Different Profiles of Jumper’s Knee Indications in Basketball, Volleyball, and Football Athletes

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PURPOSE: The present study aimed to compare the incidence of “jumper’s knee” injuries among athletes in basketball, volleyball, and football; to understand the causality and effect of the participation period and the incidence of jumper’s knee; to ascertain the link between history of injury and the incidence of jumper’s knee; and to determine the relationship between the type of tournament and the probability of jumper’s knee injury occurring.

METHODS: This analytic, observational, cross-sectional study included subjects from high schools and clubs in Bandung, Solo, and Jogja, with a sample of approximately 30 participants representing each sport selected using a purposive sampling method (N = 93). Analytic observational using a cross sectional study approach in high schools and clubs in Bandung, Solo, and Jogja with a total sample of 30 for each sport selected by the purposive sampling method and obtained a total of 93 respondents. Dependent variable in this study is the jumper’s knee diagnosis. Statistical test data analysis used is different profiles using chi-square test effect of type of injury using binary regression relationship between participation period with jumper’s knee using Kendall’s tau_b, the effect of playing time using binary regression and the relationship between the type of tournament and jumper’s knee using Kendall’s tau_b. Statistical analysis of the dependent variable risk/indication for jumper’s knee used different methods. The chi-squared test was used to analyze the effect of type of injury using a binary regression method (Kendall’s tau_b) to determine the relationship between participation period and jumper’s knee; and binary regression was used to assess the effect of playing time and the relationship between the type of tournament and jumper’s knee.

RESULTS: Chi-squared analysis yielded an asymptotic significance value of p = .079, indicating no significant difference in the incidence of knee injuries among basketball, volleyball, and football athletes. Jumper’s knee had positive percentage values of 38%, 34.6%, and 26.9% in basketball, volleyball, and football, respectively. Statistical tests examining the association between injury history and the incidence of jumper’s knee yielded a value of p = .00 with exp (b) = 0.075, which suggests an influence between ankle injury and jumper’s knee among the highest-risk athletes.

CONCLUSIONS: Basketball, volleyball, and football players sustained jumper’s knee injuries at similar rates.

Key words: Jumper’s Knee, Royal London hospital test, Basketball, Volleyball, Football

INTRODUCTION

Muscle strength and endurance are important factors in improving motor and athletic performance. Increased jumping ability is accompanied by increased quadriceps strength, which increases the load on the patellar tendon [4,5]. Stress on the knee joint can arise from decreased ankle joint resistance and can be the major risk factor of injury called jumper’s knee [2,3]. Jumper’s knee or patellar tendinopathy is an injury related to jumping and landing activities caused by excessive or repetitive forces on the patellar tendon [4,5]. The researcher’s findings highlight commonalities in three sports that involve jumping techniques: basketball, volleyball, and football. These activities, which include jump shots, smashes, and heading, carry a risk of injury influenced by both technique and playing surface [6-10].

The incident of Jumper’s knee is commonly found by individuals who actively exercise with an age range of 14-40 years, especially in basketball (32%) and volleyball athletes (40-50%) Jumper’s knee can also occur in football athletes (7-23%) [4,11,12]. Risk factors that can cause a Jumper’s
knee injury are gender, duration of practice, competition participation, BMI, difference in leg length, flat foot, and hours of play. In addition, lack of hamstring flexibility, having a history of patellar tendon rupture, knee injury, and age are also risk factors for a Jumper’s knee [13-16].

Jumper’s knee has signs and symptoms that have been categorized as 4 grade, grade 1 pain occurs after sports activities, grade 2 pain occurs at the start of sports activities but symptoms disappear when warming up and sometimes reappears when tired, grade 3 pain at rest or during activities, grade 4 marked by tendon rupture [17]. The Royal London Hospital test is considered more effective for diagnosing a Jumper’s knee with a sensitivity value of 88% and a specificity value of 98% compared to the tendon palpation test [18,19].

Jumper’s knee will affect the athlete’s performance and and quality of life by limiting sports participation and can end careers for professional athletes if proper treatment and education are not given [20-22]. Therefore, the researchers wanted to observe the distribution of profile athletes from the three types of sports in Indonesia with a potential Jumper’s knee injury. The aims of this study are to 1) determine the indications of Jumper’s knee injury in basketball, volleyball, and soccer athletes; 2) knowing the relationship and influence of participation period with the Jumper’s knee incident; 3) knowing the effect of history of injury with the incident Jumper’s knee; 4) knowing the relationship between the type of tournament and the incident Jumper’s knee.

