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Prevalence of Functional Ankle Instability and Associated Risk Factors Across Different Age Groups in Saudi Arabian Male Football Players in Madinah Province

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ABSTRACT

Background: Functional ankle instability (FAI) is a sequela of ankle sprain. Despite national league participation in the Kingdom of Saudi Arabia (KSA), the prevalence of FAI among footballers was not studied. The purpose was to investigate the prevalence of FAI and to ascertain the group at higher risk and its associated risk factors among male football players in Madinah Province.

Methods: A cross-sectional study consisted of 218 male football players aged 16-17 years (beginners), 18-19 years (youth), and 20 years and above (first team) and used the Arabic version of the Identification of Functional Ankle Instability (Ar-IdFAI) questionnaire after meeting the inclusion and exclusion criteria. A two-stage cluster random sampling was employed. The prevalence was presented as a frequency and a percentage. The Kruskal-Wallis test was performed to assess the age group at risk of FAI. Spearman's rank correlation (ρ) was employed to report the bivariate correlation between the risk variables and the Ar-IdFAI Score, and a multivariate linear regression model was used to ascertain the risk factors.

Results: The prevalence of FAI was 47.7%, with age-group frequencies of 36.5%, 56.2%, and 50.7% in the beginner, youth, and first-team groups, respectively. Regression analysis showed a good model fit: $F(4, 213) = 36.219, p < 0.001, R^2 = 0.405$, and ($\beta = 0.174, t = 2.369, p = 0.019$). Regression analysis indicated that injury ($\beta = .275, t = 2.456, p = .017$) was the key risk factor among youth, and reinjury in the first team ($\beta = 0.353, t = 2.097, p = .040$). Significant group difference between beginners and youth ($p = 0.017$), demonstrating that youth had the highest prevalence.

Conclusion: The present study revealed a 47.7% prevalence of FAI among male football players, especially among youth players (56.2%), with ankle injury as the key risk factor and reinjury as a key concern in the first team. This study emphasizes the importance of integrating systematized rehabilitation to prevent and treat FAI among football players in Madinah province, Saudi Arabia.

Keywords: Functional ankle instability, football, Saudi Arabia, ankle injury, re-injury, scale, Ar-IdFAI

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INTRODUCTION

Ankle sprains, one of the most devastating musculoskeletal injuries, accounting for 16–40% of all sporting injuries, with a high incidence rate in football (7.9%), continue to confront diagnostic and therapeutic issues. [1-4]. Professional footballers lose time due to sprains, causing an economic burden of ~\$4 billion annually [5]. In football, high-adrenaline events can cause wear and tear on the anterior talofibular ligament (ATFL), a crucial ankle stabilizer, leading to a season-long tendency toward recurrent sprains. Although most players return to action within weeks after conservative management, over 40% experience residual discomfort, recurrent “giving-way” episodes, and subjective instability, consistent with the textbook definition of chronic functional ankle instability (FAI) [4,6]. FAI, affecting 32–47% of players [7], stems from impaired neuromuscular control and foregrounds reduced proprioception, muscle weakness, delayed reflexes, and postural instability [8], leading to impaired output, heightened risk of reinjury, and secondary osteoarthritis [9,10]. FAI often precludes ~6% of players from playing again due to persistent symptoms, while 5–15% of players remain unable to perform their sport for periods ranging from 9 months up to 6.5 years [11].

