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Unveiling the Knee Injury Landscape: A Comprehensive Study of Youth Male Football Players in the Central Region of Saudi Arabia

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Abstract: Knee injuries represent a significant health concern for young male football players in Saudi Arabia. Despite global research on football-related injuries, there is a distinct lack of studies focusing on this demographic in the Saudi context. This research aims to fill this gap, offering insights into injury prevalence and risk factors, thereby contributing to athlete well-being and informing tailored interventions. This study aimed to investigate the prevalence of knee injuries among youth male football players in Saudi Arabia, with a focus on injury patterns, risk factors, and associated factors. A cross-sectional study was conducted, involving 104 male football players who represent five Saudi clubs and are aged 18.82 ± 0.68 years. Injury data, including severity, timing, and mechanisms, were collected. Logistic regression analyses were performed to assess the impact of various factors on the likelihood of knee injuries. The study revealed that 37.5% of participants reported prior knee injuries, predominantly muscle injuries (61.5%) occurring during training. Ligamentous injuries, particularly anterior cruciate ligament injuries, were also notable (25.6%). Logistic regression analyses indicated that factors such as age, weight, height, body mass index, playing position, duration of playing football, and playing surface significantly influenced the odds of sustaining a knee injury. This study provides insights into the prevalence and patterns of knee injuries among youth male football players in the central region of Saudi Arabia. Muscle injuries are common. Factors such as age, weight, and playing position contribute to the risk of knee injuries. The findings underscore the need for targeted injury prevention strategies and player education programs.

Keywords: knee injuries; youth football players; prevalence; risk factors; Saudi Arabia

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1. Introduction

Football, a globally celebrated sport, not only captivates millions but also significantly impacts the health and well-being of its participants [1]. Among the myriad challenges faced by footballers, knee injuries have emerged as a critical concern, prompting meticulous scientific scrutiny. To comprehend the prevalence of knee injuries among young male football players in Saudi Arabia, it is imperative to contextualize the epidemiological landscape globally. Previous research underscores a notable prevalence of injuries within the intricate structures of the knee joint. Research has revealed a heightened occurrence of knee injuries among youth football players, demonstrating an incidence rate ratio (IIR) of 1.49 [2]. In the context of high school football in the United States, medial collateral ligament (MCL) injuries exhibit an annual incidence of 24.2 per 100,000 athletes [3], with meniscal injuries contributing to 8% of these cases [4]. Isolated injuries to the lateral collateral ligament (LCL) manifest at a rate of 7.9% among high school athletes, while posterior cruciate ligament (PCL) injuries are the least prevalent, constituting only 2.4% of all knee injuries [5].

Narrowing the focus to youth football players, age-specific considerations become paramount. Understanding the specific risks associated with each age group is crucial for developing targeted policies and prevention strategies to ensure the safety of sports play in youth, high school, and collegiate football [6]. The relationship between playing position, training intensity, and the likelihood of sustaining knee injuries is a nuanced aspect deserving attention. Recent research by Oliva-Lozano et al. [7] suggests that specific playing positions may be associated with an increased risk of knee injuries. Moreover, they highlighted the role of training intensity and volume as potential risk factors, underscoring the necessity for a meticulous examination of training regimens among youth players.

Despite the existing body of literature on knee injuries in football, there remains a notable gap in research specific to the prevalence and patterns of knee injuries among youth male football players in Saudi Arabia. Given that youth football players represent the future of the sport, recognizing the prevalence and patterns of knee injuries in this demographic is pivotal for designing targeted interventions, improving training regimens, and ultimately safeguarding the health and longevity of aspiring football talents. This study aims to address this gap by systematically examining data collected from youth players, providing a localized perspective on the epidemiological challenges and opportunities for injury prevention and athlete well-being. We hypothesized that youth male football players in Saudi Arabia are at a higher risk of sustaining knee injuries compared to other demographic groups due to factors such as playing intensity, training regimens, and environmental conditions.

2. Materials and Methods

2.1. Design

A retrospective cohort study was conducted among young male football players from the youth teams of Alfaisali, Alfaihaa, Ataawin, Alraaid, and Alhazem Saudi clubs in Majmaah governorate and Qassim region.

