Risk Factors for Knee Injuries in Sports and Intense Physical Exercise

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Abstract

Background: Knee injuries are common in physically demanding activities, particularly in sports, and are influenced by factors like age, gender, and training intensity. In Bangladesh, where sports participation and physical labor are prevalent, understanding knee injury risks is vital to improving public health and developing targeted prevention strategies. Objectives: The objectives of this study are to investigate the socio-demographic characteristics and risk factors associated with knee injuries among individuals engaged in physically demanding activities. The research focused on a diverse population of young, predominantly participants, with a significant portion involved in sports such as football, volleyball, basketball, and boxing. Methodology: This cross-sectional investigation was carried out in a tertiary care hospital located in Bangladesh. Employing a probability-based simple random sampling technique, a total of 83 participants were identified. Data collection was performed via direct interviews utilizing a semi-structured questionnaire, which was subsequently analyzed using SPSS version 26, while adhering to ethical principles such as informed consent and confidentiality. Results: The study found that physical activities, including regular participation in sports, swimming, jogging, and physical training, are key contributors to the increased risk of knee injuries. Furthermore, a substantial number of respondents reported earning a moderate income, with most holding at least an HSC or equivalent degree. Findings: The findings emphasize the need for targeted injury prevention strategies for individuals involved in high-impact activities to reduce the risk of knee-related injuries. Conclusion: The study provides valuable insights into the demographic and activity-based factors that influence knee injury risks.

Keywords: Knee Injury, Socio-Demographic Characteristics, Physical Activity, Sports Participation, Risk Factors.

Significance | This study highlights the importance of identifying risk factors for knee injuries to develop targeted prevention and rehabilitation strategies.

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1. Introduction

Knee injuries include damage to one or more tissues that make up the knee joint, including ligaments, tendons, cartilage, bones, and muscles (Rauch, 2022). These injuries are caused by a range of factors, including age, gender, sport, BMI, flexibility, and misuse of the knee—particularly the hamstring-to-quadriceps strength muscle mass ratio. Knee injuries account for the majority of lower extremity injuries (Chia et al., 2022). High-impact sports such as running, basketball, football, hockey, soccer, and cycling can significantly increase the risk of knee pain and injury (Kolodziej et al., 2022). Athletes and active individuals often sustain knee injuries due to overuse, abrupt impacts, and incorrect technique (Moustridi

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et al., 2023). In modern sports, which have gained popularity and become highly organized with structured performance evaluations, the pursuit of achievement has driven the development of scientific training methods aimed at enhancing physical, psychological, and cognitive performance (Kemler et al., 2022). However, these increased training demands have placed greater physical and mental stress on athletes, thereby raising their risk of injury (Nusia et al., 2023). Among 1008 documented injuries, football players had the highest incidence, at 19.5%, followed by athletics at 11.3%, and basketball at 10.1%. Other sports, including cricket (8.6%), volleyball (7.6%), and hockey (6.4%), also showed notable injury rates, while table tennis had the lowest at 0.9% (Hietamo et al., 2023). Soccer was found to be the leading cause of knee injuries (30.6%), followed by kabaddi (20.9%), while other sports such as athletics, cricket, volleyball, and basketball showed varying rates of knee injuries (Shivachev & Bogomilova, 2020). Football is particularly associated with meniscal injuries, with injury rates differing by country and the popularity of the sport (Tummala et al., 2022). Knee injuries are a prevalent issue not only in athletes but also in individuals engaging in intense physical exercise (Atik & Kaya, 2022). Understanding the risk factors of knee injuries is critical for public health, especially in Bangladesh, where the incidence of such injuries remains high (Cronström et al., 2021). Research on the risk factors for knee injuries is essential to raise awareness and develop preventive measures (Zebis et al., 2022). Studies on this issue are particularly relevant and feasible in the context of the general population involved in sports and intense physical activities in Bangladesh (Trojner & Kelc, 2024).

This study will provide valuable insights into the risk factors contributing to knee injuries, helping policymakers develop strategies to prevent and control such injuries. The findings will not only reduce the risk of injury but also contribute to improved athletic performance, productivity, and overall public health in Bangladesh. Additionally, this research will serve as a foundation for future studies focused on knee injury prevention and rehabilitation in various sports and physical exercise settings.

