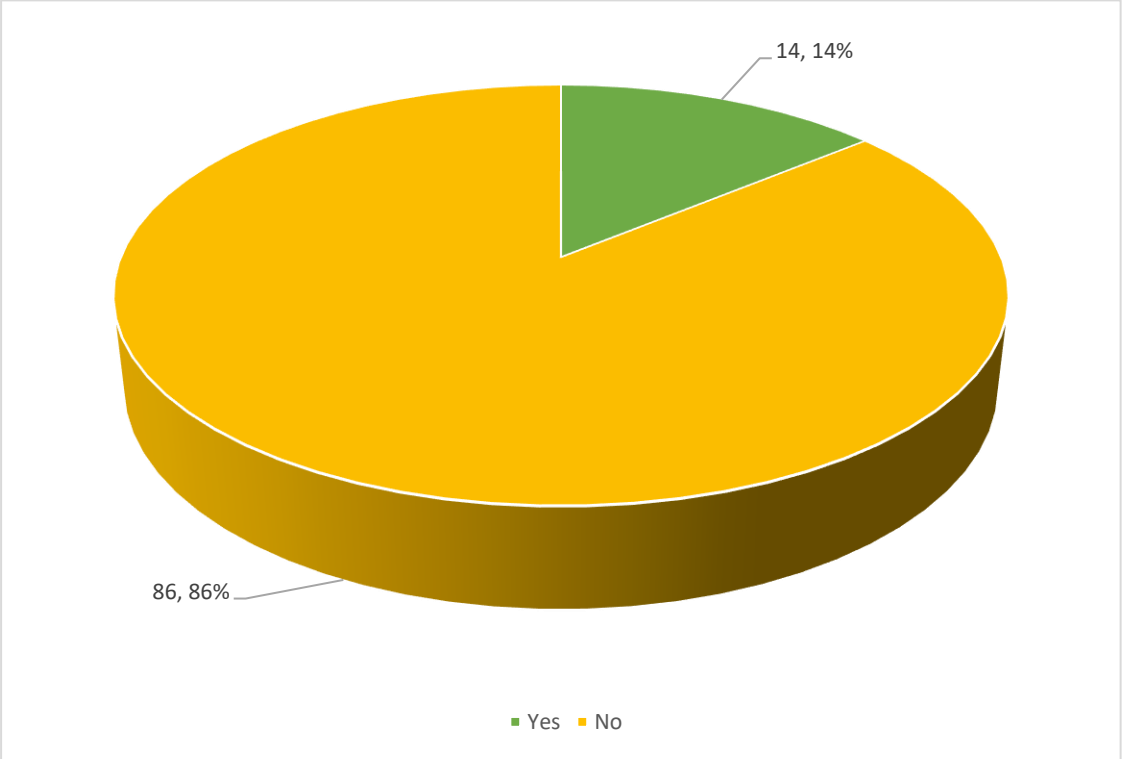


Figure 12: Previous history of ankle injuries.

4.3.2 Ankle injuries while playing basketball

Among 100 participants of basketball players, 22% (n=22) players are injured by ankle sprain while playing basketball, 2% (n=2) players are injured by ankle fracture, 4% (n=4) players are injured by partial ligament tear in ankle, 5% (n=5) players are injured by complete ligament tear. 2% (n=2) players got ankle dislocation. In all participant 65% (n=65) players are in the safe position while they playing basketball. Figure 13 demonstrate the ankle injuries of the players while they playing basketball.

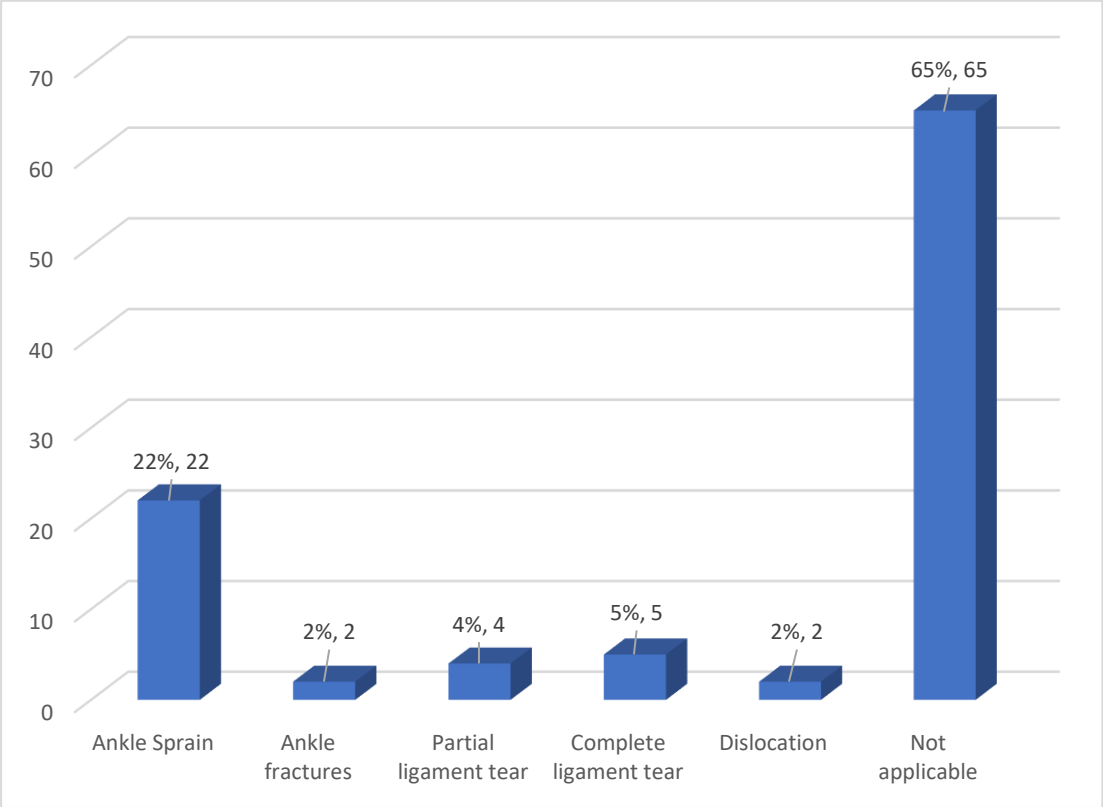


Figure 13: Type of ankle injuries while playing basketball.

4.3.3 Severity of ankle injuries

Among 100 participants of basketball players, 8% (n=8) basketball players got minor severity of their ankle injuries, 12% (n=12) players got moderate severity of their ankle injuries, 13% (n=13) players got severe severity of their ankle injuries. Among all 67% (n=67) basketball players are not included in this criterion. Figure 14 demonstrate the severity of ankle injuries of basketball players.

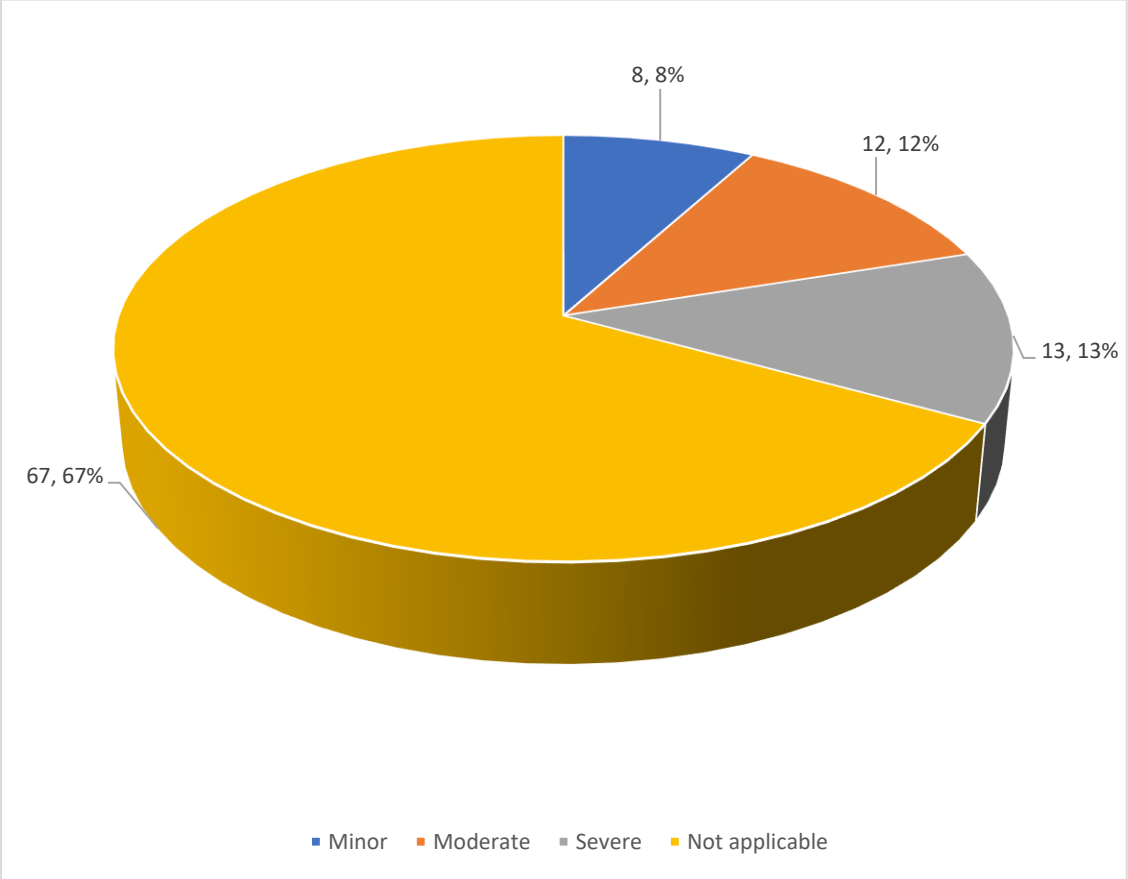


Figure 14: Severity of ankle injuries.