2.2. Sample Characteristics

The study enrolled a cohort of one hundred male youth football players, ranging in age from 18 to 20 years, representing Alfaisali, Alfaihaa, Ataawin, Alraaid, and Alhazem Saudi clubs. Inclusion criteria allowed for the participation of individuals with or without a history of knee injuries spanning from 2017 to 2022, irrespective of nationality. Exclusion criteria involved players falling outside the specified age range, those with knee injuries exceeding a five-year duration, individuals with injuries unrelated to football, and those with injuries affecting body parts other than the knee. Prior to enrolling in the study, each participant provided written informed consent. The study followed the Helsinki Declaration and was approved by the Majmaah University Ethics Committee (MUREC-May.15/COM-2022/5-2).

2.3. Data Collection

Data for this study were gathered using a combination of face-to-face interviews and medically verified injury logs. Face-to-face interviews were conducted using a modified paper checklist questionnaire adapted from Dafalla et al. [8]. The questionnaire comprised three sections. The first section focused on personal data, encompassing information such as age, weight, height, body mass index (BMI), nationality, duration of playing football, team affiliation (youth team), and playing positions. The second section delved into injury details, including the injured structures (ligaments, menisci, or other types), the mechanism of injury (contact or non-contact), and the time of injury. The final section covered intervention and recovery, gathering information on surgical and/or physical therapy (PT) management and the time taken to return to sport (RTS). A player was considered injured if they were incapable of engaging in a match or training session due to an injury sustained during a football match or training. The player retained the designation of injured until they could actively participate in a match or fully adhere to all coaching instructions, encompassing

activities such as sprinting, turning, shooting, and engaging in football at full tempo [9]. Injury severity was categorized into three classes based on duration: mild (1 to 7 days), moderate (8 to 21 days), and severe (exceeding 21 days) [10]. These categories were chosen to align with established guidelines in the sports medicine literature, which commonly classify injuries based on their expected recovery time. Mild injuries typically require minimal recovery time and do not significantly impact the player's ability to participate in matches or training sessions, while severe injuries may result in prolonged absence from play and require extensive rehabilitation.

2.4. Data Analysis

Upon completion of data collection, a comprehensive analysis was conducted to derive meaningful insights. Descriptive statistics, including frequencies and percentages, were employed to summarize the characteristics of the study participants, providing an overview of personal and injury-related variables. Additionally, inferential statistics, such as chi-square tests and logistic regression, were utilized to explore associations between different factors, such as age, playing position, and injury prevalence. The data analysis aimed to unveil patterns, trends, and potential correlations within the dataset, contributing to a nuanced understanding of knee injuries among male youth football players in Majmaah and Qassim regions, Saudi Arabia. Logistic regression analysis was used to identify any predictive factors of knee injuries, linked to the dichotomized outcome. The statistical significance threshold was established at $p < 0.05$, and the statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software, Version 29.0, designed for Macintosh by SPSS Inc. in Chicago, IL, USA.

3. Results

A cohort of 104 male soccer athletes, exclusively of Saudi nationality, willingly joined the research initiative. The average age within this cohort was 18.82 years, with a standard deviation of 0.68. The corresponding mean measurements for height, weight, BMI, and the duration of football play were 1.73 m (±0.07), 65.13 kg (±6.85), 21.83 kg/m^2 (±1.73), and 4.66 years (±2.26), respectively.

Among the 104 football players representing five teams, 39 players (37.5%) disclosed a history of prior knee injuries. Detailed injury distribution is presented in Table 1, elucidating severity, timing, and mechanisms. Muscle injuries constituted the most prevalent type, making up 61.5% of all reported injuries, predominantly occurring during training sessions. Conversely, other injuries, such as fractures or patellar injuries, were less frequent, making up 7.7%. Among muscle injuries, quadriceps and hamstring injuries showed equal prevalence. Ligamentous injuries followed (25.6%), with ACL being the most common, succeeded by meniscus injuries (17.9%), among which medial meniscus injuries prevailed. Non-contact injuries constituted the majority, accounting for 59% of reported cases. The distribution of injuries in terms of players' field positions is illustrated in Figure 1. Regarding intervention types, results reveals that 23.1% of participants opted for surgical intervention, with all injured players undergoing physical therapy rehabilitation. On average, participants returned to sport after 69.89 days, with a standard deviation of 100.83.

Table 1. Distribution of knee injuries (n = 39) among study participants.