In the Kingdom of Saudi Arabia (KSA), football spans school co-curricular programs to semi-professional clubs. Under Vision 2030, the Saudi Sports Ministry launched the ‘Mahd’ sports academy in 2020 to nurture young players in participating in professional sports, including football [12]. Nonetheless, an increased number of training and practice sessions, as well as competitive matches, during late puberty creates an exposure–capacity disparity with ongoing neuromuscular growth, likely elevating the prevalence of musculoskeletal injuries [13]. In KSA, the frequency of ankle sprains ranges from 63.8% to 77.7% [14,15]. A cross-sectional investigation in Riyadh and Tabuk reports a high incidence of lateral ankle sprains among students and club players [16, 17]. These findings underscore the need to identify the underlying causes of FAI in young players in KSA. Prior ankle injury is one of the most critical factors in ankle distress, often exacerbated by inadequate rehabilitation [18, 19]. Other risk factors include high training loads, prolonged playing history, higher body mass index (BMI), and certain playing positions that involve frequent rapid changes of direction [20]. Furthermore, lack of balance, strength, and postural control makes players vulnerable to ankle instability, rendering it a multifactorial problem that often requires a comprehensive preventive and rehabilitation approach [21, 22]. Despite this, most of these reports focused on chronic ankle instability in general rather than on FAI.

Self-administered questionnaires are ubiquitous procedures designed to identify players with ankle instability. Practical self-reported assessments of ankle instability are less formalized and lack a ‘gold standard’ measuring tool. Out of all the assessment tools, three with particular cutoff scores are recommended by the International Ankle Consortium: The Ankle Instability Instrument (AII), the Cumberland

Ankle Instability Tool (CAIT), and the Identification of Functional Ankle Instability (IdFAI). Arabic versions of these instruments identified risk variables in 310 players with ankle instability [16]. The IdFAI combines features from CAIT and AII to produce a brief, easy-to-use, intuitive assessment questionnaire [23]. Its framework is intended to enhance assessment efficiency by integrating the advantages of both tools while minimizing overlap. A notable characteristic of IdFAI is its standardization of the term ‘giving way.’ This ensures that all respondents understand and respond to related items coherently [24]. This design element enhances the precision and dependability of detecting FAI cases. Our study aimed to estimate the prevalence of FAI in male footballers in Madinah Province in the competitive age brackets and describe the patterns of association between functional instability in terms of self-reported, chronic “giving-way,” previous sprains, and re-injuries, along with FAI using Ar-IdFAI [25,26], which has unequivocally demonstrated its reliability in identifying FAI across various adult age demographics.

Despite national league player participation numbers, the prevalence of FAI and its risk factors among footballers, based on age, has not been studied in the KSA. To the best of our knowledge, no research in KSA has examined FAI prevalence across different football team age categories, using the Ar-IdFAI questionnaire, and employed multivariate analytical techniques to pinpoint key risk variables. Hence, the objective of this study was to determine the prevalence of FAI across the three age categories, to identify the group at higher risk, and to assess the association between risk variables and FAI.

METHODS

This cross-sectional observational study was conducted to quantify the prevalence of FAI among male footballers in the Madinah Province, KSA. Additionally, the present investigation aimed to identify factors associated with instability, stratified by distinct age-related cohorts. The population consisted of registered football players from 10 clubs that participated in the 2024 sporting season (May to June 2024). A two-stage cluster sampling was employed, with clubs as the primary units and nested team formations as the secondary units within each club. This approach reinforced sampling balance and response. Club administration facilitated permission requests, provided access to sites, and assisted with ground data collection.

Study participants

Male football players aged 16 years and above who were in training and playing in matches throughout the study period were included in the study. Players who do not actively play football or meet practice criteria, those with previous surgical intervention for ankle instability or a history of significant lower limb injury, or those with an inability or unwillingness to provide informed consent or complete the questionnaire were excluded from the study. All players were subdivided into different age groups: beginner (16-17 years), youth (18-19 years), and first team

(≥ 20 years).

Permission was obtained from the author of the Arabic IdFAI scale and the clubs involved in the partnership, and written informed consent was obtained from all participants. The players were briefed on the study objectives, the procedures to be followed, and the management of the collected data. The investigation was carried out in accordance with the ethical principles of the Declaration of Helsinki. The results were guided by the current standards in the field of sports medicine on reporting prevalence observation studies, involving a case definition, a clearly defined sampling frame, and prevalence estimation stratified to the level of policy and practice [27]. Majmaah University Research Ethics Committee (MUREC) approved the Ethics of Research (MUREC-Jun.11/COM-2023/22-2, approval date 11/06/2023).