2. Methodology

This cross-sectional study aimed to explore the risk factors of knee injuries among individuals in Bangladesh from July to December 2022. The study was conducted in a tertiary-level hospital known for its advanced diagnostic and therapeutic facilities, serving the general population, including civilians and individuals affected by accidents and disasters. A total of 83 participants were included using a probability-based simple random sampling technique. Data collection involved face-to-face interviews utilizing a semi-structured questionnaire and checklist, with a strong focus on ethical considerations, including proper briefing, securing informed consent, addressing sensitivities, respecting participant rights, ensuring privacy, and avoiding any personal benefit for the researcher. Data were analyzed using SPSS version 26, as shown in Figure 1.

3. Results

3.1. Sociodemographic characteristics

The demographic characteristics of the study population, consisting of 83 respondents, are shown in Table 1. In table 1 the age distribution indicates that the majority (45.8%) fall within the 20-29 age range, with a mean age of 34.80 ± 13.29 years. Notably, the male representation is predominant, accounting for 92.8% of the respondents. The religious composition is predominantly Muslim (97.6%). The marital status reveals that 71.1% of respondents are married. In terms of educational status, 55% completed HSC/equivalent education. The occupational status indicates that most of the respondents are employed (92.8%), while 7.2% are retired. The monthly family income distribution indicates that 45.8% fall within the Tk 26,000-47,000 range.

3.2. Risk factors of knee injuries

Figure 2 shows that 44 (42%) were football players, 31 (29.5%) were volleyball players, 18 (17.1%) were basketball players, 6 (5.7%) were hockey players, and 6 (5.7%) were kabaddi players.

The distribution of respondents' involvement in various sports among a sample of 83 people is summarized in the table 2, which also highlights significant differences in engagement. Judo and Taekwondo are the least popular sports, with only 3.6% of respondents partaking in each, while boxing is the most popular sport, with 13.3%. With 8.4% participation, race running is the second most popular activity, followed by wushu at 4.8%. Cycling and karate have equal participation rates of 6% each. Given that a sizable majority of respondents (more than 85%) said they did not participate in any particular activity, these findings point to a generally low level of involvement across all sports, which may be due to a lack of interest or access to these activities among the sample population.

With a total sample size of 83 participants, table 3 shows the respondents' distribution according to their involvement in accidents. Of these, 61 respondents (73.5%) reported no accidents, whereas 22 respondents (26.5%) reported having an accident. The frequency of accidents in the sample population can be inferred from these percentages. Given that over three-quarters of the respondents said they had never been in an accident, the data indicates that the respondents' chances of having an accident are minimal. If the sample is representative, this distribution could be used as a foundation for additional inferential analysis, such as examining the connection between accidents and other variables or extrapolating the results to a larger population.

Table 4 shows how respondents were distributed among the 83 people in the sample according to their history of knee injuries. 12.0% (n=10) of the respondents said they had previously suffered a knee injury, whilst 88.0% (n=73) said they had never experienced

Table 1. Distribution of Sociodemographic Characteristics Among the Respondents

Variables	Parameters	Frequency	Percentages (n=83)	Statistics
Age (years)	20-29	38	45.8%	Mean ± SD (year) = 34.80 ± 13.29 (year)
	30-39	20	24.1%	Minimum = 20 years, Maximum = 74 years
	40-49	14	16.9%	
	50-59	05	6.0%	
	60-69	03	3.6%	
	≥70	03	3.6%	
Sex	Male	77	92.8%	
	Female	06	7.2%	
Religion	Muslim	81	97.6%	
	Hinduism	01	1.2%	
	Buddhism	01	1.2%	
Marital Status	Married	59	71.1%	
	Unmarried	24	28.9%	
Educational Status	Secondary (VI-X)	04	5.0%	
	SSC/Equivalent	17	21.0%	
	HSC/Equivalent	46	55.0%	
Educational Status	Graduate/Equivalent	14	17.0%	
	Masters and above	02	2.0%	
Occupational Status	Employed	77	92.8%	
	Retired	06	7.2%	
Monthly Family Income	6000-25000	35	42.2%	Mean ± SD (Tk) = 30,795.18 ± 17,710.93 (Tk)
	26000-47000	38	45.8%	Minimum = 6,000 Tk, Maximum = 100,000 Tk
	48000-67000	06	7.2%	
	68000-87000	02	2.4%	
	≥88000	02	2.4%	

Table 2. Distribution of Respondents by Different Types of Sports (n=83)