Knee Injury Type	Severity n (%)			Timing of Injuries n (%)			Injury Mechanism n (%)		Total n (%)
	Mild	Moderate	Sever	First Half	Second Half	Training	Contact	Non-Contact	
Ligament injury									**10 (25.6)**
ACL			7 (100)	1 (14.3)	1 (14.3)	5 (71.4)	2 (28.6)	5 (71.4)	7 (17.9)
PCL									-
MCL		1 (50)	1 (50)			2 (100)	2 (100)		2 (5.1)
LCL			1 (100)		1 (100)		1 (100)		1 (2.6)
Meniscus injury									**7 (17.9)**
Medial meniscus			5 (100)			5 (100)	2 (40)	3 (60)	5 (12.8)
Lateral meniscus			2 (100)			2 (100)		2 (100)	2 (5.1)

Table 1. *Cont.*

Knee Injury Type	Severity n (%)			Timing of Injuries n (%)			Injury Mechanism n (%)		Total n (%)
	Mild	Moderate	Sever	First Half	Second Half	Training	Contact	Non-Contact	
Muscle injury									**24 (61.5)**
Quadriceps	7 (58.3)	2 (16.7)	3 (25.0)	2 (16.7)	2 (16.7)	8 (66.7)	7 (58.3)	5 (41.7)	
Hamstring	0	7 (58.3)	5 (41.7)	3 (25.0)	6 (50.0)	3 (25.0)	2 (16.7)	10 (83.3)	
Other injuries			3 (100)	1 (33.3)	1 (33.3)	1 (33.3)	2 (66.7)	1 (33.3)	**3 (7.7)**
Total	**7 (17.9)**	**10 (25.6)**	**22 (56.4)**	**7 (17.9)**	**11 (28.2)**	**21 (53.8)**	**16 (41)**	**23 (59)**	

ACL: anterior cruciate ligament; PCL: posterior cruciate ligament; MCL: medial collateral ligament; LCL: lateral collateral ligament.

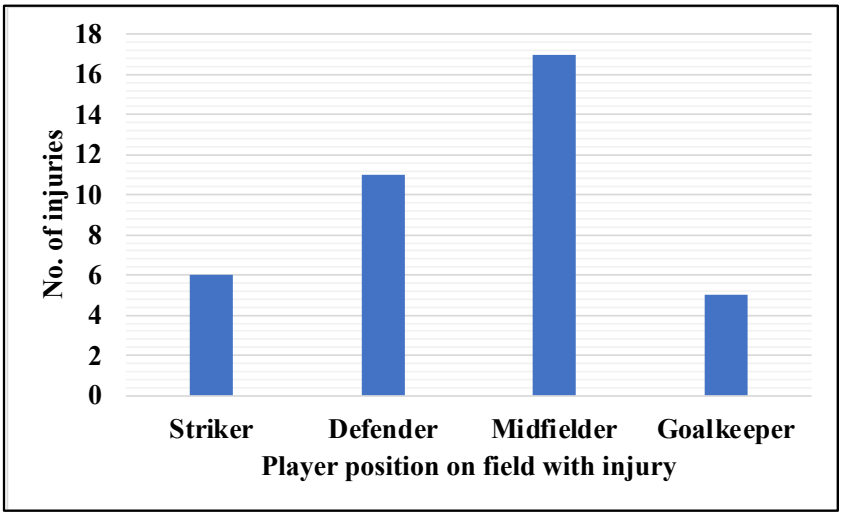

Figure 1. The distribution of injuries based on players' field positions.

Logistic regression analysis was conducted to assess the impact of age, weight, height, BMI, duration of playing football, and playing positions on predicting knee injuries (Table 2). The statistical significance, as indicated by the *p*-value (<0.001), highlights that only the duration of playing football holds significance. The coefficients for age and weight are negative. Specifically, a one-unit increase in age reduces the likelihood of a knee injury by 1.6%. Similarly, a one-unit increase in weight corresponds to a 58.5% decrease in the odds of having a knee injury, or a decrease by a factor of 0.42 times. Conversely, a one-unit increase in height is linked to an approximately 3.01 times increase in the odds of sustaining a knee injury. Likewise, a one-unit increase in BMI results in a substantial 15.97 times increase in the odds of having a knee injury. The duration of playing football shows a 50.1% increase in the odds of having a knee injury for each additional year of playing (or 1.50 times).