Study procedure

For a known population size of 480 male football players, the 'Taro Yamane' formula was used for a finite-sample size estimation, which, given a 5% margin of error, needed 218 samples and gave a 100% response rate.

Measures and Instrument Administration

The design adheres to contemporary consensus on sports injury surveillance that favors the combination of limited recall duration, the use of validated, self-administered, patient-reported outcome measures, and data collection into a single assessment interval [27]. The primary outcome was FAI measured using the Ar-IdFAI, which comprises ten items on a single page, grouped under three variables, namely: (1) details relating to the initial ankle injury, (2) the history of ankle instability, and (3) information about ankle instability during daily activities. The IDFAI scores of the questionnaire range from 0 to 37, with a discrimination score of 11 and above [27, 28]. The reliability and validity of Ar-IdFAI were found to be excellent, with accuracy, sensitivity, and specificity of 0.91, 0.80, and 0.99, respectively [28]. Age, height, weight, training period, average daily training time, limb dominance, history of previous ankle injury, proportion of re-injury since the initial event, instances of giving-way as per the IdFAI operational criteria, and the IdFAI were all considered as covariates of interest. Completed demographic and training exposure data were captured on the proforma designed for this purpose.

Data Quality Assurance

Researchers who were native Arabic speakers, with standardized instructions, provided clarification on specific terms to participants who needed it. The confidentiality of the players and the study was maintained throughout. On-site staff ensured that players completed and responded to the questionnaires, clarifying any doubts and resolving discrepancies. Responses were logged in an encrypted matrix and were subject to range and consistency checks. The collected data was then flagged for verification against primary documents. All responses were extracted and assigned unique research identifiers devoid of personal or demographic data.

Data analysis

Statistical analysis was performed employing IBM SPSS v27. Ar-IdFAI was considered in the overall sample and stratified by age groups for participants with an IdFAI score ≥11. For each variable's population, the Kolmogorov-Smirnov test was used to check for normality. Descriptive statistics were used to summarize sample characteristics. As demographic dimensions did not follow a normal distribution, they were expressed in median with the interquartile range (IQR) and range. Since the data was not typically presented for the questionnaire and its constructs among beginners, youth, and the first team, the relationships between IdFAI scores and possible predictors (history of the injury, reinjury, and subjective instability) were examined using Spearman's rank-order correlation. To explore independent risk factors within each age category (beginners, youth, and first-team players), additional multivariable linear regression models were constructed that included age, anthropometric variables, training exposure, and ankle sprain history. The overall results were assessed for model fit using R, R², adjusted R², F-statistic, and various residual diagnostics. All two-sided statistical tests were evaluated at the p < 0.05 significance level. Additionally, a sensitivity analysis estimating the FAI prevalence with a modified IdFAI cut-off score of ≥11 was performed, considering threshold variability documented in literature [28].

RESULTS

A total of 218 eligible players (as calculated using the Yamane formula) participated in the study, resulting in a participation rate of 100%. This group represented the targeted developmental range well, with a median age of 19.33 years and an IQR of 16.7 to 24.4 years, spanning 16 to 30 years (Table 1). The median height and weight of the players were 170.88 cm (167-178 cm, range 165–189 cm) and 63.58 kg (61-78 kg, range 48–105 kg), respectively. Players reported a median of 6.36 years (4.5, 7.8) of organized training, with a training volume of approximately 2 hours per day. Right-leg dominance was reported in 66.5% of players, a prevalence that matches global patterns seen in football. Notably, 36.2% of the samples recalled an ankle injury, and 22.5% reported the injury as persistent. Furthermore, 66.5% reported some injury-related giving way during competition.

