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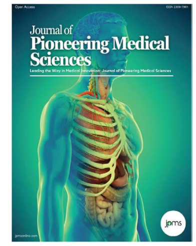

Prevalence of Generalized Joint Hypermobility among University Recreational Football Players in Saudi Arabia: A Cross-Sectional Study

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Abstract **Background:** Generalized Joint Hypermobility (GJH) is described as excessive range of motion in multiple synovial joints of human body beyond normal physiological range. Usually it is asymptomatic, GJH has been associated with modified biomechanics, neuromuscular deficits and increased risk of ligamentous and overuse injuries in athletic populations. Limited data exist regarding its prevalence among recreational football players in Saudi Arabian populations. **Objective:** To find out the prevalence of generalized joint hypermobility among university recreational football players in Saudi Arabia. **Methods:** A cross-sectional prevalence study was conducted between January and March 2024 at the Majmaah University International Rehabilitation Centre, Saudi Arabia. All registered male recreational football players aged 18–29 years (N = 284) were screened using the standardized 9-point Beighton scoring system. A cut-off score ≥4/9 defined GJH. Prevalence and exact (Clopper–Pearson) 95% confidence intervals were calculated. **Results:** Among 284 screened players, thirty-two met criteria for GJH, there is a prevalence of 11.26% (95% CI: 7.8%–15.5%). The mean Beighton score for the entire cohort was 1.9±1.4, whereas hypermobile players (score ≥4/9) demonstrated a mean score of 4.8±0.9. **Conclusion:** Approximately one in nine recreational university football players demonstrated generalized joint hypermobility, a rate that is similar to previously reported prevalences in recreational and sub-elite football cohorts and slightly higher than some non-athletic university populations. These findings support the implementation of routine hypermobility screening in university athletic programs.

Key Words Generalized Joint Hypermobility, Beighton Score, Football Players, Prevalence, Saudi Arabia, University Athletes

INTRODUCTION

Generalized Joint Hypermobility (GJH) is a common, heritable connective tissue trait defined by an increased range of motion across multiple synovial joints that surpasses the normal physiological limits [1]. This phenomenon primarily stems from alterations in the structure and composition of collagen fibers, including reduced fibril diameter, impaired cross-linking and increased elastin content within ligaments and joint capsules [2]. These microstructural changes lead to diminished passive joint stiffness and enhanced ligamentous compliance, which can manifest as increased joint excursion during both static and dynamic activities. Clinically, GJH is most frequently assessed using the Beighton scoring system-a validated, 9-point ordinal scale that evaluates bilateral passive joint laxity at the fifth metacarpophalangeal joint, thumbs, elbows, knees and forward trunk flexion with palms to the floor [1,3]. The Beighton score has demonstrated high inter-rater reliability (intraclass correlation coefficients typically exceeding 0.85) and is the gold standard for population-based epidemiological studies of hypermobility [3,4].

The prevalence of GJH in the general adult population is estimated to range from 5% to 35%, with substantial heterogeneity attributable to demographic and methodological factors [3,5]. Age exerts a profound influence, as connective tissue elasticity is highest in childhood and adolescence, declining progressively with advancing age due to cumulative collagen maturation and reduced tissue compliance [5]. Sex differences are well-established, with females consistently exhibiting higher rates, often 1.5–2 times those of males, owing to estrogen-mediated effects on collagen metabolism and ligamentous remodeling during the menstrual cycle [6]. Ethnic variations further modulate prevalence, with higher rates documented in populations of African, Middle Eastern and South Asian descent compared to Caucasian cohorts [3,7]. For instance, studies in Middle Eastern children have reported GJH prevalences of 15.2–25.6% using a Beighton cut-off of ≥4/9, significantly exceeding rates in Western pediatric populations [8,9].