METHODS

1. Participants

This research design used is observational analytic research using a cross-sectional study approach. To calculating the sample, this study uses the OpenEpiplatform. On the OpenEpiplatform, the sample size feature is used in the proportion section, by collecting data using cluster sampling on 33 athletes basketball, 30 athletes volleyball, and 30 athletes football athletes.

There were 150 participants in three sports, with 50 participants in each sport. After the screening using inclusion criteria, the final results of participants were 93 participants. The inclusion criteria in this study are (1) aged 15-20 years old, (2) can be invited to communicated, (3) willing to become research subjects, basketball, volleyball and football athletes player. The exclusion criteria are (1) process recovering from injuries other than the Jumper’s knee in the knee area for less than 3 months, (2) sick or undergoing treatment. This study was approved by the Tk Hospital Research Ethics Committee. II 04.05.01 dr. Soedjono and received an Ethical Eligibility Letter with No. 182/EC/I/2023.

2. Research variable

Dependent variable in this study is the Jumper’s knee diagnosis.

3. Operational definition

Operational definition of the differences in Jumper’s knee profiles in basketball, volleyball, and soccer athletes.

1) Sports

Basketball is a team game with the quality of an aerobic-based anaerobic sport [23] and requires intense training on how to run, stop, and move positions according to the game situation [24].

Volleyball is play the ball by volleying (hitting with the hands) and trying to drop it into the opponent’s field of play by crossing the ball over the net or net, and defending it so that the ball does not fall on its field [25].

Football is a game that is played by kicking the ball which is contested between players to win the ball into the opponent’s goal and defend their own goal to prevent goals from occurring [26]. In this study, the data was divided into 3, namely basketball, volleyball, and soccer.

2) History of injury

Athletes who have previously suffered injuries will have the risk of being injured again in the future, especially if the injury has not been properly rehabilitated [27]. Data was collected through questionnaires which categorization into 3, ankle injuries, knee area ligament injuries, and other injuries. This category is determined to make it easier for researchers whether other injuries will result in the risk of a Jumper’s knee.

3) Participation period

Is a time period during which athletes take part in the sport [28]. In this study, the data is categorization of the participation period is divided into 2, namely more than 5 years and less than 5 years.

4) Tournament types

Tournaments are competitions for teams or individuals in which a series of games or matches are conducted. The tournament is divided into 3 levels of categories namely local, regional, and national.
4. Statistical analysis

1) Univariate analysis

Univariate Analysis aims to explain or describe the characteristics of each variable include the mean (mean, median, mode) and dispersion values (variance, standard deviation, range). It also measured the total score to add to the characteristics of the data.

2) Bivariate analysis

Bivariate analysis was conducted for:

a) Knowing the differences in indications of Jumper’s knee in basketball, volleyball, and soccer athletes with the chi-square test.

b) Knowing the relationship between the period of participation and the incidence of Jumper’s knee with Kendall’s tau_b test.

c) To determine the effect of the period of participation in sports on the occurrence of Jumper’s knee incidents with a binary regression test.

d) Knowing the effect of history of injury and the incidence of Jumper’s knee with a binary regression test.

e) Knowing the relationship between the type of tournament and the occurrence of Jumper’s knee incidents with a binary regression test.

RESULTS

The research begins with collecting data through the inclusion and exclusion criteria, and 93 respondents or 100% respondents completed the entire research process. The characteristics of this research data are as follows:

Based on the table above, the results of age examinations were obtained for basketball, volleyball, and soccer athletes with an average value of 20.55; a mean value of 2.43; and the most frequently occurring value is 22. There were 93 male respondents, consisting of 33 basketball, 30 volleyball, and 30 football. There are 3 types of tournaments that athletes participate in, namely local 34, regional 47, and national 12. The athlete category at the club for less than 5 years is 59 respondents and for more than 5 years is 34 respondents (Table 1). There are 27 respondents positive Jumper’s Knee.