4.4 Treatment

4.4.1 Types of treatment

Among 100 participants of basketball players, 65% (n=65) players are safe from ankle injuries while playing basketball. So, they are not count for this treatment result. 8% (n=8) players are only received medication for their treatment purpose, 2% (n=2) players received physiotherapy treatment, 20% (n=20) player received both medication and physiotherapy. 3% (n=3) players received the treatment procedure by going throw medication, surgery and physiotherapy. Only 2% (n=2) players are not received any treatment. Figure 15 demonstrate the types of treatment which are getting by the players**.**

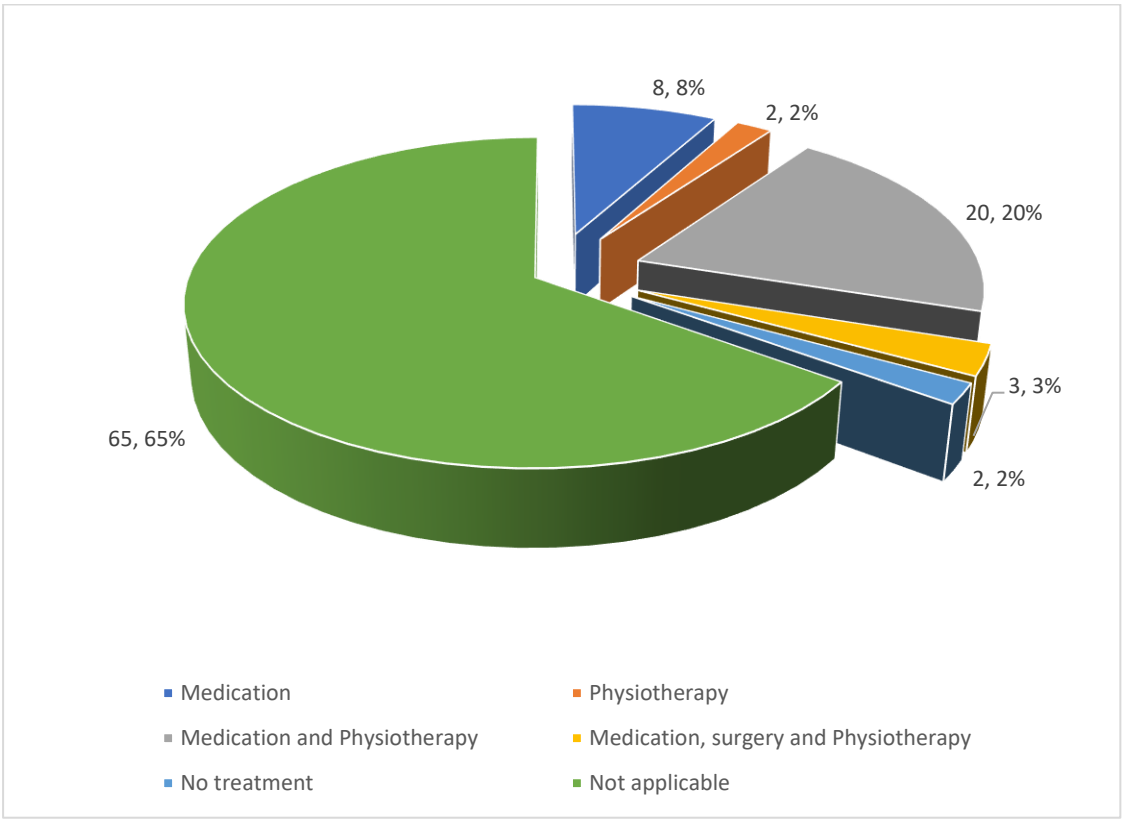


Figure 15: Types of treatment.

4.4.2 Outcomes of treatment

Among 100 participants of basketball players, 35% (n=35) players are injured ankle while playing basketball. 33% (n=33) players received treatment for ankle injuries. In these 23% (n=23) players came out of these injuries and got improvement but 10% (n=10) players who got treatment for their ankle injuries are unchanged. Figure 16 demonstrate the outcomes of the treatment for ankle injuries among basketball players.

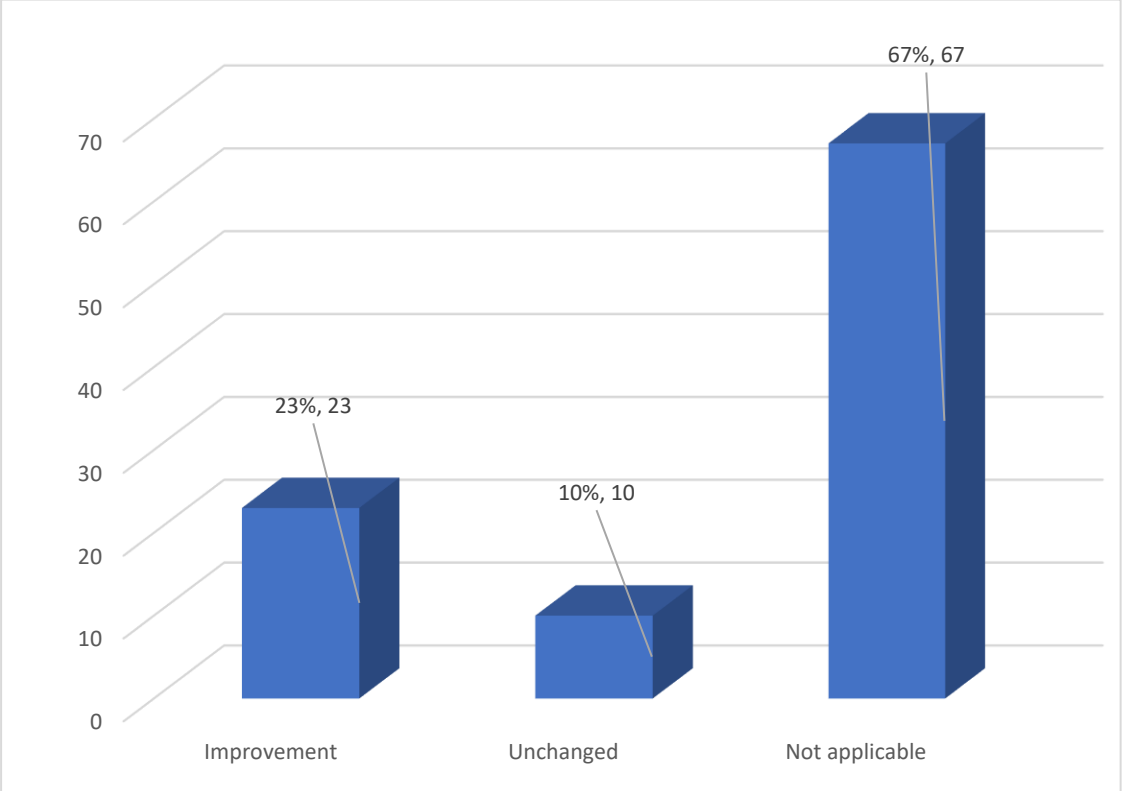


Figure 16: Treatment's outcomes.

4.5 Protective equipment

4.5.1 Using protective equipment before ankle injuries

Among 100 participants of basketball players, 19% (n=19) players are used protective equipment before ankle injuries, 16% (n=16) players are not used protective equipment before ankle injuries. Figure 17 demonstrate the using protective equipment before ankle injuries among basketball players.

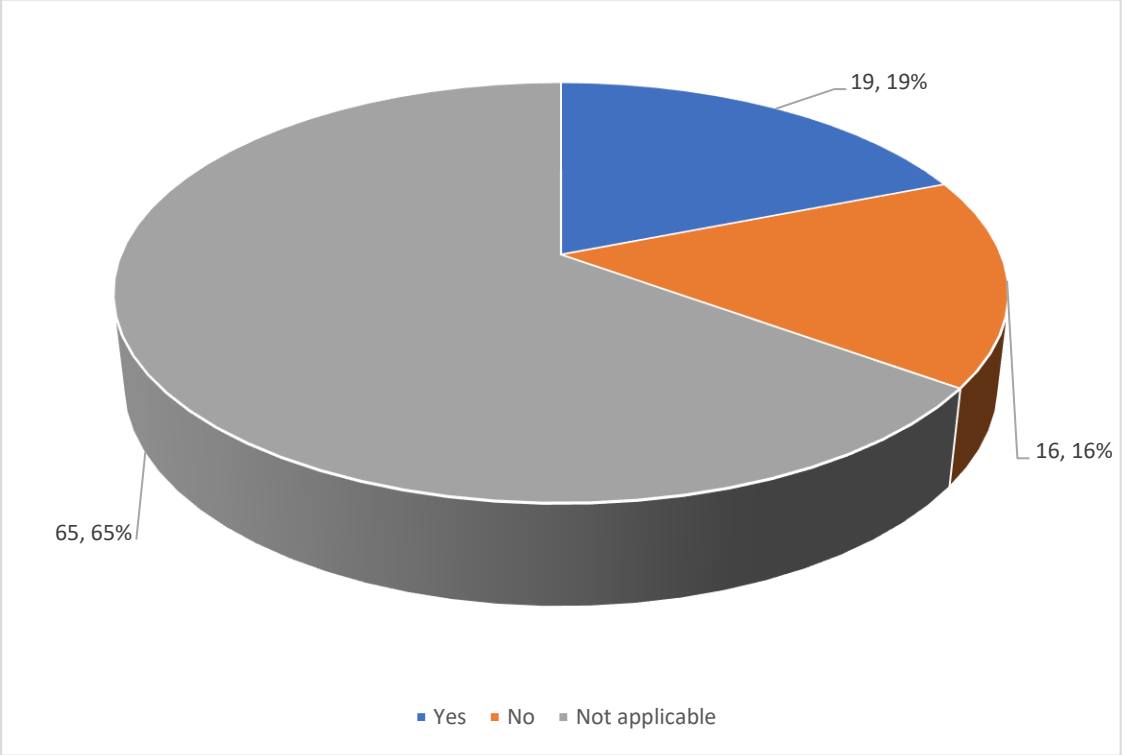


Figure 17: Uses of protective equipment before ankle injuries.

4.5.2 Using protective equipment for playing basketball

Among 100 participants of basketball players, 45% (n=45) players used protective equipment for playing basketball and 55% (n=55) are not used any kind of protective equipment for prevent the ankle injuries. Figure 18 demonstrate the using protective equipment for playing basketball.

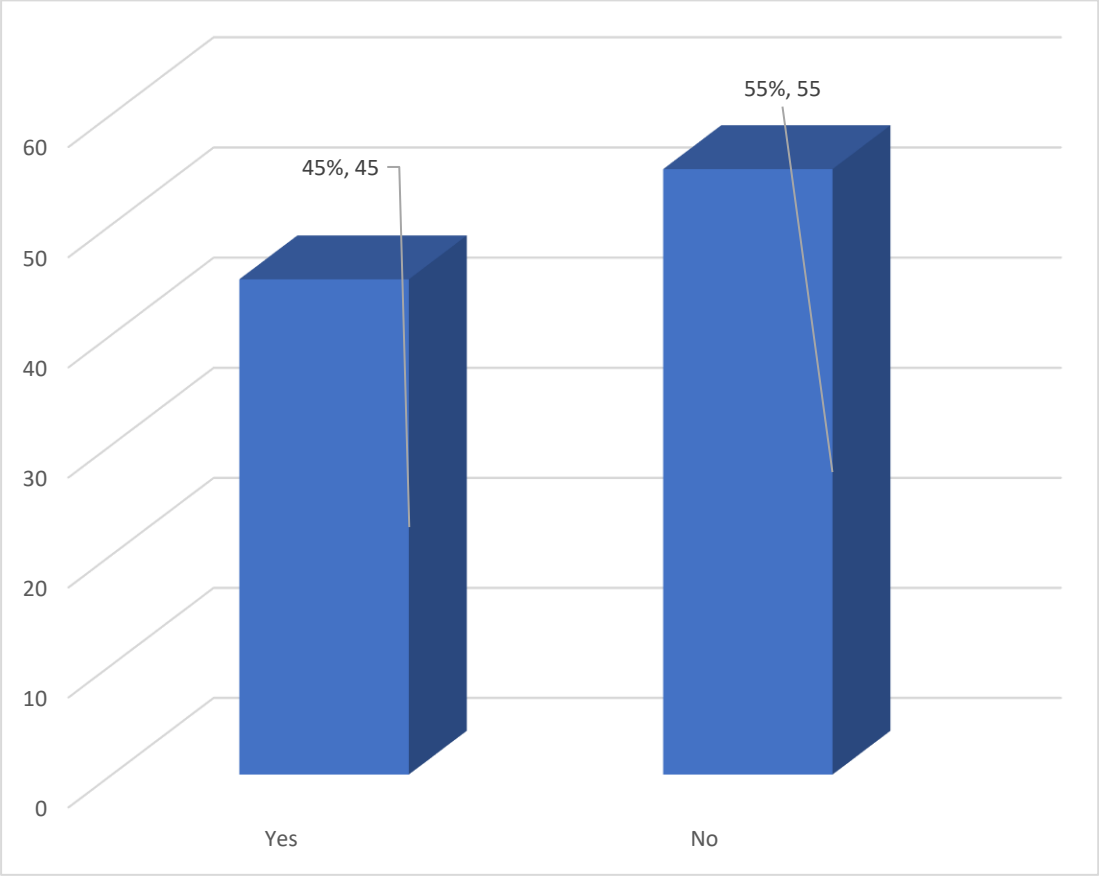


Figure 18: Uses of protective equipment for playing basketball.