Table 1. Demographic dimensions of Saudi Arabian male football players in Madinah province (n = 218)

Variable	Median with IQR	Range
Age (years)	19.33 (16.7, 24.4)	16–30
Height (cm)	170.88 (167, 178)	165–189
Weight (kg)	63.58 (61, 78)	48–105
Years of training	6.36 (4.5, 7.8)	1–19
Training hours/day	2.0 (1.5, 2.6)	1–3
Functional Ankle Instability (Y/N)	104(47.7)/114 (52.3)	

Dominant limb (R/L)	145 (66.5)/73 (33.5)
Prior ankle injury (Y/N)	79 (36.2)/139 (63.8)
History of re-injury	49 (22.5)/169 (77.5)
Feeling of giving way	145 (66.5)/73 (33.5)

Demographic dimensions did not follow a normal distribution. Hence, it is expressed as the median with an interquartile range (IQR) and a range.

The overall prevalence rate for FAI, defined operationally as IdFAI ≥ 11 , was 47.7% (104 of 218 participants). Age subgroup analysis shows FAI prevalence as 36.5% in beginners aged 16 to 17 years ($n = 27$), with higher rate of 56.2% in the 18-19-year-old age group ($n = 41$), and was 50.7% in first-team players aged 20 and older ($n = 36$) (Tables 1 & 2). Differences between beginner and youth players were significant in post hoc analyses ($p < 0.05$), highlighting a significantly increased risk in youth players.

Table 2: Prevalence of Functional Ankle Instability (FAI) among the total sample and three football age groups/teams

Variable	Total sample %	Beginners %	Youth %	First team %
FAI prevalence (Y)	47.7%	36.5%	56.2%	50.7 %

The investigation further analyzed the correlation between age, height, weight, and Ar-IdFAI outcomes. We found no significant correlation between age and overall Ar-IdFAI outcomes, suggesting that age alone could not predict ankle instability in this cohort ($p = 0.965$). Moreover, height (p -value = 0.373), weight ($p = 0.35$), duration of training, and hours of training per day (both with $p = 0.061$) also showed no significant correlation with overall Ar-IdFAI outcomes for ankle instability. The analysis also showed that the dominant limb has no positive effect on ankle instability. The current study also aimed to explore the correlation between various risk factors (history of injury, re-injury, and the feeling of giving way) with the outcomes of the Ar-IdFAI questionnaire. Bivariate correlations showed strong associations between these risk factors and FAI outcomes. The analysis revealed a moderate to strong positive correlation between history of injury and Ar-IdFAI outcomes ($p < 0.001$). Moreover, a weak-to-strong positive correlation was observed between re-injury and Ar-IdFAI outcomes ($p < 0.001$). In contrast, the feeling of giving way showed a negative correlation with the Ar-IdFAI outcomes ($p < 0.001$), underscoring the importance of diminishing

Table 5: Coefficients of predictors associated with functional ankle instability among the total sample and different age teams.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% CI	
	B	SE	Beta			Lower Bound	Upper Bound
Total sample							
(Constant)	1.945	0.109	-	17.887	0.000	1.731	2.159
Injury	.127	.077	.123	1.655	.099	-.024	.279
Re-injury	.209	.088	.174	2.369	.019	.035	.382

the 'feeling of giving way' to reduce the incidence of FAI.

The Kruskal-Wallis test was performed to assess the age group most at risk of FAI, given the non-normal distribution (Table 3). Pairwise, post-hoc comparisons revealed statistically significant differences between the beginner and youth teams. Results indicated that youth players reported higher FAI scores than beginners ($p = 0.017$). In contrast, comparisons between beginners and first team ($p = 0.085$) and between youth and first team ($p = 0.513$) were not statistically significant.