In athletic populations, GJH assumes particular clinical importance. While enhanced joint mobility may confer performance advantages in flexibility-dependent sports like gymnastics and swimming, it frequently coexists with neuromuscular impairments, including diminished proprioception, delayed muscle activation patterns and altered joint kinematics [10,11,12]. These deficits can disrupt load distribution across articular surfaces, increasing susceptibility to ligamentous injuries, recurrent sprains, patellofemoral pain and early osteoarthritis [11,13,14]. Football, a sport characterized by high-intensity intermittent efforts, rapid directional changes and repetitive high-impact loading on the lower extremities, exemplifies this risk profile. Dynamic tasks such as sprinting, cutting and landing impose substantial valgus and rotational stresses on the knee and ankle, where passive ligamentous restraints are critical for joint stability [12,15]. In individuals with GJH, compensatory reliance on active muscular stabilization is heightened, particularly during periods of fatigue, potentially elevating injury risk [11,12].

International data on GJH in football players reveal prevalence estimates ranging from 7% to 33%, depending on competitive level, sex and diagnostic thresholds [13,16,17]. In elite male cohorts, Konopinski *et al.* [17] reported a 33.3% prevalence (Beighton ≥4/9) among English Premier League players, associating hypermobility with a 15.65 injuries/1000 hours higher incidence compared to non-hypermobile peers. Conversely, multi-site studies in English Championship players documented lower rates (8.8%), while collegiate and recreational cohorts have shown intermediate figures (9–17%) [16,18]. Female elite soccer players exhibit even higher rates, with one prospective study reporting 17.5% GJH prevalence [19].

Despite the global popularity of football, region-specific epidemiological data from the Middle East-and Saudi Arabia in particular-remain limited. Recreational football is deeply embedded in Saudi university culture, with participation rates exceeding 70% among male students and serving as a primary avenue for physical activity and social engagement. Prior Saudi studies have predominantly focused on pediatric populations, revealing elevated GJH rates (i.e. 25.6% in primary school children in Al-Madinah and 15.2% in Majmaah school-aged boys) [8,9]. These findings suggest potential ethnic predispositions linked to genetic variations in collagen genes prevalent in Arab populations. However, no published studies have systematically evaluated GJH in young adult male recreational football players in Saudi Arabia, representing a critical knowledge gap. Understanding prevalence in this demographic is essential for developing contextually appropriate injury prevention strategies, pre-participation screening protocols and targeted neuromuscular interventions.

The present cross-sectional study therefore aimed to determine the prevalence of GJH, as defined by a Beighton score ≥4/9, among university recreational football players in Saudi Arabia. By screening an entire eligible population at Majmaah University, the investigation sought to provide precise, population-based estimates to inform university sports medicine practices and contribute to the growing body of evidence on hypermobility in athletic Middle Eastern cohorts. Majmaah University was selected as the study setting because it hosts one of the largest Rehabilitation center of Saudi Arabia, with centralized registration of all participating players. Screening this complete, well-defined cohort allowed us to obtain population-based prevalence estimates and to collect the data directly applicable to university sports medicine services in the region.

METHODS

Study Design

This investigation employed a descriptive cross-sectional prevalence design, conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Study Setting

Assessments were performed at the Majmaah University International Rehabilitation Centre, Majmaah, Saudi Arabia, from January to March 2024.

Participants

A complete roster of 284 registered male recreational football players aged 18-29 years was obtained from the university sports administration. All eligible individuals were invited to participate through institutional email notifications and in-person announcements during scheduled training sessions.

Inclusion Criteria

- Male university students aged 18–29 years
- Regular participation in recreational football (≥1 session per week) for a minimum of two months
- Provision of written informed consent

Exclusion Criteria

- Current spinal or lower extremity musculoskeletal injury
- History of lower limb surgery within the preceding 12 months
- Diagnosed connective tissue disorder (e.g., Ehlers–Danlos syndrome)
- Clinically significant limb length discrepancy (>1 cm)
- Inability to complete the physical examination due to pain or other limitations. Screening for eligibility and exclusion criteria was done in 2 stages by the Physical therapists. First, all players completed a standardized health questionnaire covering musculoskeletal injuries,

prior surgeries and systemic conditions. Second, physiotherapists followed a brief clinical interview and physical examination to confirm reported information and identify any current spinal or lower extremity injuries that might preclude testing and those with unresolved safety concerns were excluded

Sample Size Consideration

A minimum sample size of 150 was calculated to estimate prevalence with 95% confidence and a margin of error of ±5%, assuming an anticipated prevalence of 12% based on prior athletic cohorts. Given the finite eligible population of 284, the entire cohort was screened to enhance precision and eliminate selection bias.