4.5.3 Basketball shoes

Among 100 participants of basketball players, 36% (n=36) players are wearing high-top shoes for playing basketball, 39% (n=39) players are wearing mid-top shoes and 25% (n=25) players are wearing low-top shoes for playing. Figure 19 demonstrate the using of shoes for playing basketball.

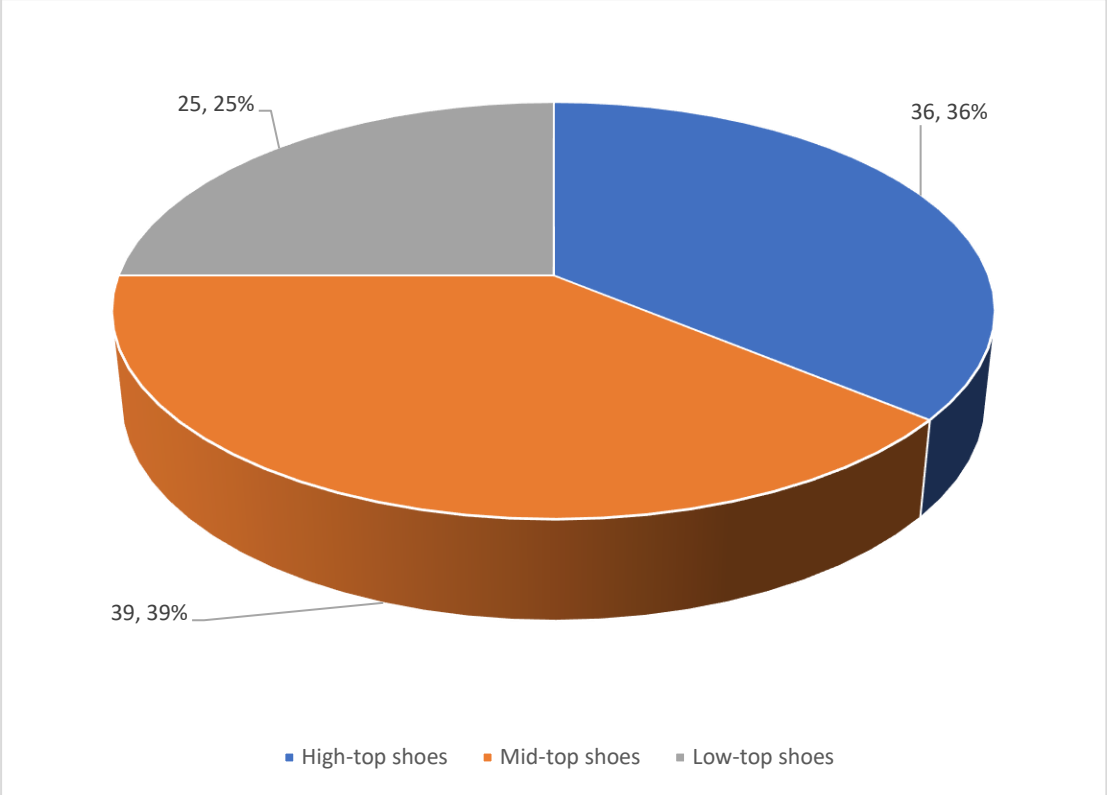


Figure 19: Players use of basketball shoes.

4.5.4 Warm up before ankle injuries

Among 100 participants of basketball players, 4% (n=4) players could not warm up before their injuries, 18 % (n=18) players are sometimes joining the warm up before ankle injuries, 13% (n=13) players are always warm up before their ankle injuries. Figure 20 demonstrate the warm up before ankle injuries for playing basketball.

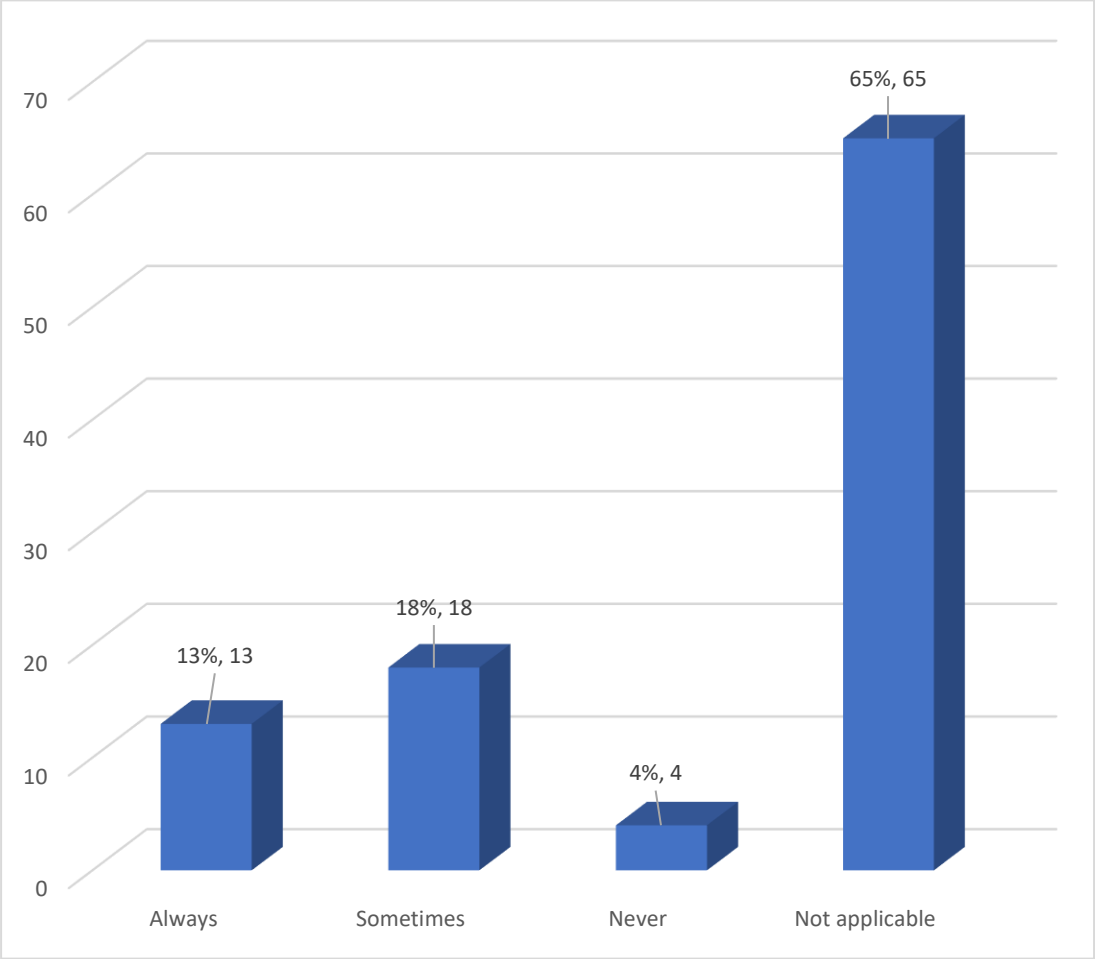


Figure 20: Warm up before ankle injuries.

4.5.5 Regular warm up for playing basketball

Among 100 participants of basketball players, 39% (n=39) players are regularly warm up for playing basketball, 44% (n=44) players are sometimes warm up for their game and 17% (n=17) players are not even warm up for playing basketball. Figure 21 demonstrate the regular warm up players for playing basketball.

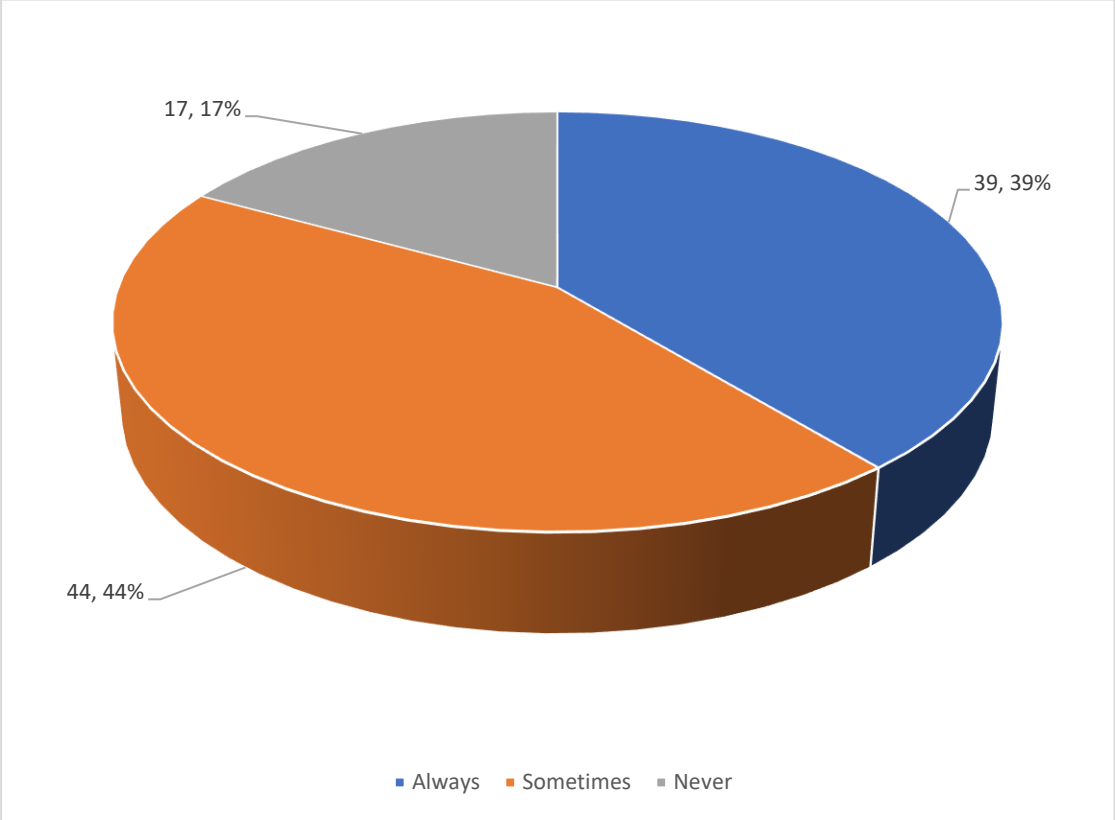


Figure 21: Regular warm up for playing basketball.

4.6 Factors Responsible

4.6.1 Playing Surface

Among 100 basketball players participating. All participants (n=100) in the study of basketball players assert that the playing surface can induce ankle injury. Rigid or irregular surfaces elevate the likelihood of ankle twisting or spraining. Figure 22 demonstrate the playing surface are responsible for ankle injuries among basketball players.

4.6.2 Protective Equipment

Among 100 participants of basketball players. 100% (n=100) basketball players believe that not using of protective equipment can cause ankle injuries. Protective equipment can help stabilize the joint and reduce the likelihood of injury during play. Figure 23 demonstrate the protective equipment are responsible for ankle injuries among basketball players.