Table 3: Comparison of functional ankle instability between player categories

Group Comparison	Kruskal-Wallis test	Z	Asymp. Sig. (2-tailed)	Significance
Beginner vs Youth	2169.50	-2.384	0.017	$p < 0.05$
Beginner vs First Team	2253.50	-1.721	0.085	NS
Youth vs First Team	2450.00	-0.654	0.513	NS

NS: Not significant

In a stratified age sample, the relationship was predicted using multiple linear regression models for injury history, re-injury, and "giving-way" feeling of ankle instability. Every attempt was made to isolate the influence of the main predictors by controlling for body metrics and training exposure. With $F(4, 213) = 36.219$ ($p < 0.001$) and adjusted $R^2 = 0.394$ (Table 4), regression modelling indicated an acceptable fit for the complete sample, suggesting that the predictors likely accounted for a significant proportion of outcomes related to ankle instability. Out of all the predictors, only re-injury positively impacted ankle instability to a statistically significant extent among youth ($p < 0.05$) (Table 5). Among youth aged 18 to 19 years, the regression indicated that reinjury was positively associated with FAI ($p < 0.05$).

Table 4: Model summary of predictors associated with ankle instability^a

R	R ²	Adjusted R ²	SE	Change Statistics				
				R ² Change	F Change	df1	df2	Sig. F Change
0.636 ^b	0.405	0.394	0.38983	0.405	36.219	4	213	0.000

^aDependent Variable: ankle instability.

^bPredictors: (Constant), Group, Injury, feeling of giving way, Re-injury.

SE, Standard error of the estimate

Feeling of giving way	-.518	.060	-.490	- 8.69	.000	-.636	-.401
Beginners team (16-17 years) n= 74							
(Constant)	5.503	2.100	-	2.620	.011	1.842	2.267
Injury	.041	.138	.040	.298	.767	1.922	2.366
Re-injury	.268	.192	.173	1.396	.168	1.525	2.173
Feeling of giving way	-.446	.125	-.423	-3.579	.001	-.545	-.432
Youth team/18-19 years n= 73							
(Constant)	-1.29	2.257	0.123	-.574	.568	-1.944	2.578
Injury	.281	.114	.275	2.456	.017	0.024	0.279
Re-injury	.008	.131	.007	.062	.951	0.026	0.252
Feeling of giving way	-.607	.094	-.575	-6.438	0.000	-0.565	-0.452
First team (≥ 20 years) n = 71							
(Constant)	4.343	1.638	0.114	2.652	.010	1.792	2.481
Injury	.031	.179	.030	.175	.862	.475	.453
Re-injury	.373	.178	.353	2.097	.040	0.044	0.267
Feeling of giving way	-.559	.101	-.543	-5.563	.000	-0.358	-0.434

^aDependent variable: ankle instability; SE, Standard Error; CI, Confidence Interval

DISCUSSION

This cross-sectional study evaluated the prevalence of functional ankle instability (FAI). It assessed the association between FAI and risk factors across age groups (competitive levels) of male football players in Madinah Province, Kingdom of Saudi Arabia. This study provides localized epidemiological data from Saudi Arabia, filling a gap in the literature on Middle Eastern football players and enabling tailored intervention measures. We found that the prevalence of FAI was 47.7% (n=104) among the total recruited sample and 36.5%, 56.2%, and 50.7% among beginners, youth, and the first team, respectively. A study by Scindia and colleagues (2018) [29] reported that the prevalence of FAI was 18.4% among the sample, with 29% observed among male collegiate football players. Because our players were professionals and involved more in physical training than collegiate football players, a study by Vladimir T. Gurau (2023) [30] also found that athletes were more likely to be exposed to injuries due to physical variations and competitive intensity, thereby increasing the risk of ankle injuries. Moreover, this study employed the IdFAI questionnaire, an established and reliable evaluation tool that improved precision and FAI detection, developed from the CAIT and AII tools [23, 24, 26]. Using this validated tool, the current study provides more accurate data on the prevalence of FAI in the Saudi football context, a topic that remains poorly documented in the literature. Another study, Patil R, 2025 [31], also reported 62.5% of FAI among Indian football players. A recent Indian study by Brahmande D Sachin, 2025 [32], also reported a high prevalence of 59.09% of ankle instability among football players.