Outcome Measure

Beighton Score GJH was assessed using the standardized 9-point Beighton scoring system, performed bilaterally where applicable:

- Passive dorsiflexion of the fifth metacarpophalangeal joint to ≥90° (2 points)
- Passive opposition of the thumb to the volar aspect of the forearm (2 points)
- Hyperextension of the elbow ≥10° (2 points)
- Hyperextension of the knee ≥10° (2 points)
- Forward trunk flexion with palms flat on the floor without knee flexion (1 point)

A score of ≥4/9 was defined as indicative of GJH, consistent with contemporary adult male population studies. All assessments were conducted by two experienced physiotherapists (with >10 years of clinical practice) who underwent standardized training in goniometric techniques and Beighton scoring. Inter-rater reliability was evaluated on a subsample of 30 participants, yielding an Intraclass Correlation Coefficient (ICC) of 0.92 (95% CI: 0.84–0.96), indicating excellent agreement. Participants were instructed to refrain from vigorous physical activity for at least two hours before testing and all evaluations were conducted prior to any team training session on that day.

Ethical Considerations

The study protocol was approved by the Majmaah University Institutional Review Board. All participants provided written informed consent after receiving a detailed explanation of study procedures, risks and benefits. Data were anonymized and stored securely in compliance with institutional data protection policies.

Statistical Analysis

Prevalence was calculated as the proportion of participants with Beighton scores ≥4/9. Exact 95% confidence intervals were derived using the Clopper–Pearson method for binomial proportions. Descriptive statistics included means±standard deviations for continuous variables and frequencies (percentages) for categorical data. All analyses were performed using IBM SPSS Statistics version 28.0 (IBM Corp., Armonk, NY, USA) and R version 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Participant Flow and Characteristics

A total of 284 male recreational football players met the eligibility criteria and were successfully screened, representing 100% of the registered cohort. No participants were excluded due to current injury, surgical history, or other contraindications and all assessments were completed without adverse events. The cohort was homogeneous with respect to age, body composition and training exposure (Table 1 and Figure 1). Mean age was 21.8±2.4 years, with a Body Mass Index (BMI) of 23.5±3.1 kg/m². Participants engaged in an average of 2.8±0.9 football sessions per week, each lasting approximately 90 minutes.

Table 1: Demographic and Anthropometric Characteristics of Participants

Variable	Total (N = 284)
Age (years), mean±SD	21.8±2.4
Height (cm), mean±SD	172.4±6.8
Weight (kg), mean±SD	69.8±10.2
BMI (kg/m²), mean±SD	23.5±3.1

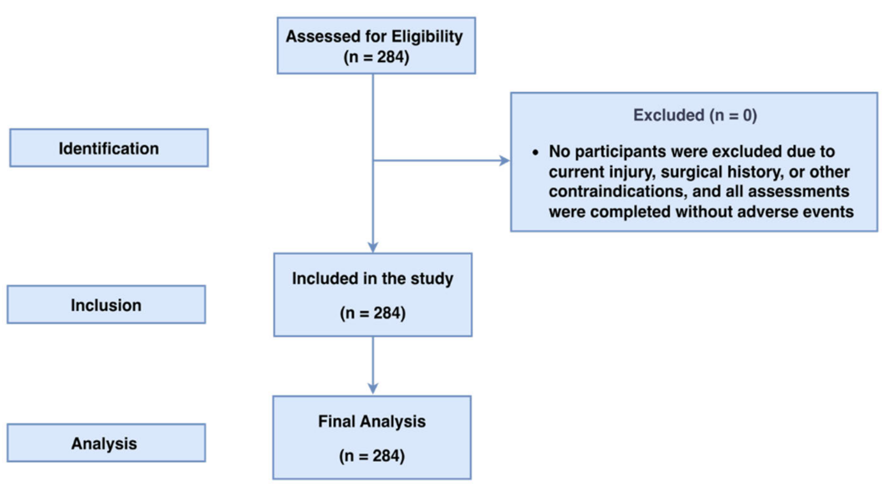

Figure 1: Strobe Flow Chart

Table 2: Distribution of Beighton Scores in the Study Cohort

Beighton Score	Frequency (n)	Percentage
0	68	23.9
1	92	32.4
2	61	21.5
3	31	10.9
4	18	6.3
5	9	3.2
6	4	1.4
7	1	0.4
≥4 (GJH)	32	11.3

