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Prevalence and Pattern of Physical Activity-Related Injuries in Saudi Adolescents: A Cross-Sectional Study

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Abstract

Background: Physical activity (PA) plays a crucial role in adolescent health but carries inherent risks of injury. Data on PA-related injuries among Saudi adolescents are limited. **Objective:** The study examines the prevalence, severity, and risk factors of PA-related injuries among Saudi youth aged 12–18 years in sports club activity, leisure time physical activity, and school physical activity. **Methods:** A cross-sectional observational study involving 402 Saudi youth employed a web-based survey sent through social media. Cluster sampling aimed at youths with musculoskeletal injury from organized sport, leisure, or school. Exclusion was made among participants with musculoskeletal or neurological conditions. Demographic and injury characteristics were computed using SPSS software with descriptive statistics, chi-square tests, and logistic regression for association evaluation between injury prevalence and risk factors. **Results:** A study of 402 participants found that 87.3% were male, with 37.8% and 35.3% in the west and south regions. The majority were aged 12-14, with 48% normal BMI. 54.2% had a history of sports participation, with 40.0% playing weekly and 34.1% twice per week. The injury incidence of PA was 37%, with no significant correlation between age, gender, BMI, location, or sport type. Previous instruction reduced injury rates. **Conclusion:** PA-related injury is common among Saudi adolescents without heterogeneity by age, gender, BMI, location, or type of sport. Pre-exercise instruction markedly decreases risk, highlighting the need for targeted prevention programs for adolescent health.

Keywords: Physical Activity, Injury, Saudi Adolescents, Prevalence, Sport, Leisure Time

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Introduction

Physical activity (PA) is the cornerstone of adolescent health with positive effects on musculoskeletal growth, cardiovascular health, and chronic disease prevention through obesity and diabetes (1-3). Physical fitness, e.g., VO2 max, is enhanced by a regular PA, and mental well-being as well as quality of life are improved (4-6). However, school sport, recreation, and PA are inherently at risk for musculoskeletal injury, particularly in adolescents (7,8). Adolescents are more susceptible to injury compared to adults because they possess immature reflexes, limited motor coordination, and impaired ability to assess environmental hazards (2). These injuries are a major cause of PA cessation among children and adolescents based on the prevalence of injury and fear of re-injury (9,10). These interruptions may lead to pain, inactivity, and

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school absence with potential long-term consequences like chronic pain or reduced mobility (11).

In Saudi Arabia, PA levels for adolescents are typically low due to environmental and cultural factors (12), and awareness of the prevalence and profile of PA injury is needed to promote safe participation. Ankle injuries among Saudi schoolchildren have been reported at high rates in other research, such as Almalki et al. (13), but comprehensive data on injuries by different PA settings are scarce. This difference brings to the fore the need for locally applicable research to offer evidence-based injury prevention interventions appropriate to Saudi adolescents.

This study will address this gap by investigating the prevalence, characteristics, and risk factors of PA-related injury among Saudi adolescents aged 12–18 years in three settings: organized sport club activity, leisure-time PA, and school-based PA. By identifying injury patterns and correlates, the study aims to contribute to the development of purposeful interventions to enhance adolescent health and well-being.

Objectives

1. To determine the prevalence of PA-related injury in sports club activity, PA during leisure time, and PA at school among Saudi adolescents aged 12-18 years.
2. To examine differences in the type of injury across environments.
3. To examine the association between the prevalence of injury and risk factors, including age, gender, body mass index (BMI), geographic location, and type of sport.

Methods

Study Design

A cross-sectional observational study was conducted to assess the prevalence, nature, and risk factors of PA-related injury among Saudi adolescents aged 12–18. A cross-sectional design enabled data on injury within a specified time frame, gaining an estimate of the distribution of injuries across different PA environments.

Participants

402 adolescents with previous or current musculoskeletal injuries that occurred during organized sport, leisure-time physical activity, or school-based PA. Recruitment was carried out using a cluster sampling method to provide practical and representative recruitment within Saudi Arabia. The sample size was estimated on a 95% confidence level, 5% margin of error, and significance level of 0.05 to provide statistical power that was robust. Exclusion criteria were teenagers with a history of musculoskeletal or neurological disorders, steroid abusers, or high risk of injury, to eliminate confounding variables unrelated to PA.