4.6.3 Warm UP

Among 100 participants of basketball players. 100% (n=100) basketball players believe that lack of proper warm up can cause ankle injuries. Warm-up exercises enhance flexibility, increase joint stability, and prepare muscles for intense activity. Figure 24 demonstrate the lack of proper warm up are responsible for ankle injuries among basketball players.

4.6.3 Wrong kind of Shoes

Among 100 participants of basketball players. 100% (n=100) basketball players believe that inappropriate can cause ankle injuries. Inappropriate footwear is commonly associated with an increased risk of ankle injuries in basketball. Poor shoe support can compromise ankle stability and lead to sprains during high-impact movements. Figure 25 demonstrate the wrong kind of Shoes are responsible for ankle injuries among basketball players.

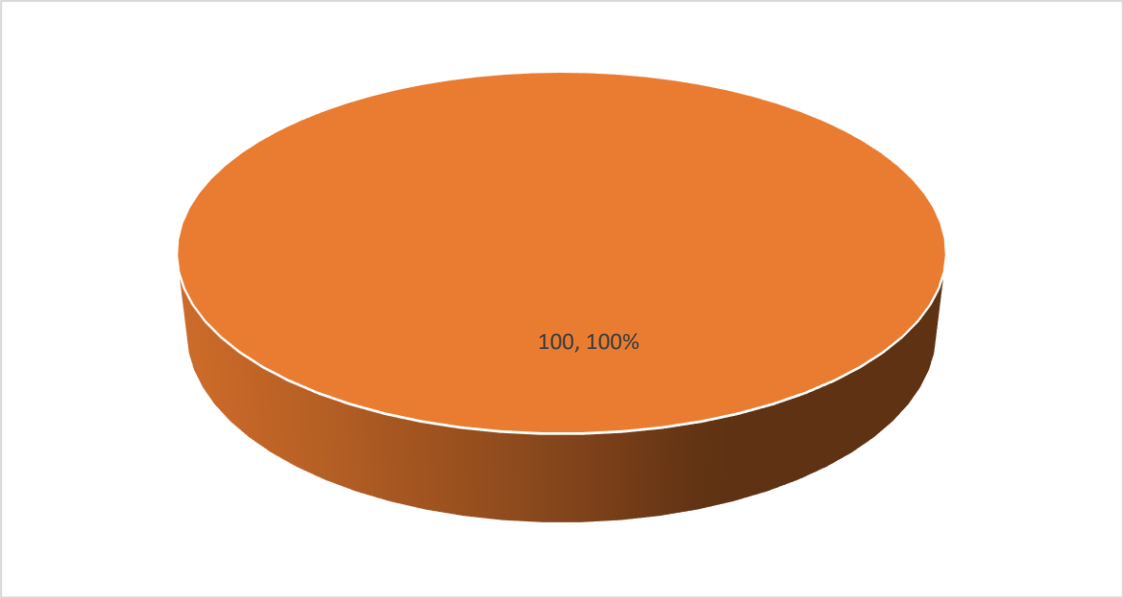


Figure 22: Playing surface, Protective Equipment, Warm UP, Wrong kind of Shoes are responsible for ankle injuries.

4.7 Comparison between the variable

Table 1 shows the comparison between the variables.

Variable	Chi-square value ($\chi 2$)	df	P value	Interpretation
Injury History vs Footwear Type	17.795	2	0.000	Significant
Injury History vs Playing Position	12.456	3	0.001	Significant
Injury Severity vs Treatment Received	10.245	3	0.016	Significant
Warm-up Frequency vs Injury Frequency	8.745	2	0.013	Significant
Training Frequency vs Injury Severity	6.578	2	0.036	Significant
Injury History vs Playing Surface	9.112	4	0.057	Marginally Significant
Protective Equipment Use vs Injury Frequency	14.352	3	0.002	Significant
Injury History vs Training and Rehabilitation	8.432	3	0.037	Significant
Injury Severity vs Risk Factors	12.875	4	0.012	Significant
Footwear Type vs Warm-up Frequency	6.745	2	0.034	Significant

The Chi-square analysis revealed several statistically significant associations between key variables related to ankle injuries among basketball players. A highly significant relationship was found between injury history and footwear type ($\chi^2 = 17.795$, $p = 0.000$), indicating that the type of footwear used may play a critical role in the occurrence of ankle injuries. Similarly, playing position was significantly associated with injury history ($\chi^2 = 12.456$, $p = 0.001$), suggesting that certain positions may carry a higher risk of injury. The severity of injury showed a strong association with the type of treatment received ($\chi^2 = 10.245$, $p = 0.016$), implying that more severe injuries tend to receive specific or more intensive treatment. A significant link was also observed between warm-up frequency and injury frequency ($\chi^2 = 8.745$, $p = 0.013$), highlighting the protective effect of regular warm-up routines. Training frequency was significantly associated with injury severity ($\chi^2 = 6.578$, $p = 0.036$), suggesting that improper training loads may contribute to more severe injuries. The relationship between injury history and playing surface was marginally significant ($\chi^2 = 9.112$, $p = 0.057$), indicating that the type of surface may influence injury occurrence, though the evidence is not strong. Use of protective equipment was significantly linked to injury frequency ($\chi^2 = 14.352$, $p = 0.002$), reinforcing the importance of wearing appropriate gear. Additionally, a significant association was found between injury history and the presence of training and rehabilitation programs ($\chi^2 = 8.432$, $p = 0.037$), showing the potential impact of these programs in injury prevention or recurrence. Injury severity was also significantly associated with various risk factors ($\chi^2 = 12.875$, $p = 0.012$), emphasizing the multifactorial nature of severe injuries. Lastly, footwear type was significantly related to warm-up frequency ($\chi^2 = 6.745$, $p = 0.034$), possibly indicating behavioral patterns among players who take preventive measures more seriously. Overall, the findings underscore the importance of footwear, training habits, protective equipment, and injury management strategies in reducing the risk and severity of ankle injuries among basketball players.

4.8 Correlation

4.8.1 Correlation between daily playing hours and number of ankle injuries

Table 2 demonstrates the correlation between daily playing hours and number of ankle injuries.

Correlation				
			Daily Playing Hours	Number of Ankle Injuries
Spearman's rho	Daily Playing Hours	Correlation Coefficient	1.000	-.562
		Sig. (2-tailed)	.	.000
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	-.562	1.000
		Sig. (2-tailed)	.000	.
		N	100	100

The Spearman's rank correlation analysis presented in the table examines the relationship between daily playing hours and the number of ankle injuries among basketball players. The correlation coefficient of -0.562 indicates a moderate negative relationship between the two variables, suggesting that as the daily playing hours increase, the number of ankle injuries tends to decrease, and vice versa. This negative correlation implies that players who engage in fewer hours of play are more likely to experience a higher number of ankle injuries. The p-value of 0.000**,** which is less than the commonly accepted significance level of 0.05, indicates that the observed correlation is statistically significant. This means there is a strong likelihood that the relationship observed in the sample reflects a true relationship in the population of basketball players. With 100 participants in the study, these findings provide valuable insight into the potential impact of playing time on the frequency of ankle injuries.

4.8.2 Correlation between age of respondent and number of ankle injuries

Table 3 demonstrates the correlation between age of respondent and number of ankle injuries.

Correlation				
			Age of Respondent	Number of Ankle Injuries
Spearman's rho	Age of Respondent	Correlation Coefficient	1.000	-.155
		Sig. (2-tailed)	.	.123
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	-.155	1.000
		Sig. (2-tailed)	.123	.
		N	100	100

The Spearman's rank correlation analysis was conducted to assess the relationship between the age of respondents and the number of ankle injuries among basketball players. The correlation coefficient was found to be -0.155**,** indicating a very weak negative correlation between age and ankle injuries. This suggests that, as age increases, there is a slight tendency for the number of ankle injuries to decrease; however, the relationship is minimal. Furthermore, the p-value was 0.123**,** which is greater than the commonly accepted significance level of 0.05. Therefore, the correlation is not statistically significant**,** implying that there is no meaningful association between age and the number of ankle injuries in this sample of 100 participants.

4.8.3 Correlation between previous history of ankle Injury and number of ankle injuries

Table 4 demonstrates the correlation between previous history of ankle Injury and number of ankle injuries.

Correlation				
			Previous History of Ankle Injury	Number of Ankle Injuries
Spearman's rho	Previous History of Ankle Injury	Correlation Coefficient	1.000	.511
		Sig. (2-tailed)	.	.000
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	.511	1.000
		Sig. (2-tailed)	.000	.
		N	100	100

A Spearman's rank correlation was conducted to investigate the relationship between previous history of ankle injury and the number of ankle injuries among basketball players. The analysis yielded a correlation coefficient of 0.511**,** indicating a moderate positive correlation between the two variables. This suggests that players who have a history of ankle injury are more likely to experience multiple ankle injuries. The correlation was found to be statistically significant at the 0.01 level, as evidenced by the p-value of 0.000**,** which is well below the threshold of 0.05. With a sample size of 100 participants, these findings imply that a previous history of ankle injury is a meaningful factor associated with an increased risk of recurrent ankle injuries in basketball players.

4.8.4 Correlation between type of basketball shoes and number of ankle injuries

Table 5 demonstrates the correlation between type of basketball shoes and number of ankle injuries.

Correlation				
			Type of Basketball Shoes	Number of Ankle Injuries
Spearman's rho	Type of Basketball Shoes	Correlation Coefficient	1.000	.555
		Sig. (2-tailed)	.	.000
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	.555	1.000
		Sig. (2-tailed)	.000	.
		N	100	100

A Spearman's rank correlation was performed to assess the relationship between the type of basketball shoes worn and the number of ankle injuries among basketball players. The analysis revealed a correlation coefficient of 0.555**,** indicating a moderate positive correlation between the two variables. This suggests that certain types of basketball shoes may be associated with a higher frequency of ankle injuries. The correlation was found to be statistically significant at the 0.01 level, as indicated by the p-value of 0.000. With a sample size of 100 participants, this finding implies that the type of footwear used by basketball players may be an important factor contributing to the occurrence of ankle injuries.

4.8.5 Correlation between type of playing ground and number of ankle injuries among basketball players

Table 6 demonstrates the correlation between type of playing ground and number of ankle injuries among basketball players.

Correlation				
			Type of Playing Ground	Number of Ankle Injuries
Spearman's rho	Type of Playing Ground	Correlation Coefficient	1.000	-.091
		Sig. (2-tailed)	.	.367
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	-.091	1.000
		Sig. (2-tailed)	.367	.
		N	100	100

The Spearman's rank correlation coefficient was calculated to assess the relationship between the type of playing ground and the number of ankle injuries among basketball players. The results revealed a very weak negative correlation of -0.091**,** indicating that, as the type of playing ground changes, there is a slight decrease in the number of ankle injuries. However, this correlation is not statistically significant, as the p-value (0.367) is greater than the conventional threshold of 0.05**.** Therefore, we conclude that there is no strong or meaningful relationship between the type of playing ground and the frequency of ankle injuries in this sample.

4.8.6 Correlation between warm-up routine before injury and number of ankle injuries among basketball players

Table 7 demonstrates the correlation between warm-up routine before injury and number of ankle injuries among basketball players.