Another study by Gülşah Ünver and colleagues (2023) [33] also reported a 46.3% prevalence of FAI in Turkish soccer players, in line with our rate, but did not use regression analysis to determine the association between variables. At the same time, this study differs from other prevalence studies by adding methodological robustness through regression analysis to identify risk factors associated

with FAI. Similarly, another study by Alberto Crus and colleagues (2017) [34] reported a prevalence of 41% for FAI among football players with a history of ankle injury, which is consistent with our findings. Another study by Simran D. Kotawala and colleagues (2018) [35] also reported a 61.6% prevalence of FAI among football players. Findings were compared with many studies from other nations (India, Turkey, and Portugal), providing contextual validation and establishing them within the global evidence base. Compared with other sports, the prevalence of FAI was 57.74% among basketball players, as reported by Mehta J (2015) [36]. This also underscores the problem of ankle instability in sports with heavy cutting, jumping, and rapid directional changes, as seen in football. Variability in reported prevalence results from direct comparisons being less conclusive due to variations in research methodologies and inclusion criteria across the studies. A systematic review by Chiao-I Lin (2021) [37] concluded that variability in reported prevalence rates of ankle instability may be attributed to differences in study settings, research methodologies, inclusion/exclusion criteria, and participants' characteristics across studies.

This study's result showed that 36.2% of players had a history of injury, 22.5% reported a history of re-injury, and 66.5% reported feelings of giving away. A study by Aamir and colleagues (2024) [17] reported 36.6% of ankle sprains in Saudi Arabia, which aligns with our frequency. A study by Alberto Crus and colleagues (2017) [34] reported that 49.2% of players had a history of injury, 58.6% had a history of re-injury, and 58.65% had a feeling of givingway, which is linked to the development of FAI and strengthens the pathophysiological basis for the progression to FAI. The parallel prevalence patterns indicate the sequelae of repetitive ankle sprains, especially in the high-demanding cohort. A meta-analysis by Cailbhe Doherty (2014) [1] reported that ankle sprains are the most common, with 1.94 per 1,000 exposures, compared with 0.72. A systematic study by Jessica Fulton and colleagues (2014) [38] reported that a high rate of initial ankle injury was linked to reinjury, poor rehabilitation, exhaustive training schedules, and a

competitive playing environment, thereby increasing the risk of reinjury. Moreover, the re-injury frequency of 22.5% reported in this investigation aligned well with a study reported by Delahunt E, 2019 [19], which highlighted that 26% of players with ankle injuries, especially those in jumping, cutting, and pivoting sports, suffer recurrent ankle sprains, establishing the external validity and consistency of the findings across many cohorts and contexts.

Similarly, this study reported an asymmetrical distribution of limb dominance, with right (66.5%) and left (33.55%). A study by Karen Friel (2006 [39]) reported that limb dominance is a contributing factor, most likely due to its influence on neuromuscular response times and load asymmetry. Furthermore, the mean training duration of 6.36 years and 2 hours of daily training (Table 1) implies sufficient exposure to repetitive joint stress, a precondition for cumulative microtrauma and proprioceptive deterioration leading to ankle sprains and thereby FAI as reported by Susanna Basciani and colleagues, 2024 [40], and exhibits a thorough approach to potential intrinsic and extrinsic risk factors. The literature is sparse on the prevalence of FAI across competitive levels, including beginners, youth, and first-team players. By analysing FAI at these levels, the study fills a gap in the literature and provides a preliminary analysis. This study demonstrated a gradient of FAI prevalence across age. There was also a significant difference between beginners and youth ($p = 0.017$), with youth showing the highest prevalence. Youth players experienced the most significant instability (56.2%), and the highest frequency of FAI in this group offers essential insights into age-specific vulnerabilities, especially during periods of rapid growth and elevated training demands.