Furthermore, when comparing football players classified as strikers to goalkeepers, the odds of having a knee injury increase by 48.4% (or 1.484 times). Similarly, defenders compared to goalkeepers have a 59.3% increase in the odds of knee injuries (or 1.593 times). In contrast, midfielders compared to goalkeepers experience a 24.3% decrease in the odds of knee injuries (or 0.757 times). Additionally, the odds of knee injuries show a significant increase for players on natural surfaces compared to artificial surfaces.

Table 2. Risk factors in youth footballers with and without knee injury.

Variable	With Knee Injury (n = 39)	Without Knee Injury (n = 65)	*p* Value	Odds Ratio
Age (years)	18.92 ± 0.62	18.75 ± 0.71	0.97	0.98
Height (m)	1.73 ± 0.08	1.73 ± 0.07	0.24	3.01
Weight (kg)	65.67 ± 6.44	64.82 ± 7.11	0.25	0.42
BMI (kg/m^2)	21.99 ± 1.53	21.73 ± 1.85	0.25	15.96

Table 2. *Cont.*

Variable	With Knee Injury (n = 39)	Without Knee Injury (n = 65)	*p* Value	Odds Ratio
Duration of playing football M ± SD	5.79 ± 1.96	3.98 ± 2.17	0.002 *	1.51
0–1 year n (%)	*1 (2.6)*	*3 (4.6)*		
1–3 years n (%)	*2 (5.1)*	*33 (50.8)*		
3–5 years n (%)	*14 (35.9)*	*14 (21.5)*		
>5 years n (%)	*22 (56.4)*	*15 (23.1)*		
Player position n (%)	39 (37.5)	65 (62.5)		
Goalkeeper	*5 (12.8)*	*12 (18.5)*	*0.54*	
Striker	*6 (15.4)*	*10 (15.4)*	*0.59*	*1.48*
Defender	*11 (28.2)*	*22 (33.8)*	*0.29*	*1.59*
Midfielder	*17 (43.6)*	*21 (32.3)*	*0.75*	*0.76*
Playground surface n (%)	36 (100)	65 (100)	0.99	6187

* Indicates significant correlation at the $p < 0.05$ level.

4. Discussion

The aim of this study was to comprehensively examine the prevalence and associated risk factors of knee injuries among youth football players in Saudi Arabia. Our investigation, encompassing 104 male players from five teams, revealed that 37.5% of participants had experienced prior knee injuries, predominantly characterized by muscle injuries occurring during training sessions. This study provides a novel and detailed exploration of injury distribution, encompassing severity, timing, and mechanisms, shedding light on the prevalence of multiple injuries. In contrast, existing studies have often focused on specific types of knee injuries, such as ligaments or menisci, or have been limited to specific populations like university students.

To the best of our knowledge, the current study is the first attempt to assess the prevalence of muscle injuries among youth football players in Saudi Arabia. In the current study, muscle injuries constituted the most prevalent type, making up 61.5% of all reported injuries, with quadriceps and hamstring injuries being equally common and predominantly occurring during training sessions. The results of the current study are consistent with previous studies [11,12] that found that knee injuries caused the highest burden among injuries and that muscular injuries in general were the most common in youth football players. However, no direct comparison can be conducted because these studies do not specifically address the incidence of knee muscle injuries in this population. In the same context, Ekstrand et al. [9] found that almost one third of all injuries in professional football are muscle injuries.

The reason for the high prevalence of muscle injuries in youth football players may be the nature of the sport; it features high-intensity activities such as accelerations during running, jumping, and kicking and the predominant use of pelvic muscles rather than core abdominal muscle stabilizers [13]. Furthermore, incomplete muscular development and the limited shock absorption of developing muscles in adolescents are major concerns [14]. This is consistent with the findings of Ergün et al. [15], who reported that muscle injuries were the most common type of injury (61.4%) and that the majority of muscle injuries and all ligament injuries occurred during training. In general, knee injuries in youth football players predominantly occur during training sessions. The higher incidence of knee injuries in youth football players during training compared to matches can be attributed to factors such as training intensity, physical contact, individual focus, fatigue, and age and maturation status [11,15,16]. These factors contribute to the increased risk of knee injuries during training sessions, while matches may provide a less intense and more varied environment that reduces the risk of knee injuries.