Data Collection

Data were collected through an online survey conducted over social media during October-December 2023. The Google Forms survey kept participants anonymous, and response was treated as informed consent. Ethical approval was provided by the Majmaah University Research Ethics Committee (MUREC-Aug,l4/COM-2023/25-z). Parental consent and participants' assent were provided for all participants. The survey contained two parts:

1. Demographic Data: Age (in ranges 12–14, 14–16, 16–18), gender, geographic location (central, north, west, east, south), weight, height, and derived BMI (underweight, normal, overweight, obese).
2. Injury Characteristics: Prevalence, frequency, severity, and type of injuries sustained in sport club activities, leisure-time PA, and school-based PA. Additional questions assessed prior participation in sports, frequency of PA participation, formal instruction received, and capacity to perform PA safely.

Statistical Analysis

Analyses were done on data with SPSS software version 25. Descriptive statistics (percentages, frequency, means, standard deviations) characterized participant details and the prevalence of injury. Chi-square and Fisher's exact tests were utilized to test differences in categorical variables, e.g., kinds of injury in situations. Multivariate logistic regression tested the association between prevalence of injury and risk factors (age, gender, BMI, place, sport type, prior instruction), with odds ratios (OR) and 95% confidence intervals (CI). Statistical significance was taken to be $p<0.05$. Cronbach's alpha and item-total statistics were utilized to determine the reliability and validity of the survey tool, with post-revision Cronbach's alpha being 0.733, indicating acceptable reliability.

Results

Participant Characteristics

402 adolescents took part in the research, with a gender distribution of 87.3% male (n=351) and 12.7% female (n=51). Geographically, 37.8% (n=152) lived in the western sector, 35.3% (n=142) lived in the southern sector, 17.2% (n=69) lived in the central sector, 7.2% (n=29) lived in the northern sector, and 2.2% (n=9) lived in the eastern sector (Table 1). Age distribution was 43.8% (n=176) aged 12–14, 17.2% (n=69) aged 14–16, and 39.1% (n=157) aged 16–18 (Figure 1). BMI categorization presented 48% (n=193) with normal weight, 26.4% (n=106) underweight, 17.2% (n=69) overweight, and 8.5% (n=34) obese. Previous sports participation was reported by 54.2% (n=218), with 40.0% (n=161) engaging in PA weekly and 34.1% (n=137) twice a week.

Injury Prevalence

Overall prevalence of PA-related injury was 37% (n=149). In the sports club, 62.9% (n=253) were not injured, with 26.1% (n=105) injured once, 9.2% (n=37) twice, and 1.7% (n=7) three or more times. In leisure-time PA, 72.6% (n=292) had no injuries, 19.4% (n=78) once, and 6.4% (n=26) three or more times. In school-based PA, 73.6% (n=296) had no injuries (Table 2 and Figure 2). The most common injuries were foot injuries in 48.9% of sports training and 36.7% of leisure-time cases, followed by arm injuries (24.4% vs. 30.6%) and ankle injuries (17.8% vs. 24.5%). The settings differed significantly in the injuries ($p<0.001$) (Table 3 and Figure 3).

Risk Factors

There were no meaningful correlations between prevalence of injury and age ($p=0.96$), gender ($p=0.74$), BMI ($p=0.87$), location ($p=0.77$), or type of sport ($p=0.41$). Specifically

- Age: Injuries were suffered in 36.4% (n=64) of the 12–14-year-olds, 37.7% (n=26) of the 14–16-year-olds, and 37.6% (n=59) of the 16–18-year-olds.
- Gender: Injuries were suffered in 36.8% (n=129) of males and 39.2% (n=20) of females.
- BMI: Injuries occurred in 36.8% (n=39) of underweight, 36.8% (n=71) of normal weight, 40.6% (n=28) of overweight, and 32.4% (n=11) of obese participants.
- Location: The prevalence of injury varied from 35.2% (south) to 55.6% (east).
- Type of Sport: 37.9% (n=116) of football players, 18.2% (n=4) of kickboxers, 37.7% (n=20) of volleyball players, 44.4% (n=4) of tennis players, and 41.7% (n=5) of others had injuries.