Prevalence of Generalized Joint Hypermobility

Thirty-two participants (11.26%) achieved a Beighton score of ≥4/9, confirming GJH. The exact Clopper–Pearson 95% confidence interval was 7.8%–15.5%. The distribution of Beighton scores across the cohort is detailed in Table 2. Scores ranged from 0 to 7, with a right-skewed distribution reflecting the predominance of low laxity in the majority of participants. Among those with GJH, the most frequently positive items were bilateral knee hyperextension (81.3%) and thumb opposition (75.0%), followed by fifth metacarpophalangeal dorsiflexion (68.8%).

DISCUSSION

This cross-sectional study is the first to report the prevalence of GJH among university recreational football players in Saudi Arabia, identifying a rate of 11.26% (95% CI: 7.8%–15.5%) using a standardized Beighton cut-off of ≥4/9. This estimate aligns closely with international data from male football cohorts, where prevalence typically ranges from 7% to 13% in recreational and sub-elite settings [13,16,18]. For comparison, a multi-site cohort of English Championship players reported 8.8% GJH prevalence, while preliminary data from university athletes in the United States documented rates of 9–14% in soccer-specific subgroups [16,20]. Higher figures, such as the 33.3% observed in an English Premier League squad, likely reflect selection biases favoring hypermobile athletes in elite environments or differences in training volume and competitive demands [17].

The observed prevalence in the present Saudi cohort is consistent with expectations for a young adult, Middle Eastern male population. Regional pediatric studies have documented elevated GJH rates (15.2–25.6%), attributable to genetic factors influencing collagen composition in Arab populations [8,9]. The lower rate in our university-aged sample, compared to Saudi children, mirrors the well-described age-related decline in joint laxity, as connective tissue stiffens with maturation.[5] Notably, the 11.26% figure exceeds some Western athletic cohorts i.e., 9.6% in NCAA football players, but remains within the broader spectrum reported for contact sports athletes [4,21].

From a biomechanical perspective, GJH may predispose football players to injury through several mechanisms. Hypermobile individuals often exhibit increased anterior tibial translation and knee valgus moments during landing and cutting tasks, elevating Anterior Cruciate Ligament (ACL) strain [15,22]. Prospective studies have linked GJH to higher injury incidence in professional soccer (15.65 additional injuries/1000 hours), though conflicting evidence exists in elite female cohorts where no association was found [11,17]. The current study did not collect injury data, precluding direct correlation analyses; however, the prevalence suggests that approximately one in nine recreational players may benefit from targeted screening and intervention.

Clinically, these findings have several implications for university sports programs in Saudi Arabia. Routine incorporation of Beighton scoring into pre-participation physical examinations could identify at-risk athletes for individualized neuromuscular training. Programs emphasizing proprioceptive exercises, core stabilization and eccentric strengthening have shown promise in reducing injury rates among hypermobile athletes [11,23,24]. Given the high participation rates in recreational football, such screening could yield substantial public health benefits by mitigating musculoskeletal morbidity among young Saudi males.

Strengths and Limitations

Key strengths include the complete enumeration of an entire eligible population (N = 284), minimizing selection bias; standardized, reliable Beighton assessments by trained physiotherapists; and the use of exact confidence intervals for precise prevalence estimation. The single-center, male-only design, however, limits generalizability to female or multi-institutional cohorts. The cross-sectional nature precludes causal inferences regarding GJH and injury risk and the absence of injury surveillance data represents a notable limitation. Future multi-center, longitudinal studies incorporating both sexes and prospective injury tracking are warranted to elucidate the clinical trajectory of GJH in this population.

CONCLUSION

The prevalence of GJH among Saudi university recreational football players was 11.26%, supporting the integration of hypermobility screening into university athletic health frameworks. These data contribute valuable region-specific insights and underscore the need for tailored injury prevention strategies in Middle Eastern athletic populations.

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