In the current investigation, ligamentous injuries had the second-highest prevalence at 25.6%, with the ACL emerging as the most frequently affected. These findings closely align with the research of Khired et al. [17] who reported that the prevalence of knee ligament injury was 48.8% and the ACL was implicated in 46.2% of the cases. Likewise, the

results of our investigation exhibit partial consistency with the outcomes of Eldeen et al. [8] and Alassiri et al. [18], who reported a knee injury prevalence of 61.2% based on MRI assessments, with ACL tears ranging from 26.2% to 41.8% and meniscus tears observed in 44.9% of instances. The observed disparities in prevalence may be attributed to variations in population demographics and age groups.

The severity and nature of knee injuries play a pivotal role in determining the recovery time, with more severe injuries necessitating prolonged periods of rest, rehabilitation, and treatment. The impact of an injury can be gauged by its severity and the number of missed training days or competitive matches [10]. In our study, 56.4% of all injuries resulted in time loss, typically entailing 21 days or more away from football. Moreover, the majority of severe injuries occurred during matches. This finding contrasts with that of Ergün et al. [15], who reported that 65.9% of all injuries led to time loss, often resulting in absence from football for one week or less. Although the type and severity of the injury likely influenced the decision for surgical management [19], 23% of all knee injuries underwent surgical procedures in this study. This may be attributed to the predominance of muscular injuries, which may necessitate several weeks to months for complete healing.

Assessing the risk of knee injuries, our present study indicates that a one-unit increase in age is associated with a 1.6 times reduction in the likelihood of sustaining a knee injury. These findings may be linked to the impact of maturation status on injury patterns [16] and the existence of muscle strength imbalances [20,21] within this specific population. This interpretation finds support in the work of Alassiri et al. [18], who demonstrated that individuals in the younger adult age group (16–30 years) faced a 1.5 times higher risk compared to their middle-aged counterparts (31–45 years), underscoring the role of age as a significant factor in knee injury prevalence. Additionally, Wik et al. [22] identified a higher incidence of joint sprains and bone stress injuries among players in the U16, U17, and U18 age categories, with the most substantial burden observed in U16 players.

In examining weight, height, and BMI as potential risk factors for knee injuries in youth footballers, our study reveals that a one-unit increase in weight is associated with 0.42 times decrease in the likelihood of sustaining a knee injury. Conversely, a one-unit increase in height is associated with an approximately 3.01 times increase in the odds of experiencing a knee injury, while a one-unit increase in BMI results in a 15.97 times increase in the odds of knee injury occurrence. Despite limited comparative studies, a comprehensive understanding of the impact of weight, height, and BMI on youth football players may elucidate the factors influencing knee injury development. Specifically, the interplay of weight and height can contribute to muscle imbalances, heightening the risk of knee injuries [20]. Taller individuals may face elevated stress on the knee joint, potentially linked to their greater height and weight, thereby increasing the susceptibility to knee injuries [23]. Additionally, weight, height, and BMI have the potential to impact the anatomical structure of the knee joint, influencing factors like the alignment of knee bones and the shape of knee joint surfaces. These anatomical variations may, in turn, affect the distribution of force and stress on the knee joint, potentially predisposing individuals to knee injuries [24]. This rationale is supported by Moafa et al. [25], who suggested that university students with higher BMI values may be at a higher risk of developing knee injuries. Although a study by Gage et al. [26] did not identify weight and height as significant risk factors for ACL tears, it did find that taller players were at a higher risk of ACL tears compared to their shorter counterparts.

Interestingly, the present investigation reveals a 1.50 times increase in the odds of experiencing a knee injury for each additional year of playing football. This observation can be ascribed to the physical demands inherent in the sport, involving activities such as running and sudden directional changes, which contribute to the cumulative stress and strain on the knee joint. Prolonged engagement in football, particularly during matches, induces muscle fatigue, jeopardizing knee stability and predisposing individuals to injuries [12]. Moreover, continuous involvement in football activities promotes the development of muscle imbalances [27], amplifying susceptibility to knee injuries [20]. This assumption is

supported by Andersen et al. [12] who identified a higher injury incidence rate per 1000 h during match play compared to team practice, suggesting that the intensity and duration of football exposure may impact the risk of knee injuries. Another study reported an overall injury incidence of 12.0 per 1000 h, with a heightened burden observed in the U16 age group [22].