Having been instructed previously reduced the prevalence of injury significantly ($p=0.001$; OR=0.58, 95% CI: 0.42–0.80), with 28.6% (n=34) of uninstructed versus 8.5% (n=24) of instructed participants sustaining an injury. Multivariate logistic regression found prior instruction to be the only independent predictor of reduced risk of injury ($B=-0.54$, $p<0.05$).

Table 1. Participant Demographic Characteristics

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	351	87.3
	Female	51	12.7
Location	Western	152	37.8
	Southern	142	35.3
	Central	69	17.2
	Northern	29	7.2
	Eastern	9	2.2
Age Group	12–14	176	43.8
	14–16	69	17.2
	16–18	157	39.1
BMI	Underweight	106	26.4
	Normal	193	48.0
	Overweight	69	17.2
	Obese	34	8.5
Prior Sports Participation	Yes	218	54.2
	No	184	45.8
PA Frequency	Once weekly or less	161	40.0
	2–3 times weekly	137	34.1
	4–5 times weekly	73	18.2
	6–7 times weekly	31	7.7

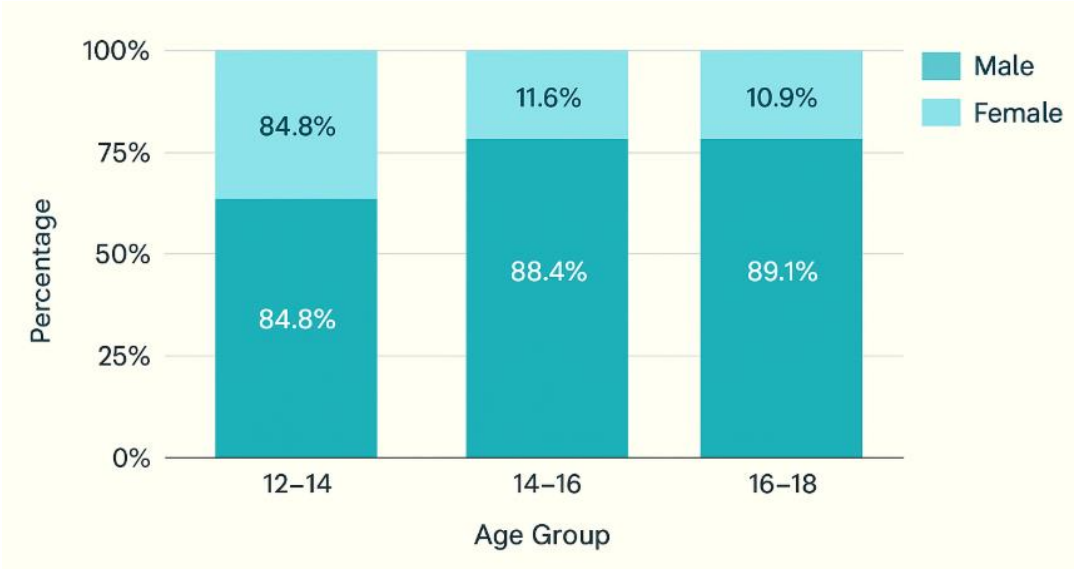

Figure 1. Distribution of Participants by Gender and Age Group.

Table 2. Prevalence of PA-Related Injuries by Setting.

Setting	**No Injury (n, %)**	**Once (n, %)**	**Twice (n, %)**	**Three or More (n, %)**
Sports Club Activities	253 (62.9%)	105 (26.1%)	37 (9.2%)	7 (1.7%)
Leisure-Time PA	292 (72.6%)	78 (19.4%)	6 (1.5%)	26 (6.4%)
School-Based PA	296 (73.6%)	-	-	-