Correlation				
			Warm-up Routine Before Injury	Number of Ankle Injuries
Spearman's rho	Warm-up Routine Before Injury	Correlation Coefficient	1.000	.0921
		Sig. (2-tailed)	.	.000
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	.0921	1.000
		Sig. (2-tailed)	.000	.
		N	100	100

The Spearman's rho correlation between the warm-up routine before injury and the number of ankle injuries **is** 0.921**,** with a p-value of 0.000**,** which is less than the significance level of 0.01. This indicates a strong, positive, and statistically significant correlation between the two variables. In other words, a more consistent or intensive warm-up routine is strongly associated with a lower number of ankle injuries among basketball players.

4.8.7 Correlation between using protective equipment and number of ankle injuries among basketball players

Table 8 demonstrates the correlation between using protective equipment and number of ankle injuries among basketball players.

Correlation				
			Using Protective Equipment	Number of Ankle Injuries
Spearman's rho	Using Protective Equipment	Correlation Coefficient	1.000	.482
		Sig. (2-tailed)	.	.000
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	.482	1.000
		Sig. (2-tailed)	.000	.
		N	100	100

The Spearman's rho correlation between using protective equipment and the number of ankle injuries is 0.482**,** with a p-value of 0.000, which is less than the significance level of 0.01. This indicates a moderate, positive, and statistically significant correlation between the two variables. In other words, the use of protective equipment is moderately associated with a lower number of ankle injuries among basketball players.

4.8.8 Correlation between years of playing basketball and number of ankle injuries among basketball players

Table 9 demonstrates the correlation between years of playing basketball and number of ankle injuries among basketball players.

Correlation				
			Years of Playing Basketball	Number of Ankle Injuries
Spearman's rho	Years of Playing Basketball	Correlation Coefficient	1.000	-.465
		Sig. (2-tailed)	.	.000
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	-.465	1.000
		Sig. (2-tailed)	.000	.
		N	100	100

The Spearman's rho correlation between years of playing basketball and the number of ankle injuries is -0.465**,** with a p-value of 0.000**,** which is statistically significant at the 0.01 level. This indicates a moderate, negative, and statistically significant correlation between the two variables. In simpler terms, players with more years of experience tend to have fewer ankle injuries, suggesting that experience may contribute to better injury prevention or management.

4.8.9 Correlation between playing position and number of ankle injuries among basketball players

Table 10 demonstrates the correlation between playing position and number of ankle injuries among basketball players.

Correlation				
			Years of Playing Basketball	Number of Ankle Injuries
Spearman's rho	Years of Playing Basketball	Correlation Coefficient	1.000	-.117
		Sig. (2-tailed)	.	.245
		N	100	100
	Number of Ankle Injuries	Correlation Coefficient	-.117	1.000
		Sig. (2-tailed)	.245	.
		N	100	100

The Spearman's rho correlation between playing position and the number of ankle injuries is -0.117, with a p-value of 0.245. This indicates a very weak negative correlation that is not statistically significant, as the p-value is greater than 0.05. This suggests that the playing position of basketball players does not have a meaningful or significant relationship with the number of ankle injuries in this sample.

CHAPTER: V DISCUSSION

The findings revealed that 35% of participants had experienced ankle injuries, with sprains being the most common (22%), followed by partial ligament tears (4%), complete ligament tears (5%), fractures (2%), and dislocations (2%). These results align with global literature which identifies ankle sprains particularly lateral ligament sprains as the most common basketball-related injury (Moore et al., 2021; Akoh et al., 2019). The high rate of injury recurrence among players further underscores the need for effective injury management and prevention strategies.

While most participants were male (96%), only 4% were female, limiting gender-based analysis. However, previous literature suggests that male basketball players are more prone to ankle injuries, whereas females experience more knee injuries (Molinas et al., 2018). Age-wise, the majority of the sample fell within the 22–26-year age bracket. Correlation analysis showed a weak and statistically non-significant negative relationship between age and number of ankle injuries ($r = -0.155$, $p = 0.123$), indicating that younger and older players in this sample faced relatively similar injury risks. This supports findings from Tummala et al. (2023), which indicate that while age may not be a standalone factor, cumulative exposure and game intensity are more predictive of injury likelihood.

Playing experience and daily training hours significantly influenced injury prevalence. A negative correlation was found between years of playing and ankle injuries ($r = -0.465$, $p = 0.000$), suggesting that more experienced players suffered fewer injuries. Similarly, players who played fewer hours daily had a higher incidence of ankle injuries ($r = -0.562$, $p = 0.000$). This implies that less experienced players or those with inadequate conditioning are more susceptible, likely due to poor biomechanics, reduced proprioception, or insufficient injury prevention knowledge. These findings reinforce the value of training maturity and structured skill development.

This study categorized players based on their court positions: center (19%), power forward (31%), small forward (20%), point guard (18%), and shooting guard (12%). The correlation between playing position and ankle injuries was weak and statistically insignificant ($r = -0.117$, $p = 0.245$), suggesting no clear relationship in this sample. However, Chi-square analysis showed a significant association ($\chi^2 = 12.456$, $p = 0.001$),

indicating that specific positions, particularly those involving frequent lateral movements and landings, might be more prone to injuries. Guards, known for speed and directional changes, are typically at higher risk, aligning with earlier studies (Svilar et al., 2018).

Footwear was found to be a major extrinsic risk factor. Participants used high-top (36%), mid-top (39%), and low-top (25%) shoes. A moderate positive correlation ($r = 0.555$, $p = 0.000$) suggested that certain shoe types may be more associated with injuries. Chi-square analysis also revealed a significant relationship between footwear type and injury history ($\chi^2 = 17.795$, $p = 0.000$). These findings contradict some existing research, which argues that shoe design (e.g., high-top vs low-top) does not significantly impact injury rates (Tansey et al., 2023), but aligns with other findings that support the importance of midsole design, collar height, and cushioning in ankle stability (Lam et al., 2019).

The majority of players (92%) reported playing on concrete surfaces, with a minority on hardwood (7%) and asphalt (1%). While 100% of participants believed the surface type contributes to injuries, the statistical correlation between ground type and ankle injuries was weak and insignificant ($r = -0.091$, $p = 0.367$). Nonetheless, previous studies show that hard or high-friction surfaces increase ankle injury risk due to higher impact forces and poor absorption (Kong et al., 2018; Bocanegra & Fong, 2021). While not statistically significant here, the dominance of concrete surfaces in local play environments might still pose a cumulative injury risk over time.

Warm-up frequency and consistency were strongly associated with injury rates. Players who regularly warmed up reported fewer injuries, and 100% of respondents agreed that lack of warm-up contributes to ankle injuries. The Spearman correlation ($r = 0.921$, $p = 0.000$) showed a very strong positive and statistically significant association. These results are consistent with literature suggesting neuromuscular warm-up programs (e.g., SHRed, FIFA 11+) reduce injury rates by improving proprioception, joint stability, and muscle readiness (Emery et al., 2021; Padua et al., 2019). Chi-square analysis further supported this association ($\chi^2 = 8.745$, $p = 0.013$).

Protective equipment usage showed a moderate positive correlation with reduced ankle injuries ($r = 0.482$, $p = 0.000$). Only 45% of players consistently used protective gear during play, though 100% acknowledged its importance. Chi-square testing confirmed

the relationship between protective gear and injury frequency ($\chi^2 = 14.352$, $p = 0.002$). These findings reflect previous studies that suggest ankle braces and taping, especially in players with prior injuries, significantly reduce the recurrence of sprains (Zwiers et al., 2016; Verhagen & Bay, 2010). Despite this, underutilization remains an issue, possibly due to discomfort, lack of awareness, or limited access.

A strong positive correlation was observed between previous ankle injuries and current injury incidence ($r = 0.511$, $p = 0.000$). This aligns with global literature noting that prior ankle sprains increase the odds of re-injury fivefold (McKay et al., 2001). The chronic instability following initial sprains, if not adequately rehabilitated, leads to ligament laxity and functional impairments (Gross et al., 2019). These results emphasize the importance of comprehensive rehabilitation and long-term conditioning programs, including neuromuscular and balance training, to reduce recurrence.

Training frequency showed a statistically significant association with injury severity ($\chi^2 = 6.578$, $p = 0.036$), indicating that poor training habits or overuse can lead to more severe injuries. Overtraining may lead to fatigue, reducing muscle efficiency and joint stability, thereby increasing injury susceptibility (Weiss et al., 2017). These findings support the notion that both undertraining and overtraining carry risk, and that load management is key to injury prevention in athletes.

Among injured players, only a small proportion received comprehensive treatment combining medication and physiotherapy (20%), and just 3% underwent surgery. Despite this, 23% reported improvement post-treatment, whereas 10% saw no change. These outcomes suggest that proper rehabilitation especially with physiotherapy is critical for recovery, a view echoed in literature emphasizing the effectiveness of integrated sports medicine and physiotherapy approaches (Leanderson et al., 1992; Tummala et al., 2023).

5.1 Limitation of the study

The study should be considered in light of the following limitations. Researcher could manage only 100 samples which are very small to generalize the result for the wider population of the basketball players. There is no literature on the causes of ankle injuries among basketball players from Bangladesh's point of view. As a result, comparing the work to another research is challenging. For a brief time, the researcher was able to gather data from a few specific areas: BKSP, CRP, JU, and DU. This limited the study's ability to generalize its findings to a larger population. The questionnaire was created by looking through a lot of literature and specifically based on the well-documented data that was available from BKSP, CRPDU, and JU. However, a pilot research would be important before creating the questionnaire because of the population's demographics.

CHAPTER: VI CONCLUSION & RECOMENDATION

6.1 Conclusion

This study investigated the key factors contributing to ankle injuries among basketball players from four prominent institutions in BKSP, CRP, Jahangirnagar University, and Dhaka University. Utilizing a cross-sectional design and a structured questionnaire, data was collected from 100 participants and analyzed using SPSS to identify patterns, associations, and significant risk contributors.

The findings clearly indicate that ankle injuries, particularly sprains, are highly prevalent among basketball players, with a large proportion (35%) reporting injury history. Intrinsic factors such as previous ankle injuries, limited playing experience, and inadequate warm-up practices were significantly associated with increased injury risk. Similarly, extrinsic factors especially the type of footwear, lack of protective equipment, and playing on hard surfaces were also shown to influence injury occurrence and severity.

Spearman's correlation analysis revealed moderate to strong associations between multiple variables. Notably, players who did not warm up consistently, used inappropriate shoes, or had a previous injury were significantly more likely to suffer ankle injuries. Chi-square analysis further reinforced these findings, highlighting the critical role of footwear type, protective equipment, warm-up frequency, and playing position in injury outcomes.

The study also found that players with more years of experience or those who engaged in longer daily training sessions had lower injury rates, possibly due to better conditioning, biomechanics, and awareness. However, the lack of consistent and comprehensive rehabilitation strategies among injured players suggests an area needing urgent attention, especially to prevent recurrence and long-term complications like chronic ankle instability.

Overall, the study emphasizes the multifactorial nature of ankle injuries in basketball. Preventive strategies such as regular warm-up exercises, use of proper footwear and protective gear, structured training, and professional rehabilitation can significantly

reduce the incidence and recurrence of these injuries. These insights are vital for athletes, coaches, physiotherapists, and sports program coordinators in developing targeted interventions to promote safer participation and prolong athletic careers.

6.2 Recommendation

Based on the findings of this study, several actionable recommendations are proposed to help reduce the incidence and recurrence of ankle injuries among basketball players. These recommendations are directed toward players, coaches, physiotherapists, and sports administrators.