Table 1. Univariate analysis on data characteristics

<table>
<thead>
<tr>
<th>Inspection</th>
<th>N</th>
<th>F</th>
<th>Percentage (%)</th>
<th>Mean ± STDEV</th>
<th>Range</th>
<th>Median</th>
<th>Variant</th>
<th>Mode</th>
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</table>

Source: Primary data, 2023.
Based on primary data sources, the results of the chi-square test on basketball, volleyball, and soccer athletes found no difference. The chi-square statistical test yielded an asymptotic significance value of $p = .079$, indicating that there is no difference in the occurrence of jumper’s knee injuries among basketball, volleyball, and soccer players. Jumper’s knee has a positive percentage value of 38% in basketball, 34.6% in volleyball, and 26.9% in football, and there is a result of statistical tests related to injury history and incidence of jumper’s knee obtained a value of $p = 0.00$ with exp (b) = 0.075, which means that there is an influence between ankle injury and jumper’s knee with the highest risk. The results of Kendall’s tau_b test between the participation period and the jumper’s knee found an association with a negative correlation. The results of the binary regression test between the time of participation and the sport branch found no effect. The results of the binary regression test between history of ankle injury found that there was an effect on the jumper’s knee, then the results of the Kendall’s tau_b test between the type of tournament and jumper’s knee found that there was no relationship.

**DISCUSSION**

Based on the results of statistical tests between basketball, volleyball, and soccer athletes, the value of $p = .079$ was found, which means there was no difference in the incidence of jumper’s knee injuries between basketball, volleyball, and soccer athletes. From the results of the researcher’s observations, there are similarities in the three types of sport, namely they both use jumping techniques. The researcher finds highlights commonalities in three sports that involve jumping techniques: basketball, volleyball, and football. These activities, which include jump shots, smashes, and heading, carry a risk of injury influenced by both technique and playing surface. Frequent jumping movements can increase the risk of “Jumper’s knee,” supported by Dutch research. In basketball, soft landing techniques are crucial to prevent excessive lower limb stress. Volleyball athletes jumping ability is vital for success, with takeoff velocity linked to jump height. Landing forces in volleyball exceed takeoff forces, emphasizing the need for specialized skills to optimize performance while reducing injury risks. In soccer, biomechanics cover technical skills, equipment, and injury causes. While kicking is well-studied, skills like throwing, goalkeeping, tackling, and jumping receive less attention. Different playing surfaces, natural or artificial, lead to distinct injury patterns, with players adapting over time. Transitioning between surfaces is a major factor in

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**Table 2. Bivariate analysis**

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>F (%)</th>
<th>p</th>
<th>R</th>
<th>Exp (B)</th>
<th>Conclusion</th>
</tr>
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<tr>
<td>Chi-square test</td>
<td>93</td>
<td></td>
<td>.079</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Basketball</td>
<td>10</td>
<td>(38)</td>
<td></td>
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<tr>
<td>Volleyball</td>
<td>23</td>
<td>(34.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Football</td>
<td>9</td>
<td>(34.6)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>21</td>
<td>(31.3)</td>
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<tr>
<td></td>
<td>7</td>
<td>(26.9)</td>
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<tr>
<td></td>
<td>23</td>
<td>(34.3)</td>
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<tr>
<td>Total</td>
<td>26</td>
<td>(28)</td>
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<tr>
<td></td>
<td>67</td>
<td>(72)</td>
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<tr>
<td>Test Kendall’s Tau_b</td>
<td>93</td>
<td></td>
<td>.033</td>
<td>.21</td>
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<td>H0 accepted</td>
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<tr>
<td>Participation period with jumper’s knee</td>
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<tr>
<td>Jumper’s knee with tournament type</td>
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<tr>
<td>Binary regression test</td>
<td>93</td>
<td></td>
<td>.722</td>
<td>.36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a jumper’s knee positive, b jumper’s knee negative.*
'Jumper’s knee' injuries [6-10].

Many researchers have observed jumping athletes, such as a study conducted by [11] on basketball athletes who stated that 3 athletes out of 12 people were affected by a jumper’s knee. Similar to the study of [29], knee injuries that occur in basketball teams find a prevalence rate of 24%, while recent research states that the prevalence of jumper’s knee in professional basketball athletes is 32% [30].