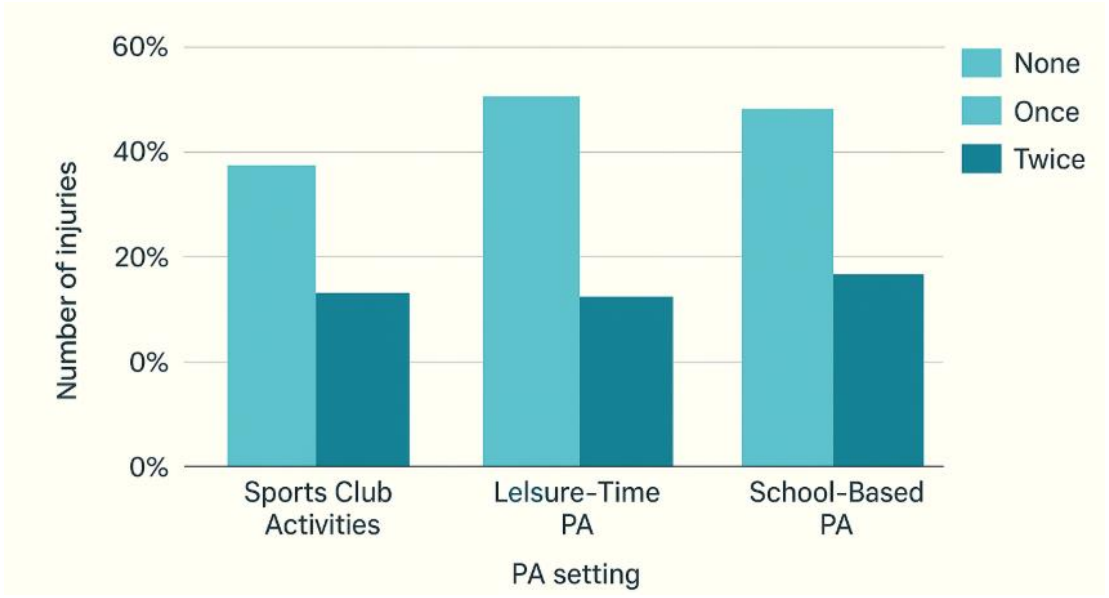

Figure 2. Prevalence of Injuries Across PA Settings

Table 3. Types of Injuries by PA Setting

Injury Type	Sports Training (n, %)	Leisure-Time PA (n, %)	p-value
Foot	73 (48.9%)	55 (36.7%)	<0.001
Arm	36 (24.4%)	46 (30.6%)	<0.001
Ankle	27 (17.8%)	37 (24.5%)	<0.001
Hand	27 (17.8%)	34 (22.4%)	<0.001
Back	17 (11.1%)	3 (2.0%)	<0.001
Knee	3 (2.2%)	3 (2.0%)	<0.01
Pelvis	10 (6.7%)	6 (4.1%)	<0.01
Neck	3 (2.2%)	0 (0.0%)	<0.05
Shoulder	0 (0.0%)	0 (0.0%)	-