Players should always perform structured warm-up exercises before games and practice. Neuromuscular training, balance drills, and dynamic stretches should be prioritized. Selection of basketball shoes should be based on individual biomechanics and support needs. Mid- or high-top shoes with adequate cushioning and ankle support are recommended. Players with a history of ankle injuries should consistently use ankle braces or taping to reduce the risk of re-injury. Athletes should not ignore minor injuries. Prompt medical attention and physiotherapy can prevent long-term complications. Conduct regular workshops on the importance of warm-up, footwear selection, and load management. Avoid overtraining and ensure adequate recovery between sessions to prevent fatigue-related injuries. Training should include strength, balance, and proprioceptive exercises to enhance lower limb stability. Encourage players to report injuries without fear of losing playtime or opportunity. Each injured athlete should receive a personalized rehab protocol based on injury type, severity, and recurrence risk. Emphasize return-to-play criteria, including functional tests and reconditioning, to ensure full recovery. Address anxiety, fear of reinjury, and performance pressure that may contribute to premature return to play. Invest in safer, shock-absorbing court materials to reduce impact on joints. Provide ankle braces and other equipment at subsidized rates for student-athletes. Regular tracking of injuries can help identify patterns and guide preventive strategies. Encourage further studies focusing on injury prevention among Bangladeshi basketball players.

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APPENDIX: A

INFORMED CONSENT (English)

VERBAL CONSENT STATEMENT

This research is part of a Physiotherapy course and the researcher's name is **Md. Asmanur Rahman Limon**. He is a student at Bangladesh Health Professions Institute (BHPI), studying for a B.Sc. in Physiotherapy in 4th year. The study was entitled- **Factors responsible for ankle injuries among basketball players.**

In this study, I am a participant and I have been informed about the purpose and aim of the study. I will have the right to refuse to take part at any time at any stage of the study. I will not be bound to answer to anybody.

I as a participant have no problem with giving the researcher my data twice as the researcher's study requires.

I am also informed that all the information collected from the interview that will be used in the study will be kept safe and maintain confidentiality. Your name and address will not be published anywhere. Only the researcher and supervisor will be eligible to access the information for the publication of the research result.

If you have any questions, please contact the researcher **Md. Asmanur Rahman Limon** or his supervisor, **Fabiha Alam Disha**, Assistant Professor, Department of Physiotherapy, Savar, Dhaka-1343.

I have been informed about the information mentioned above and I am willing to participate in the study with giving consent.

Name of participant: _____

Signature & date of participant: _____

Signature & date of data collector: _____

APPENDIX: B
সম্মতিপত্র

এই গবেষণাটি ফিজিওথেরাপি কোর্সের অংশ এবং গবেষকের নাম মো. আসমানুর রহমান লিমন । তিনি বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই)-এর চতুর্থ বর্ষের বি.এসসি. ফিজিওথেরাপি বিভাগের একজন ছাত্র । এই গবেষণার বিষয় ছিল- **"বাস্কেটবল খেলোয়াড়দের গোড়ালির আঘাতের জন্য দায়ী কারণসমূহ "**

এই গবেষণায় আমি একজন অংশগ্রহণকারী এবং আমাকে গবেষণার উদ্দেশ্য ও লক্ষ্য সম্পর্কে জানানো হয়েছে । আমার যেকোনো সময়, গবেষণার যেকোনো পর্যায়ে অংশগ্রহণ করতে অস্বীকার করার অধিকার থাকবে । আমি কারো কাছে উত্তর দিতে বাধ্য থাকব না । একজন অংশগ্রহণকারী হিসাবে গবেষকের গবেষণার প্রয়োজনে দু'বার তথ্য দিতে আমার কোনো সমস্যা নেই ।

আমাকে আরও জানানো হয়েছে যে সাক্ষাৎকার থেকে সংগৃহীত সমস্ত তথ্য গবেষণায় ব্যবহার করা হবে এবং তা নিরাপদে ও গোপনীয়তা বজায় রেখে সংরক্ষণ করা হবে । আপনার নাম এবং ঠিকানা কোথাও প্রকাশিত হবে না । শুধুমাত্র গবেষক এবং সুপারভাইজার গবেষণার ফলাফল প্রকাশের জন্য তথ্যে প্রবেশাধিকার পাবেন ।

আপনার যদি কোনো প্রশ্ন থাকে, তাহলে গবেষক **মো. আসমানুর রহমান লিমন** অথবা তার সুপারভাইজার **ফাবিহা আলম দিশা, সহকারী অধ্যাপক, ফিজিওথেরাপি বিভাগ, সাভার, ঢাকা-১৩৪৩**-এর সাথে যোগাযোগ করুন । উপরের উল্লেখিত তথ্য সম্পর্কে আমাকে জানানো হয়েছে এবং আমি সম্মতি সহকারে গবেষণায় অংশগ্রহণ করতে ইচ্ছুক ।

অংশগ্রহণকারীর নাম: _____

অংশগ্রহণকারীর স্বাক্ষর ও তারিখ: _____

তথ্য সংগ্রহকারীর স্বাক্ষর ও তারিখ: _____

APPENDIX: C

শিরোনাম: বাস্কেটবল খেলোয়াড়দের গোড়ালির আঘাতের জন্য দায়ী কারণসমূহ

ব্যক্তিগত তথ্য

১.	নাম	
২.	বয়স	
৩.	ঠিকানা	
৪.	যোগাযোগ নম্বর	
৫.	লিঙ্গ	১= পুরুষ ২= মহিলা
৬.	বৈবাহিক অবস্থা	১= বিবাহিত ২= অবিবাহিত ৩= বিধবা ৪= বিবাহবিচ্ছেদপ্রাপ্ত
৭.	সম্পন্ন শিক্ষার স্তর	১= কোনো আনুষ্ঠানিক শিক্ষা নেই ২= প্রাথমিক স্তর ৩= মাধ্যমিক স্তর ৪= উচ্চ মাধ্যমিক স্তর ৫= স্নাতক (অধ্যয়নরত) ৬= স্নাতক (সম্পূর্ণ)
৮.	বসবাসের এলাকা	১= গ্রামীণ ২= আধা-শহুরে ৩= শহুরে
৯.	খেলার স্তর	১= জাহাঙ্গীরনগর বিশ্ববিদ্যালয় ২= বিকেএসপি ৩= ঢাকা বিশ্ববিদ্যালয় ৪= সিআরপি

খেলার ইতিহাস

১০.	খেলার অবস্থান	১= সেন্টার ২= পাওয়ার ফরোয়ার্ড ৩= স্মল ফরোয়ার্ড

		৪= পয়েন্ট গার্ড ৫= শুটিং গার্ড
১১.	আপনি কতদিন ধরে বাস্কেটবল খেলছেন?	১= ০-১ বছর ২= ১-২ বছর ৩= ২-৫ বছর ৪= ৫ বছরের বেশি
১২.	আপনি দিনে কত ঘন্টা বাস্কেটবল খেলেন?	১= ০ ঘন্টা ২= ১-২ ঘন্টা ৩= ২-৪ ঘন্টা ৪= ৪ ঘন্টার বেশি
১৩.	আপনি কি সারা বছর বাস্কেটবল খেলেন, নাকি শুধুমাত্র একটি নির্দিষ্ট মৌসুমে?	১= সারা বছর ২= মৌসুমী
১৪.	আপনি কি ধরনের মাঠে বাস্কেটবল খেলেন?	১= অ্যাসফল্ট ২= কংক্রিট ৩= হার্ডউড কোর্ট ৪= রাবার সার্ফেসিং ৫= অ্যাক্রিলিক ৬= অন্যান্য

আঘাতের ইতিহাস

১৫.	আপনার কি গোড়ালির আঘাতের কোনো পূর্ব ইতিহাস আছে?	১= হ্যাঁ ২= না
১৬.	বাস্কেটবল খেলার সময় আপনার কি কখনও গোড়ালির আঘাত লেগেছে?	১= হ্যাঁ ২= না
১৭.	যদি হ্যাঁ হয়, কি ধরনের গোড়ালির আঘাত?	১= গোড়ালি মচকে যাওয়া ২= গোড়ালি ভেঙে যাওয়া ৩= আংশিক লিগামেন্ট ছিঁড়ে যাওয়া ৪= সম্পূর্ণ লিগামেন্ট ছিঁড়ে যাওয়া ৫= স্থানচ্যুতি ৬= অন্যান্য ৭= প্রযোজ্য নয়
১৮.	বাস্কেটবল খেলার সময় আপনার গোড়ালিতে কতবার আঘাত লেগেছে?	১= একবার ২= ২-৩ বার ৩= ৪ বা তার বেশি বার ৪= প্রযোজ্য নয়

১৯.	আপনার গোড়ালির আঘাতের তীব্রতা কেমন ছিল?	১= সামান্য ২= মাঝারি ৩= গুরুতর ৪= প্রযোজ্য নয়
২০.	গত ৬ মাসে আপনার গোড়ালিতে কতবার আঘাত লেগেছে?	১= ০ ২= ১-২ বার ৩= ৩ বারের বেশি ৪= প্রযোজ্য নয়
২১.	গোড়ালির আঘাতের জন্য আপনি কতদিন প্রশিক্ষণ থেকে বাইরে ছিলেন?	১= ০-৪ সপ্তাহ ২= ১-৩ মাস ৩= ৩ মাসের বেশি ৪= প্রযোজ্য নয়
২২.	আপনার সাম্প্রতিক গোড়ালির আঘাত থেকে সেরে উঠতে কতক্ষণ সময় লেগেছে?	১= ৪ সপ্তাহের কম ২= ১-৩ মাস ৩= ৩ মাসের বেশি ৪= প্রযোজ্য নয়

ব্যথা সম্পর্কিত তথ্য

২৩.	গোড়ালির আঘাতের পর আপনার কি কোনো ব্যথা আছে?	১= হ্যাঁ ২= না ৩= প্রযোজ্য নয়
২৪.	ভিএএস স্কেল অনুযায়ী ব্যথার তীব্রতা: --- ০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০ ১= হালকা (১-৩) ২= মাঝারি (৪-৬) ৩= গুরুতর (৭-১০) ৪= প্রযোজ্য নয়	
২৫.	আপনার ব্যথা কি নড়াচড়ার সাথে শুরু হয়?	১= হ্যাঁ ২= না ৩= প্রযোজ্য নয়
২৬.	যদি হ্যাঁ হয়, কোন অবস্থানে ব্যথা বেড়ে যায়?	১= বসা ২= দাঁড়ানো ৩= হাঁটা ৪= শোয়া ৫= অন্যান্য ৬= না ৭= প্রযোজ্য নয়

২৭.	বিশ্রামের সময় কি আপনার ব্যথা হয়?	১= হ্যাঁ ২= না ৩= প্রযোজ্য নয়
২৮.	আপনার ব্যথার প্রকৃতি?	১= অবিরাম ২= মাঝে মাঝে ৩= না ৪= প্রযোজ্য নয়
২৯.	কোন অবস্থানে আপনি ভালো অনুভব করেন?	১= বসা ২= দাঁড়ানো ৩= হাঁটা ৪= শোয়া ৫= অন্যান্য ৬= না ৭= প্রযোজ্য নয়
৩০.	আপনার ব্যথা কি আপনার ঘুমে ব্যাঘাত ঘটাচ্ছে?	১= হ্যাঁ ২= না ৩= প্রযোজ্য নয়
৩১.	যদি হ্যাঁ হয়, কত ঘন্টা?	১= ০-১ ঘন্টা ২= ২-৩ ঘন্টা ৩= ৩ ঘন্টার বেশি ৪= না ৫= প্রযোজ্য নয়