The findings align with established theories suggesting that increased training loads without adequate neuromuscular adaptation elevate injury risk, especially in youth athletes, augmenting the risk of injuries leading to instabilities in an age group of 18-19 years, as reported by Delahunt E, 2019 [19], and aligning with the age group of our youth team. The lower occurrence among first-team players compared to the youth team is linked to improved neuromuscular control, proprioception, and adherence to return-to-play protocols, underscoring the preventive significance of structured injury-prevention techniques, as reported by Zacharias Flore and colleagues (2024) [41], thereby further lowering the risk of instability. Youth players, on the other hand, are more likely to have increased instability because of residual physical stress, competitive pressure, and incomplete recovery from prior injuries. This is consistent with the meta-analysis by Ryan Berkey and colleagues (2024) [42], which indicated that poorly controlled sprains increase the risk of future instability among youth, and aligns with our results. In contrast, the youth team had the highest FAI prevalence, following a prior ankle sprain prevalence of 36.2%, which is a key risk factor for FAI in this study's youth team. Furthermore, the delayed maturation in terms of symmetrical strength as well as proprioceptive control as reported by Friederike

E. Roch and colleagues, 2025 [43], along with the IdFAI responses seen in youth and the history of prior sprains, support the hypothesis that continuous sensorimotor deficits, in contrast to just isolated mechanical factors, are the primary cause of functional instabilities in the ankle region as reported by Yimeng Yang and colleagues, 2025 [27]. Lower rate of FAI (36.5%) was seen among beginners, and a significant difference was found compared to youth. Moreover, the regression model was not fit with any of the proposed risk factors among beginners, as depicted in Table 5. Coaching quality, access to medical care, and individual biomechanics were not thoroughly investigated, which may affect FAI occurrence across groups.

This study found no significant correlation between FAI and age among all three age categories/teams of football players ($p \geq 0.05$). Research by Kyle B. Kosik (2017) [44] found no direct, significant correlation between age and the presence of FAI across different adult age groups. Also, there was no correlation between FAI and anthropometric factors across all age categories/teams (such as height & weight) ($p > 0.01$), and the same result ($p > 0.94$, $p > 0.72$) was also reported by Alberto Crus and colleagues, 2017 [34]. Also, there was no correlation between FAI and play-related variables such as years of training, training hours per week, and dominant limb across all teams, in line with the previous study [34]. According to Hanz Tao and colleagues (2020) [45], limb dominance does not appear to be a reliable indicator of FAI and is consistent with our result. It is difficult to draw broad conclusions because different players have distinct technical gestures, movements, and situations. Therefore, more research is needed to determine whether these variables are risk factors to consider, especially in contact sports like football, and whether they are linked to ankle instability.

There was a moderate to strong positive correlation between FAI and three injury-related risk factors: 0.409, 0.311, & 0.687 ($p < 0.001$), such as history of injury, re-injury & feeling of giving way, respectively, and in agreement with the previous study results, 0.504, 0.657 & 0.741 by Alberto Crus and colleagues, 2017 [34], and another recent study by Ünver and colleagues, 2023 [33], also show moderate correlation that strengthens the external validity. Still, none of the previous studies employed regression models to assess risk factors for FAI [33, 35, 46]. The use of a multiple regression model in this study enhances analytical depth by enabling the combined evaluation of multiple risk factors and their distinct contributions to FAI across three age categories/teams of football players in the Madina province of the Kingdom of Saudi Arabia, thereby reinforcing the reliability of the findings. This strengthens the study's methodological rigor and distinguishes it from earlier research. Moreover, the study provides localized insights that are important for regional sports medicine and injury-prevention strategies.