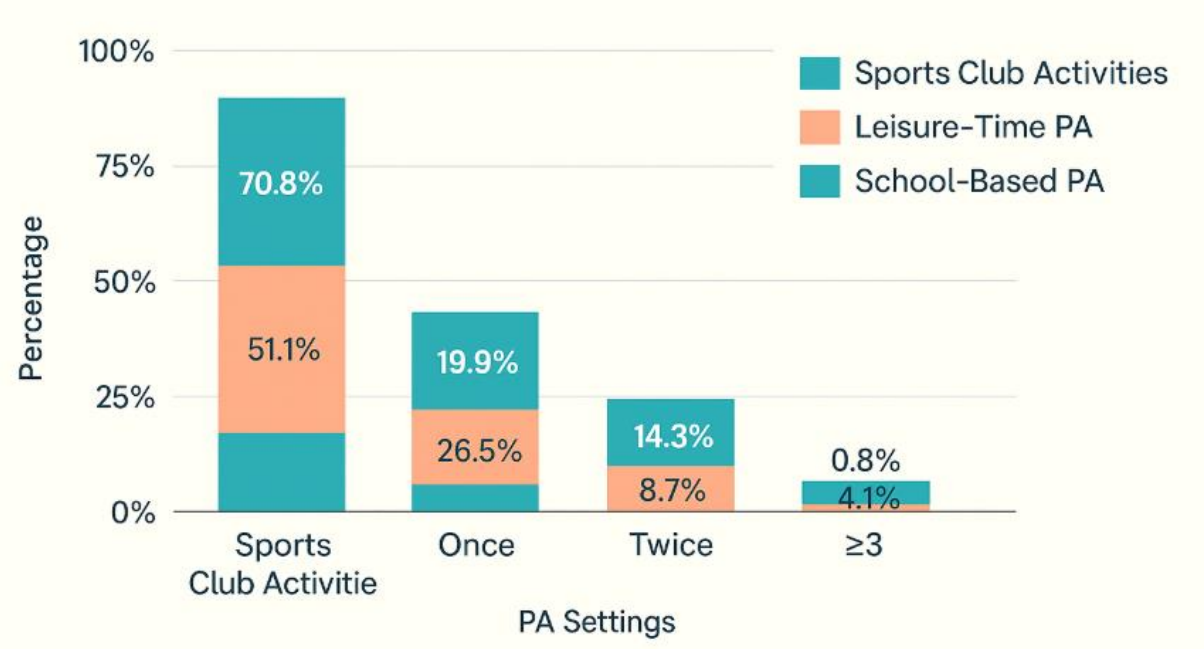

Figure 3. Distribution of Injury Types Across PA Settings.

Table 4. Association Between Risk Factors and Injury Prevalence

Risk Factor	Category	Injury Prevalence (n, %)	p-value
Age	12–14	64 (36.4%)	0.96
	14–16	26 (37.7%)	
	16–18	59 (37.6%)	
Gender	Male	129 (36.8%)	0.74
	Female	20 (39.2%)	
BMI	Underweight	39 (36.8%)	0.87
	Normal	71 (36.8%)	
	Overweight	28 (40.6%)	
	Obese	11 (32.4%)	
Location	East	5 (55.6%)	0.77
	Central	26 (37.1%)	
	North	12 (41.4%)	
	South	50 (35.2%)	
	West	56 (36.8%)	
Sport Type	Football	116 (37.9%)	0.41
	Kickboxing	4 (18.2%)	
	Volleyball	20 (37.7%)	
	Tennis	4 (44.4%)	
	Other	5 (41.7%)	
Prior Instruction	No	34 (28.6%)	0.001
	Yes	24 (8.5%)	