Different Types of Sports	Yes (Frequency)	Yes (Percentages)	No (Frequency)	No (Percentages)
Race Runner	07	8.4%	76	91.6%
Cycling	05	6%	78	94%
Karate	05	6%	78	94%
Judo	03	3.6%	80	96.4%
Boxing	11	13.3%	72	86.7%
Wushu	04	4.8%	78	94.0%
Taekwondo	03	3.6%	80	96.4%

Table 3. Distribution of Respondents by Accident (n=83)

Accident	Frequency	Percentage
Yes	22	26.5%
No	61	73.5%
Total	**83**	**100%**

Table 4. Distribution of Respondents by Previous Knee Injury (n=83)

Previous Knee Injury	Frequency	Percentage
Yes	10	12.0%
No	73	88.0%
Total	**83**	**100%**

Table 5. Distribution of Respondents by Participation in Different Types of Physical Activities (n=83)

Physical Activity	Frequency	Percentage
Physical training	71	85.5%
Running (1.6 km)	72	86.7%
Running (3.2 km)	71	85.5%
Swimming	68	81.9%
Drill	65	78.3%
Crossing 6 feet ditch	62	74.7%
Crossing horizontal rope	60	72.3%
Jumping 9 feet ditch	59	71.1%
Fireman lift	57	68.7%
Monkey rope	55	66.3%
Running (16 km)	55	66.3%

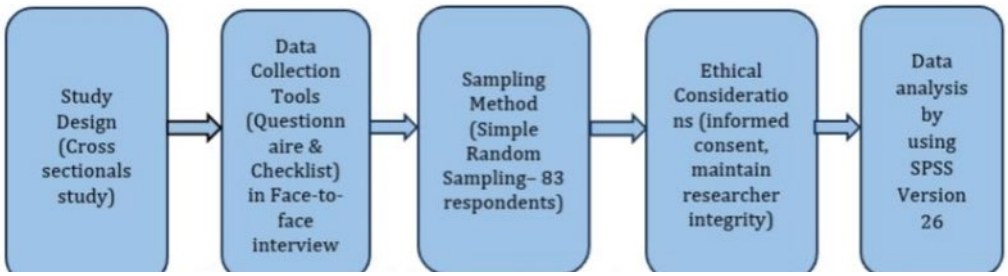

Figure 1. Flowchart of methodology among risk factors knee injuries in population.

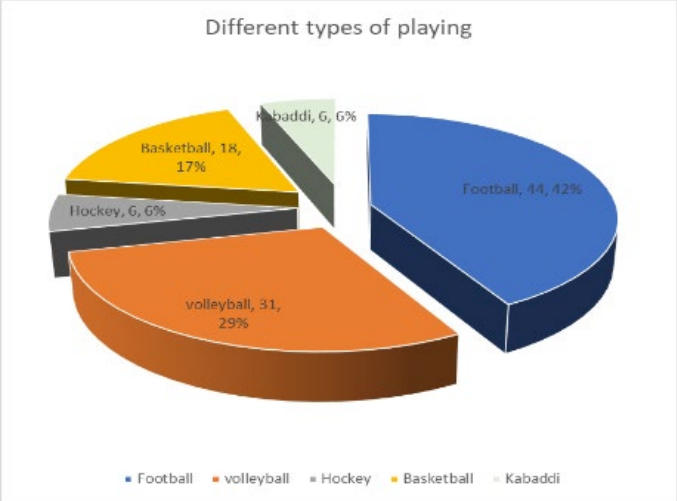

Figure 2. Distribution of Respondents by Different Types of Sports (n=83).

one. The data may be used as a foundation for additional inferential research to investigate correlations or patterns between knee injuries and other factors within the group under study. These proportions imply that knee injuries are rather rare in this cohort.

Table 5 shows that most of the respondents (72 or 86.7%) participated in running 1.6 km, followed by physical training (71 or 85.5%) and running 3.2 km (71 or 85.5%). A high percentage of respondents engaged in shorter, high-intensity activities such as running 1.6 km (86.7%) and physical training (85.5%), indicating these were the most common activities. Conversely, activities requiring specialized skills or extended endurance, such as monkey rope (66.3%) and running 16 km (66.3%), were less frequent, although still notable. The data suggests a general trend toward greater participation in activities requiring moderate to high levels of physical effort, with participation rates gradually declining as activities become more challenging or specialized. This distribution highlights potential areas for targeted training interventions or improvements in physical activity programs to ensure more balanced participation across different activities. The least participation was in activities like monkey rope and running 16 km, with 55 participants (66.3%) each (Huang & Zheng, 2022).