Then in volleyball athletes, it was found that 20% of players experienced some knee symptoms during the initial testing period [3], while another study said that the prevalence of volleyball athletes affected by jumper’s knee was 50% [11]. Whereas in football athletes it is 2.5% which is the lowest prevalence among the three sports [22]. This is not following with research conducted by the author which stated that basketball athletes had the highest prevalence. This is explained in the study by [31] why a high prevalence of jumper’s knee occurs in volleyball because the peak force on the patella tendon is higher when making jumps that have a horizontal component compared to jumps that only have a vertical component.

This relates to the productive period of an athlete towards his profession. When a jumper’s knee occurs, no further treatment or prevention may cause long-lasting symptoms that can lead to the athlete’s early retirement from the sport. A small prospective case-control study found that 53% of their symptomatic subjects with jumper’s knee had quit their sport [32,33]. Some common ways to do as a preventive measure for knee jumpers include moderate training, adequate warm-up, ice cooling after activity, muscle stretching, and eccentric strengthening of the quadriceps, besides using patella straps and soft insole helps reduce the risk of injury to jumper’s knee. Afterward, an increase in activities is begun (moderate training, adequate warm-up, ice cooling after activity, muscle stretching, eccentric strengthening of the quadriceps). Patella straps and soft insoles are used as prevention [34].

Furthermore, the statistical test results between the period of participation and the incidence of jumper’s knee obtained a value of $p = .033$, which means there is a relationship between the period of participation and the incidence of jumper’s knee, with a negative correlation coefficient (-.21). Previous research was not in line with this study which said that increasing the volume of training tentatively and when the athletes approached the senior level was said to be a greater risk factor for jumper’s knee [32].

The results of the influence test related to the participation period with a value of $p = .593$, which means that there is no effect between the participation period and a particular sport. This is contrary to research [35] that the youngest participants are affected and over time, will be more at risk of developing a jumper’s knee due to changes in the structure of the patella tendon.

The results of statistical tests related to injury history and incident jumper’s knee obtained a value of $p = .00$ with $\exp(b) = .075$, which means that there is an influence between ankle injury and jumper’s knee with the highest risk. While knee area ligament injuries with a value of $p = .26$, $\exp(b) = .15$ and other injuries with $p = .54$, $\exp(b) = 1.66$ which means there is no influence between knee area ligament injuries or other injuries with jumper’s knee which is a lower risk than ankle injuries. This is supported by research [36] which states that the decrease in ankle dorsiflexion can increase the risk of a jumper’s knee. This occurs due to a decrease in the range of motion of the joint in the ankle area which in turn will interfere with optimizing the force to the lower extremities when jumping, causing the patella tendon to experience a greater load.

Then the results of the statistical test between the type of tournament and the incidence of jumper’s knee obtained a value of $p = .722$ can be seen at table 2, which means there is no relationship between the type of tournament and the incidence of jumper’s knee, with a correlation coefficient (.36).

The limitation of this study is that respondents are not separated into sex groups so the theory cannot be proven clearly and in detail in this study. In addition, researchers did not pay enough attention to the identification of exercise frequency, rest duration, type of footwear, and surface hardness of the field, which might lead to bias.

CONCLUSION

The results test between basketball, volleyball, and soccer athletes obtained there was no difference in the incidence of jumper’s knee injuries between basketball, volleyball, and soccer athletes. Basketball and volleyball athletes are said to have a high prevalence of jumper’s knee because the peak force on the patellar tendon is higher when jumping.

Furthermore, results between the period of participation and the incidence of jumper’s knee obtained there is a relationship between the period of participation and the incidence of jumper’s knee while from the contribution side, there was no contribution from the participation period with an indication of the occurrence of jumper’s knee with the highest risk factor to ankle injuries. In addition, there is no relationship between the type of tournament and the incidence of jumper’s knee.
CONFLICT OF INTEREST

Author declared no conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: I Yugantara; Data curation: I Yugantara; Formal analysis: I Yugantara; Funding acquisition: I Yugantara; Methodology: I Yugantara, F Rahman; Project administration: I Yugantara; Visualization: I Yugantara; Writing - original draft: I Yugantara; Writing - review & editing: F Rahman.

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