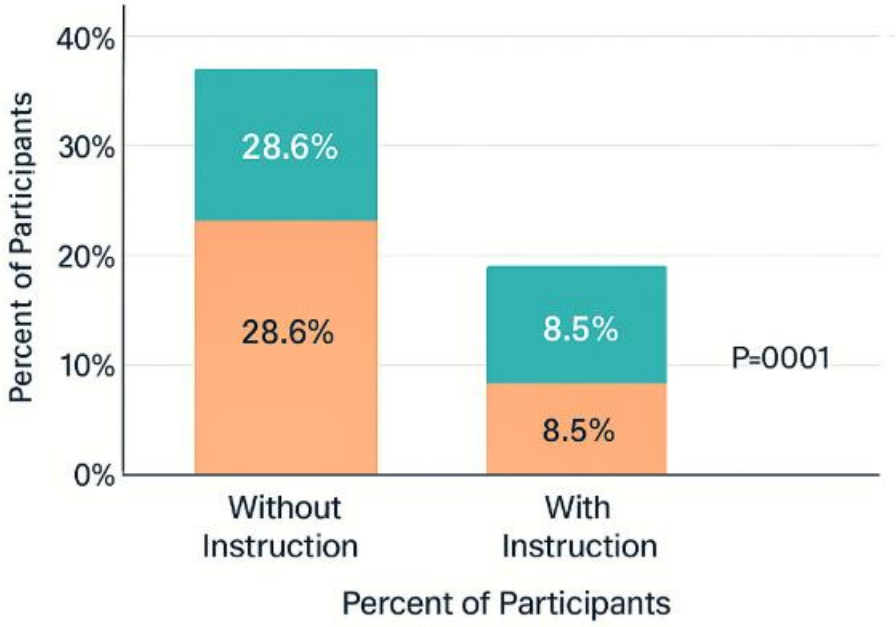

Figure 4. Injury Prevalence by Prior Instruction

Discussion

This study shows a 37% prevalence of physical activity-related injury among Saudi youth between the ages of 12 and 18, which is in line with global trends but much lower than some within-region studies. Almalki et al. (13) showed a 34.7% prevalence of only ankle injuries among male high school students at Riyadh high school, which may represent differences between localized higher rates for different types of injury. The general emphasis of the current study across different settings (school-based PA, leisure-time PA, and sports clubs) and body regions might provide a more even picture and may mask the prevalence of specific injuries like ankle sprains. This prevalence shows the high burden of PA-related injury among Saudi adolescents, which is consistent with global patterns whereby adolescents experience higher risks for injury when they are compared to adults by virtue of developmental challenges such as immature reflexes, lack of motor coordination, and impaired hazard appraisal (14,15).

That there are no major correlations among prevalence of injury and demographic factors—age (p=0.96), gender (p=0.74), BMI (p=0.87), and geography (p=0.77)—varies from that documented in previous research. For example, Cai et al. (16) indicated gender-specific risk factors in Chinese students attending universities, in which males had a higher rate of injury during intense PA and females during moderate leisure activities. This variation may be an indication of cultural or context-specific differences, e.g., the demographic structure of male study participants (87.3%), which may have limited the statistical power to detect differences between the genders. In addition, the homogeneous risk of injury across the age groups (12–14, 14–16, 16–18) and BMI categories suggests that PA-related injuries among Saudi adolescents are not very sensitive to the latter, possibly due to comparable exposure to high-risk sports like football in these categories.

The incidence of foot injuries, particularly among sports training (48.9%) as compared to leisure-time PA (36.7%), is likely attributed to the popularity of high-impact sports such as football, contributing to

37.9% of injuries. Football involves repeated high-impact actions, sudden changes of direction, and contact, making injuries to the lower limbs more susceptible (13). Arm and ankle injuries were also common, differing significantly according to setting types of injuries ($p<0.001$), suggesting the varied physical demands of sports training (structured, high-intensity), PA during leisure time (unstructured, variable intensity), and school PA (often less supervised). These findings suggest the need for setting-specific injury prevention that recognises the unique demands of each setting.

Among the significant findings is the significant protective effect of prior training on the incidence of injury ($p=0.001$; OR=0.58, 95% CI: 0.42–0.80). Formal training before PA engagement was associated with fewer injuries (8.5%) compared to those without such training (28.6%). This supports Alaqil et al. (14), who highlighted the need for proper training in reducing exercise injuries among Saudi Arabian fitness center clients. Instruction likely enhances adolescents' familiarity with good technique, tool handling, and safe procedures, minimizing risk through poor form or unnecessary strain. This finding emphasizes education as a weapon against injury, particularly in settings like sports clubs and schools where structured coaching can be implemented.

The significant disparity between injury types by PA setting ($p<0.001$) also highlights the relevance of specific interventions. Higher proportions of foot injury occurring during sports training suggest that warm-ups, proper shoes, and technique practice may be stressed in sports clubs. Conversely, leisure-time PA, with the highest percentage of arm injuries (30.6%), may require education on safe play behavior, i.e., not overstraining during casual activities. School-based PA, which has the lowest rate of injury (26.4%), would benefit from increased supervision and uniform safety measures to further reduce risks.

The lack of strong correlation of injury prevalence with type of sport ($p=0.41$), given the variety of sports covered (e.g., football, volleyball, kickboxing, tennis), suggests that the risk of injury is more likely due to the properties of PA (e.g., intensity, supervision) rather than the type of sport. The small sample sizes within less common sports (e.g., kickboxing, n=22) may have forestalled such differences from becoming significant, and it would be of interest to investigate this further within larger sport-specific populations.