প্রশিক্ষণ এবং পুনর্বাসন

৩২.	গোড়ালির আঘাতের জন্য আপনি কি ধরনের চিকিৎসা পেয়েছেন?	১= ঔষধ ২= অস্ত্রোপচার ৩= ফিজিওথেরাপি ৪= ঔষধ এবং ফিজিওথেরাপি ৫= ঔষধ, অস্ত্রোপচার এবং ফিজিওথেরাপি, ৬= ঔষধ এবং অস্ত্রোপচার ৭= অস্ত্রোপচার এবং ঔষধ ৮= কোনো চিকিৎসা নেই ৯= প্রযোজ্য নয়
৩৩.	গোড়ালির আঘাতের চিকিৎসার পর উন্নতি কেমন ছিল?	১= উন্নতি ২= খারাপ ৩= অপরিবর্তিত

		৪= প্রযোজ্য নয়
৩৪.	গোড়ালির আঘাতের পর, আপনি কি আপনার গোড়ালি শক্তিশালী করার জন্য কোর্টের বাইরে কোনো কার্যকলাপ করেন?	১= হ্যাঁ নিয়মিত ২= মাঝে মাঝে ৩= না ৪= প্রযোজ্য নয়
৩৫.	আপনি কি ভবিষ্যতে গোড়ালির আঘাত প্রতিরোধ করার জন্য কোনো কোচিং বা প্রশিক্ষণের পদ্ধতি পেয়েছেন?	১= হ্যাঁ ২= না ৩= প্রযোজ্য নয়

সুরক্ষামূলক সরঞ্জাম

৩৬.	গোড়ালির আঘাতের আগে বাস্কেটবল খেলার সময় আপনি কি কোনো গোড়ালি সুরক্ষামূলক সরঞ্জাম ব্যবহার করতেন?	১= হ্যাঁ ২= না ৩= প্রযোজ্য নয়
৩৭.	আপনি কি এখন বাস্কেটবল খেলার সময় কোনো গোড়ালি সুরক্ষামূলক সরঞ্জাম ব্যবহার করেন?	১= হ্যাঁ ২= না
৩৮.	আপনি কি ধরনের বাস্কেটবল জুতো পরেন?	১= হাই-টপ জুতো ২= মিড-টপ জুতো ৩= লো-টপ জুতো
৩৯.	আপনি কত ঘন ঘন আপনার বাস্কেটবল জুতো পরিবর্তন করেন?	১= প্রতি ৬ মাস বা তার বেশি ২= বছরে একবার ৩= শুধুমাত্র যখন ক্ষতিগ্রস্ত হয়
৪০.	আপনার বর্তমান বাস্কেটবল জুতোর আরামকে আপনি কিভাবে মূল্যায়ন করবেন?	১= খুব আরামদায়ক ২= আরামদায়ক ৩= নিরপেক্ষ ৪= অস্বস্তিকর
৪১.	গোড়ালির আঘাতের আগে বাস্কেটবল খেলার আগে আপনি কি নিয়মিত ওয়ার্ম আপ বা স্ট্রেচ করতেন?	১= হ্যাঁ, সবসময় ২= কখনও কখনও ৩= কখনও না ৪= প্রযোজ্য নয়
৪২.	আপনি কি এখন বাস্কেটবল খেলার আগে নিয়মিত ওয়ার্ম আপ বা স্ট্রেচ করেন?	১= হ্যাঁ সবসময় ২= কখনও কখনও ৩= কখনও না

ঝুঁকির কারণসমূহ

৪৩.	আপনি কি বিশ্বাস করেন যে খেলার পৃষ্ঠ আপনার গোড়ালির আঘাতের ঝুঁকির কারণ?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৪৪.	আপনি কি মনে করেন যে গোড়ালির দুর্বল নমনীয়তা বা শক্তি গোড়ালির আঘাতের ঝুঁকি বাড়ায়?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৪৫.	আপনি কি বিশ্বাস করেন যে আপনার শারীরিক সুস্থতার স্তর আপনার গোড়ালির আঘাতের ঝুঁকিকে প্রভাবিত করে?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৪৬.	আপনি কি বিশ্বাস করেন যে সুরক্ষামূলক সরঞ্জাম ব্যবহার না করার ফলে গোড়ালির আঘাত হতে পারে?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৪৭.	আপনি কি মনে করেন যে খেলার আগে দুর্বল ওয়ার্ম আপ গোড়ালির আঘাতের ঝুঁকি বাড়ায়?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৪৮.	আপনি কি মনে করেন যে সঠিক নির্দেশনা ছাড়া প্রশিক্ষণার্থীরা গোড়ালির আঘাত পেতে পারে?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৪৯.	আপনি কি বিশ্বাস করেন যে ভুল ধরনের জুতো পরার ফলে গোড়ালির সমস্যা হতে পারে?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৫০.	আপনি কি বিশ্বাস করেন যে মনস্তাত্ত্বিক চাপ (কর্মক্ষমতার চাপ, উদ্বেগ, স্ট্রেস) এবং পরিবেশগত (উচ্চ-বাজির প্রতিযোগিতা, বন্ধুত্বপূর্ণ খেলা) কারণগুলির কারণে গোড়ালির আঘাত হতে পারে?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৫১.	আপনি কি মনে করেন যে অতিরিক্ত ওজন গোড়ালির আঘাতের কারণ হতে পারে?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই
৫২.	নবীন বাস্কেটবল খেলোয়াড়দের কি গোড়ালির আঘাত লাগা সম্ভব?	১= হ্যাঁ ২= না ৩= নিশ্চিত নই

APPENDIX: D

Title: Factors responsible for ankle injuries among basketball players.

Personal Information

1.	Name	
2.	Age	
3.	Address:	
4.	Contact Number	
5.	Gender	1= Male 2= Female
6.	Marital Status	1= Married 2= Unmarried 3= Widowed 4= Divorced
7.	Level of Education Completed	1= No Formal Education 2= Primary Level 3= Secondary Level 4= Higher Secondary Level 5= Under Graduate 6= Graduated
8.	Living Area	1= Rural 2= Semi-urban 3= Urban
9.	Level of Play	1= Jahangirnagar University 2= BKSP 3= Dhaka University 4= CRP

Playing History

10.	Playing position	1= Center 2= Power forward 3= Small forward 4= Point guard 5= Shooting guard
11.	How long you have been playing basketball?	1= 0-1 year 2= 1-2 years 3= 2-5 years 4= More than 5 Years
12.	How many hours do you play basketball in a day?	1= 0-1 hour 2= 1-2 hours 3= 2-4 hours 4= More than 4 hours

13.	Do you play basketball year-round, or only during a specific season?	1= Year-round 2= Seasonal
14.	What kind of ground do you play basketball on?	1= Asphalt 2= Concrete 3= Hardwood Court 4= Rubber Surfacing 5= Acrylic 6= Others

Injury History

15.	Do you have any previous history of ankle injury?	1= Yes 2= No
16.	Have you ever had any ankle injuries while playing basketball?	1= Yes 2= No
17.	If yes, what type of ankle injuries?	1= Ankle sprain 2= Ankle fractures 3= Partial ligament tear 4= Complete ligament tear 5= Dislocation 6= Others 7= Not applicable
18.	How many times have you injured your ankle while playing basketball??	1= Once 2= 2-3 times 3= 4 or more times 4= Not applicable
19.	How was the severity of your ankle injury?	1= Minor 2= Moderate 3= Severe 4= Not applicable
20.	How many times have you got ankle injury from last 6 months?	1= 0 2= 1-2 times 3= More than 3 times 4= Not applicable
21.	How long you are out of training for ankle injury?	1= 0-4 weeks 2= 1- 3 months 3= More than 3 months 4= Not applicable
22.	How long did it take for you to recover from your most recent ankle injury?	1= Less than 4 weeks 2= 1-3 months 3= More than 3 months 4= Not applicable

Pain related information

23.	Do you have any pain after ankle injury?	1= Yes 2= No 3= Not applicable
24.	Severity of pain according to VAS scale	

	---------- 0 1 2 3 4 5 6 7 8 9 10 1= Mild (1-3) 2= Moderate (4-6) 3= Severe (7-10) 4= Not applicable	
25.	Does your pain start with movement?	1= Yes 2= No 3= Not applicable
26.	If yes, in which position pain is aggravating?	1= Sitting 2= Standing 3= Walking 4= Lying 5= Others 6= No 7= Not applicable
27.	Do you feel pain at any rest?	1= Yes 2= No 3= Not applicable
28.	Behavior of your pain?	1= Continuous 2= Intermittent 3= No 4= Not applicable
29.	In which position you feel better?	1= Sitting 2= Standing 3= Walking 4= Lying 5= Others 6= No 7= Not applicable
30.	Is your pain disturbing your sleep?	1= Yes 2= No 3= Not applicable
31.	If yes, how many hours?	1= 0-1 hours 2= 2-3 hours 3= More than 3 hours 4= No 5= Not applicable

Training and Rehabilitation

32.	What type of treatment have you received for ankle injury?	1= Medication 2= Surgery 3= Physiotherapy 4= Medication and physiotherapy 5= Medication, surgery and physiotherapy 6= Medication and surgery

		7= Surgery and medication 8= No treatment 9= Not applicable
33.	How was the improvement after treatment for ankle injury?	1= Improvement 2= Worse 3= Unchanged 4= Not applicable
34.	After suffering an ankle injury, do you perform any off-court activities designed to strengthen your ankles?	1= Yes, regularly 2= Occasionally 3= No 4= Not applicable
35.	Do you received any coaching or training methods to prevent further ankle injuries?	1= Yes 2= No 3= Not applicable

Protective Equipment

36.	Do you have used any ankle protective equipment while playing basketball before ankle injury?	1= Yes 2= No 3= Not applicable
37.	Do you have now used any ankle protective equipment while playing basketball?	1= Yes 2= No
38.	What type of basketball shoes do you wear?	1= High-top shoes 2= Mid-top shoes 3= Low-top shoes
39.	How often do you replace your basketball shoes?	1= Every 6 months or more 2= Once a year 3= Only when damaged
40.	How would you rate the comfort of your current basketball shoes?	1= Very comfortable 2= Comfortable 3= Neutral 4= Uncomfortable
41.	Do you regularly warm up or stretch before playing basketball before ankle injury?	1= Yes, always 2= Sometimes 3= Never 4= Not applicable
42.	Do you now regularly warm up or stretch before playing basketball?	1= Yes, always 2= Sometimes 3= Never