4. Discussion

4.1. Socio-demographic Characteristics of the Respondents

In the present study, it was found that most of the respondents (45.8%) were within the 20-29 years age group. The mean age of the respondents was 34.80 years, with a standard deviation of 13.29 years, which is nearly similar to the findings of a previous study, where the majority of respondents (41.8%) were from the 25-34 years age group (Dauty et al., 2022). Another study also found that 43.1% of respondents were in the 20-29 years age group. The higher risk of knee injury in this age group may be attributed to the fact that most of the respondents in this age range participate in various physical activities, including sports and exercise (Payne et al., 2023). In the present study, the highest proportion of osteoarthritis cases (27.8%) were found in the 40-49 years age group, which differs from another study where the majority of osteoarthritis cases were found in the broader age range of 18-84 years. The difference in the age group and the geographical location of the studies could explain this discrepancy (Wang, 2024). The study also revealed that 92.8% of the respondents were male and 7.2% were female. This finding aligns with other studies, though there may be some differences due to variations in sample size, study population, and sampling methods (Afridi et al., 2023). The majority of respondents (97.6%) were Muslim, consistent with the demographic profile of Bangladesh. In terms of education, over half of the respondents (55%) had an HSC or equivalent qualification, similar to studies conducted in other countries among populations with similar educational backgrounds (Tranaeus et al., 2022). In terms of occupation, 73.5% of the respondents were in occupations with a higher likelihood of physical activity, which is comparable to similar studies in other regions. The mean monthly income of the respondents was Tk 30,795.18, which is similar to studies conducted in Bangladesh, but lower than income levels found in more economically developed countries (Donelon et al., 2020).

4.2. Risk Factors for Knee Injury Among Respondents

The present study found that 42.0% of respondents were football players, which aligns with similar studies in other populations. Other sports, such as volleyball (29.0%) and basketball (17.0%), were also identified as high-risk activities for knee injuries (Halimuzzaman, Sharma, Hossain, et al., 2024). This is consistent with findings from other studies examining sports injuries in various populations. The differences in injury rates between studies may be due to variations in study populations and sample sizes (Halimuzzaman et al., 2023).

Additionally, 8.4% of respondents were race runners, which is lower than in studies conducted in other regions, possibly due to differences in sample populations and study methodologies. Boxing was identified as a risk factor for knee injuries in 13.3% of respondents, which matches findings from other studies on boxing injuries (Halimuzzaman & Sharma, 2022).

4.3. Risk Factors for Knee Injury Due to Different Types of Physical Training

The study found that 85.5% of respondents were engaged in physical training, which is similar to findings from other studies on physical training routines (Halimuzzaman, Sharma, Bhattacharjee, et al., 2024). Furthermore, 86.7% of respondents participated in running activities as part of their physical training, which is consistent with other research on physical training programs (Halimuzzaman, Sharma, & Khang, 2024).

4.4 Limitation

The small sample size of respondents may not represent the overall population, as the study was confined to a specific group of individuals. Some respondents were reluctant to participate due to concerns about the potential impact on their service, requiring additional incentives to encourage participation. Timely interviews were also challenging due to the busy schedules of the respondents. There was hesitation among respondents during interviews, which prompted efforts to boost their confidence. Additionally, the sample did not include individuals from all relevant institutions, limiting the generalizability of the findings. The research was also limited in duration and did not address all potential risk factors for knee injury in the population under study.

5. Conclusion

The study population is primarily young, male, and Muslim, with a significant portion of participants engaging in physically demanding activities, according to the demographic analysis of the cross-section. The majority of respondents are married, belong to lower rank groups, and have at least an HSC or equivalent degree.

Approximately 50% of participants earn between TK. 26,000 and TK. 47,000 monthly, suggesting a moderate level of financial security. Sports participation among respondents shows football as the most popular, followed by volleyball and basketball. Boxing is also relatively common, while judo and taekwondo are less popular. Despite the variety in sports participation, a significant portion of the population regularly engages in physically demanding activities such as swimming, physical training, and jogging, all of which increase the risk of knee injury.

Author contributions

All authors made equal contributions to the study design, statistical analysis, and drafting of the manuscript. The corresponding author, along with the co-authors, reviewed and approved the final version of the article prior to submission to this journal.

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Competing financial interests

The authors have no conflict of interest.

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