In our investigation, a comparison of football players categorized as strikers to goalkeepers revealed a 48.4% increase in the odds of sustaining a knee injury. Likewise, defenders when compared to goalkeepers exhibited a 59.3% increase in the odds of knee injuries. Conversely, midfielders, in comparison to goalkeepers, experienced a 24.3% decrease in the odds of knee injuries. The literature lacks consensus on whether player position significantly influences the overall injury risk in male soccer. This lack of agreement may stem from variations in injury rates and patterns among different playing positions due to distinct loads, movement patterns, and a unique blend of anticipated and non-anticipated movements (reactive movements) [28]. Our findings align partially with those of Andersen et al. [29] and Arliani et al. [30], who noted that goalkeepers face a lower injury risk compared to outfield players. However, our results contradict previous studies reporting higher risk in forwards due to the intensity of match play in their typical playing zones and fast kicking and acceleration/deceleration activities [31] and greater risk in midfielders [32].

The present study's results indicate a noteworthy increase in the odds of knee injuries for players on natural surfaces compared to artificial surfaces. This phenomenon may be attributed to the biomechanical implications of the surface, potentially leading to heightened stress on the knee joints. Notably, the existing literature has predominantly focused on injuries sustained on artificial turf, particularly in American football. Given the substantial differences between football and American football, including distinct injury profiles, it is imperative to analyze football injuries independently [33,34]. A relevant study, albeit small and limited to elite players, aligned with our findings by highlighting that muscle injuries were more frequent and injury incidence rates were generally higher when Saudi National Team footballers played on grass compared to 3G artificial surfaces [35]. Furthermore, our results partially align with a systematic review [36] suggesting that the overall incidence of football injuries is lower on artificial turf than on grass. The aforementioned review highlighted that professional players, specifically, exhibited a lower incidence of injury on artificial turf, with no apparent differences in injury incidence observed among amateur players. Moreover, comparative analyses across sports reveal varying knee injury rates and types. Football notably exhibits a high incidence of surgical interventions. A study comparing surgery rates among 25 National Collegiate Athletic Association sports from 2004 to 2014 showed that football ranked third, with 6.1 surgeries per 10,000 exposures [37], underscoring its elevated risk compared to other sports.

5. Limitations

The present study, while shedding valuable light on the prevalence and patterns of knee injuries among youth male football players in Saudi Arabia, is subject to several limitations that warrant consideration. Firstly, the study's sample was drawn from specific regions of Saudi Arabia, potentially limiting the generalizability of its findings to the entire country. Given the diverse geographical and cultural landscape of Saudi Arabia, the injury patterns observed in this study may not fully represent those in other regions. Secondly, the focus exclusively on male youth football players restricts the applicability of the findings to other demographic groups, such as female players or individuals in different age brackets or skill levels. Consequently, the study's conclusions may not be directly extrapolated to these populations. Lastly, the study did not account for external factors that could influence injury patterns, such as changes in training methods, equipment, or coaching strategies over time. Considering these external factors could provide a more comprehensive understanding of the dynamics underlying knee injuries in youth football players. Addressing these limitations in future research endeavors would enhance the robustness and applicability of findings related to knee injuries among football players in Saudi Arabia. Future studies in

this area could consider expanding the sample size to include a more diverse population from various regions of Saudi Arabia, thereby enhancing the generalizability of findings to the entire country. Additionally, investigating knee injury patterns among female football players and individuals across different age groups and skill levels would provide a more comprehensive understanding of the prevalence and risk factors associated with knee injuries in football. Moreover, longitudinal studies tracking changes in training methods, equipment, and coaching strategies over time could elucidate the impact of these external factors on injury patterns among youth football players in Saudi Arabia.

6. Conclusions

In conclusion, this study provides valuable insights into the prevalence and patterns of knee injuries among youth male football players in Saudi Arabia. With a focus on players aged 18 to 20 from five clubs, the research revealed that 37.5% had experienced knee injuries, with muscle injuries being the most prevalent type. The study also identified age, weight, height, BMI, duration of playing football, playing position, and surface type as potential risk factors for knee injuries. Notably, the findings highlight the significance of age, with older players showing a reduced likelihood of knee injuries, and the impact of playing position and surface type on injury risk. These insights contribute to a better understanding of the factors influencing knee injuries in this population, which is crucial for developing targeted prevention strategies and optimizing player safety in youth football. Further research and interventions tailored to the specific needs of youth footballers in Saudi Arabia are warranted to mitigate the burden of knee injuries and promote long-term athlete well-being.

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