Limitations

The research involves several limitations that should be considered while interpreting the findings. First, the fact that the data comes from self-reporting implies that recall bias is most likely and could affect the validity of reported prevalence, frequency, and recovery times of injuries. Adolescent participants have the potential to underreport or overreport injuries due to forgetting or social desirability bias. Second, the use of cluster sampling, while efficient, might result in selection bias and limit the generalizability of findings to the whole Saudi adolescent population, particularly those from underrepresented regions like the eastern region (2.2% of respondents). Third, the cross-sectional design prevents the establishment of causality between risk factors and the development of injury, limiting knowledge about the temporal sequence of events resulting in injuries. Fourth, restricting the study to healthy adolescents with musculoskeletal injury could have excluded those with pre-existing conditions, thus underestimating the overall burden of injury. Finally, survey validity was not entirely established, though reliability was sufficient (Cronbach's alpha=0.733). Subsequent research may enhance reliability by adding objective measures, e.g., health reports or clinical findings, and longitudinal study designs to investigate the incidence of injury over time. Larger, more representative samples would also strengthen generalizability.

Conclusion

The present study highlights that PA-related injuries affect 37% of Saudi adolescents aged between 12 and 18 years, with the foot being the most prevalent in sports training (48.9%) and leisure PA (36.7%) settings. The high protective value of prior training (p=0.001) highlights the critical role of education interventions to reduce injury risk. No significant correlations existed for the prevalence of injury and age, gender, BMI, geographic setting, or type of sport, suggesting that prevention should aim more towards universal education and safety than towards methods tailored to demographics. The disparity in injury patterns between different PA settings proves that context-based interventions such as adequate warm-ups and technique training at sports clubs, better supervision at school, and safe education for leisure-time physical activity are paramount.

Conflict of interest: NIL

Funding: NIL

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الانتشار ونمط الإصابات المتعلقة بالنشاط البدني بين المراهقين السعوديين: دراسة مقطعية

الملخص الخلفية :يلعب النشاط البدني (PA) دورًا حاسمًا في صحة المراهقين، لكنه يحمل مخاطر الإصابة. البيانات حول الإصابات المتعلقة بالنشاط البدني بين المراهقين السعوديين محدودة .**الهدف :**تدرس هذه الدراسة انتشار الإصابات المتعلقة بالنشاط البدني وشدتها وعوامل الخطر بين الشباب السعوديين الذين تتراوح أعمارهم بين 12-18 عامًا في أنشطة الأندية الرياضية، والنشاط البدني أثناء وقت الفراغ، والنشاط البدني المدرسي .**الطرق :**دراسة مقطعية رصدية شملت 402 شابًا سعوديًا، استخدمت استبيانًا إلكترونيًا تم إرساله عبر وسائل التواصل الاجتماعي. تم استخدام العينة العنقودية لاستهداف الشباب الذين يعانون من إصابات عضلية هيكلية ناتجة عن الرياضة المنظمة أو النشاط في وقت الفراغ أو المدرسة. تم استبعاد المشاركين الذين يعانون من حالات عضلية هيكلية أو عصبية. تم حساب الخصائص الديموغرافية وخصائص الإصابات باستخدام برنامج SPSS مع الإحصاءات الوصفية، واختبارات كاي-تربيع، والانحدار اللوجستي لتقييم العلاقة بين انتشار الإصابة وعوامل الخطر .**النتائج :**وجدت الدراسة التي شملت 402 مشاركًا أن 87.3% كانوا ذكورًا، و38.7% و35.3% من المناطق الغربية والجنوبية على التوالي. كانت الغالبية من الفئة العمرية 12-14 عامًا، مع 48% بمؤشر كتلة جسم طبيعي. كان لدى 54.2% تاريخ في المشاركة الرياضية، حيث مارس 40.0% الرياضة أسبوعيًا و34.1% مرتين أسبوعيًا. بلغ معدل حدوث الإصابات المتعلقة بالنشاط البدني 37%، دون وجود ارتباط معنوي بين العمر، الجنس، مؤشر كتلة الجسم، الموقع، أو نوع الرياضة. قلل التدريب المسبق من معدلات الإصابة .**الاستنتاج :**الإصابات المتعلقة بالنشاط البدني شائعة بين المراهقين السعوديين دون اختلافات حسب العمر، الجنس، مؤشر كتلة الجسم، الموقع، أو نوع الرياضة. التدريب المسبق يقلل بشكل كبير من المخاطر، مما يبرز الحاجة إلى برامج وقاية مستهدفة لصحة المراهقين .

الكلمات المفتاحية :النشاط البدني، الإصابة، المراهقون السعوديون، الانتشار، الرياضة، وقت الفراغ