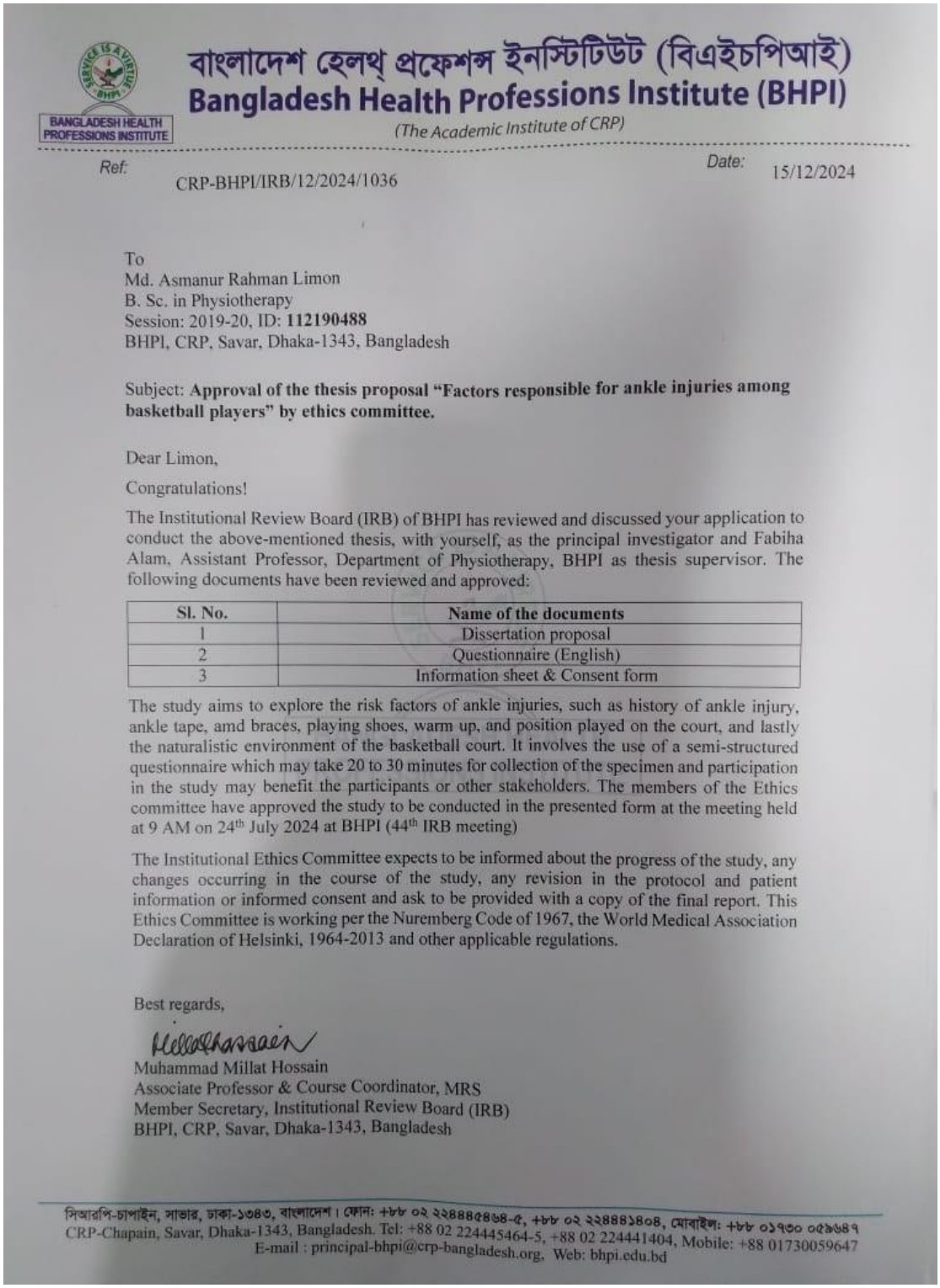
Risk Factors

43.	Do you believe that the playing surface contributes to your risk of ankle injury?	1= Yes 2= No 3= Not sure
44.	Do you think that poor ankle flexibility or strength increases the risk of ankle	1= Yes 2= No 3= Not sure

	injury?	
45.	Do you believe that your risk of ankle injuries is influenced by your level of physical fitness?	1= Yes 2= No 3= Not sure
46.	Do you believe that ankle injuries can result from not using protective gear?	1= Yes 2= No 3= Not sure
47.	Do you think that poor warm up before game increases the risk of ankle injury?	1= Yes 2= No 3= Not sure
48.	Do you think that without the right guidelines, trainees may sustain ankle injuries?	1= Yes 2= No 3= Not sure
49.	Do you believe that ankle problems might result from wearing the wrong kind of shoes?	1= Yes 2= No 3= Not sure
50.	Do you believe that ankle injuries might be caused by psychological stress (performance pressure, anxiety, stress) and environmental (high-stakes competitions, friendly games) factors?	1= Yes 2= No 3= Not sure
51.	Do you think that overweight can be the result of ankle injuries?	1= Yes 2= No 3= Not sure
52.	Is it possible for novice basketball players to ankle injuries?	1= Yes 2= No 3= Not sure

APPENDIX: E

IRB Approval Letter



বাংলাদেশ হেলথ্ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

BANGLADESH HEALTH PROFESSIONS INSTITUTE

Ref: CRP-BHPI/IRB/12/2024/1036

Date: 15/12/2024

To
Md. Asmanur Rahman Limon
B. Sc. in Physiotherapy
Session: 2019-20, ID: **112190488**
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: **Approval of the thesis proposal "Factors responsible for ankle injuries among basketball players" by ethics committee.**

Dear Limon,

Congratulations!

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned thesis, with yourself, as the principal investigator and Fabiha Alam, Assistant Professor, Department of Physiotherapy, BHPI as thesis supervisor. The following documents have been reviewed and approved:

Sl. No.	Name of the documents
1	Dissertation proposal
2	Questionnaire (English)
3	Information sheet & Consent form

The study aims to explore the risk factors of ankle injuries, such as history of ankle injury, ankle tape, amd braces, playing shoes, warm up, and position played on the court, and lastly the naturalistic environment of the basketball court. It involves the use of a semi-structured questionnaire which may take 20 to 30 minutes for collection of the specimen and participation in the study may benefit the participants or other stakeholders. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 9 AM on 24th July 2024 at BHPI (44th IRB meeting)

The Institutional Ethics Committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided with a copy of the final report. This Ethics Committee is working per the Nuremberg Code of 1967, the World Medical Association Declaration of Helsinki, 1964-2013 and other applicable regulations.

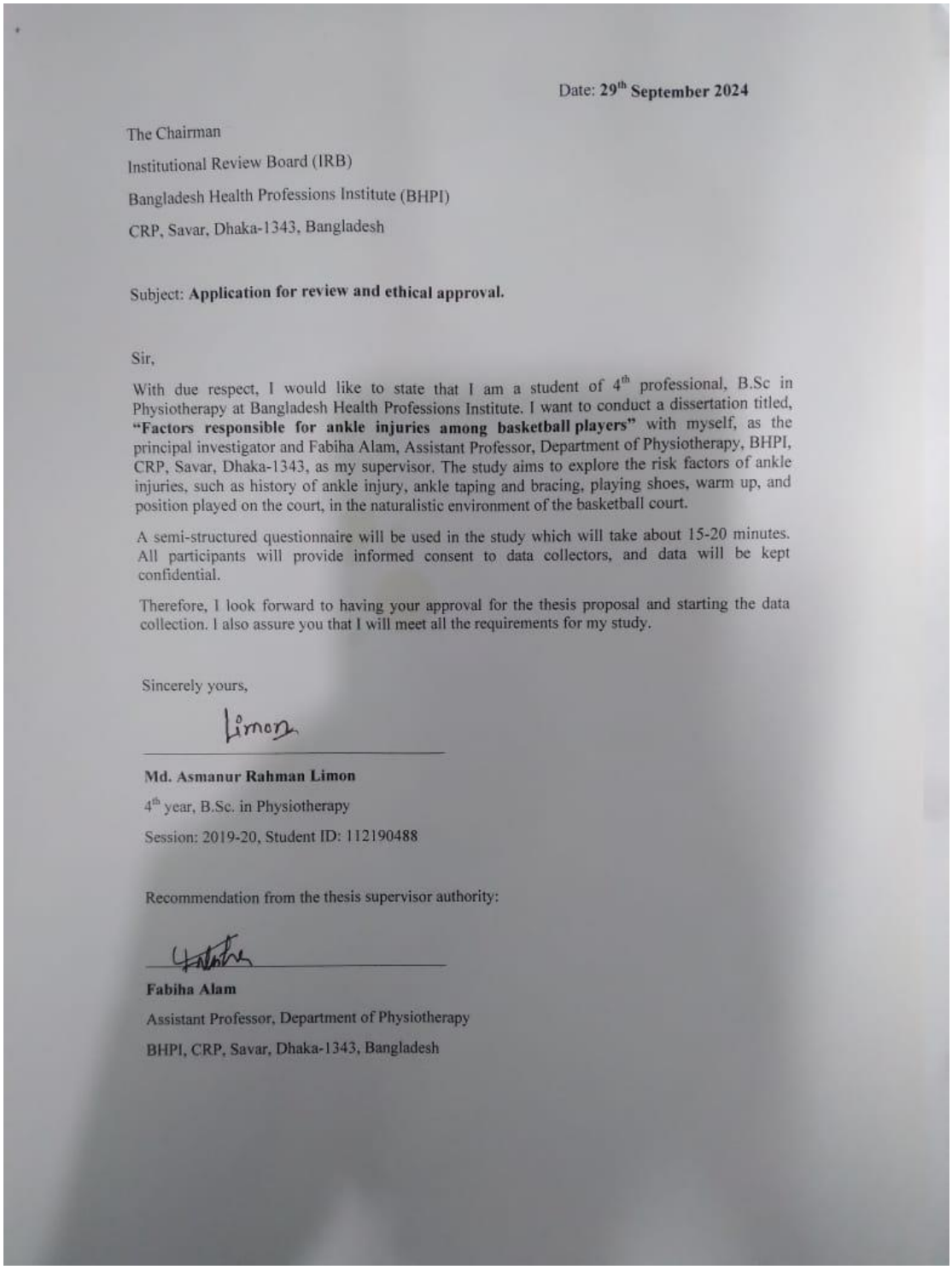
Best regards,

Muhammad Millat Hossain
Associate Professor & Course Coordinator, MRS
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

সিআরপি-চাপাইন, সাভার, ঢাকা-১৩৪৩, বাংলাদেশ। ফোন: +৮৮ ০২ ২২৪৪৪৫৪৬৪-৫, +৮৮ ০২ ২২৪৪৪১৪০৪, মোবাইল: +৮৮ ০১৭৩০ ০৫৯৬৪৭
CRP-Chapain, Savar, Dhaka-1343, Bangladesh. Tel: +88 02 224445464-5, +88 02 224441404, Mobile: +88 01730059647
E-mail : principal-bhpi@crp-bangladesh.org, Web: bhpi.edu.bd

APPENDIX: F

IRB Application Form



Date: **29th September 2024**

The Chairman

Institutional Review Board (IRB)

Bangladesh Health Professions Institute (BHPI)

CRP, Savar, Dhaka-1343, Bangladesh

Subject: **Application for review and ethical approval.**

Sir,

With due respect, I would like to state that I am a student of 4th professional, B.Sc in Physiotherapy at Bangladesh Health Professions Institute. I want to conduct a dissertation titled, **"Factors responsible for ankle injuries among basketball players"** with myself, as the principal investigator and Fabiha Alam, Assistant Professor, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka-1343, as my supervisor. The study aims to explore the risk factors of ankle injuries, such as history of ankle injury, ankle taping and bracing, playing shoes, warm up, and position played on the court, in the naturalistic environment of the basketball court.

A semi-structured questionnaire will be used in the study which will take about 15-20 minutes. All participants will provide informed consent to data collectors, and data will be kept confidential.

Therefore, I look forward to having your approval for the thesis proposal and starting the data collection. I also assure you that I will meet all the requirements for my study.

Sincerely yours,

Limon

Md. Asmanur Rahman Limon

4th year, B.Sc. in Physiotherapy

Session: 2019-20, Student ID: 112190488

Recommendation from the thesis supervisor authority:

Fabiha Alam

Assistant Professor, Department of Physiotherapy

BHPI, CRP, Savar, Dhaka-1343, Bangladesh