The regression analysis showed a good model fit. It indicated that re-injury was independent and significantly associated with FAI ($p = 0.019$) after controlling for other risk variables in the total sample, as shown in Table 5. Hertel

J (2019) [7] has explained their instability model, which also offers additional insight into how recurring sprains and ligament laxity drive the gradual development of ankle instability. Another study by Delahunt E, 2019 [19], also reported that an initial ankle sprain leads to a recurrence of ankle sprains and, thereby, FAI. The regression analysis showed poor model fit among beginners aged 16-17 years, and none of the risk factors were associated with FAI. Self-reported injury history or understanding of the feeling of “giving way” could have obscured the true association, given their early exposure to football games and limited practice experience.

Future research using prospective cohort studies to analyze confounding risk variables is suggested. Our age-stratified regression analysis was a good model fit among the youth team and resulted in the injury being independent and significantly associated with FAI ($p=0.017$) after controlling for other risk variables, as shown in table 5 among the 18–19-year-old youth team and had the most replicable set of key factors (adjusted $R^2 = 0.39$) as shown in table 4. A previous study by Cailbhe Doherty and colleagues (2016) [47] reported that 40% of participants who sustained a first ankle sprain developed ankle instability within 1 year, with a strong association. A systematic review by Chiao-I Lin (2021) [37] reported ankle instability among participants with initial ankle injury, in agreement with our youth team. Hence, prevention strategies should be implemented to reduce the risk of ankle sprain; therefore, recurrence of sprain and ankle instability should be targeted at 16-17 years of age before attaining youth age 18-19 years. Regression analysis also showed a good model fit among the first team and indicated that re-injury was independent and significantly associated with FAI ($p = 0.040$), as shown in Table 5. Mackenzie M. Herzog and colleagues (2019) [48] have clearly explained the vicious cycle in which an initial ankle sprain leads to recurrent sprains and, in turn, ankle instability. To reduce recurrence and ankle instability and improve performance, the results highlight the need for early screening and planned rehabilitation programs that emphasize balance, proprioception, and neuromuscular control, especially among youth and first-team players in clubs in the Madina province of the Kingdom of Saudi Arabia. Future research should adopt longitudinal designs, including objective functional assessments and physiotherapy interventions, to ascertain the true scope of FAI among football players.

Limitations

The current study poses its own limitations. Notably, its cross-sectional design limits the ability to determine whether risk factors, such as prior injuries, primarily cause FAI. The use of self-reported injury history may also lead to recall bias, contributing to data discrepancies. The population, comprising only male football players from the single Madinah province, further restricts the generalizability of the findings to female players and other geographical regions. Additionally, the lack of objective biomechanical assessment feasibility at clubs, as well as potential residual confounding variables, warrants cautious

interpretation of the results. Furthermore, these are our preliminary results analysis reported to test the hypothesis. Altogether, these findings must be supplemented with longitudinal data and diverse, objective-oriented samples to propose actionable steps for effective prevention of announced injuries.

CONCLUSION

The present study revealed a 47.7% prevalence of FAI among male football players in the Madinah Province of the Kingdom of Saudi Arabia, particularly among youth (18-19) players (56.2%), with ankle injury as the key risk factor and reinjury among first-team players. This study emphasizes the importance of integrating systematized rehabilitation and screening instruments, such as Ar-IdFAI, to minimize the burden of FAI and prevent and treat it, thereby enhancing the sports performance of football players in Madinah province, Saudi Arabia.

ABBREVIATION

KSA - Kingdom of Saudi Arabia
FAI - Functional Ankle Instability
IdFAI - Identification of Functional Ankle Instability
ATFL - Anterior Talofibular Ligament
BMI - Body Mass Index
CAIT - Cumberland Ankle Instability Tool
AII - Ankle Instability Instrument
SPSS - Statistical Package for the Social Sciences
IBM - International Business Machines
MUREC - Majmaah University research ethics committee
IQR - Interval Quartile Range
cm - Centimeters
Kg - Kilograms
NS - Not-significant

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