

SPORTS INJURIES IN SECOND-CYCLE INSTITUTIONS: THE BURDEN ON, AND RISK FACTORS ASSOCIATED WITH STUDENT HEALTH

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Abstract

Introduction: Adolescent engagement in sport and other recreational activities has been increasingly embraced worldwide due to its benefits. Notwithstanding, it also remains one of the major contributors to injury burden translating into half of the global injury rate. Yet not much is known about the prevalence of sports-related injuries and the associated risk factors among second-cycle institution athletes in Ghana. This study sought to estimate prevalence and identify the risk factors associated with sport injuries among athletes in Second-cycle institutions in the Kumasi Metropolitan area.

Method: A cross-sectional design was carried out with 600 athletes from 16 out of the 24 public schools in the Kumasi metropolis through a two-stage cluster sampling. A smartphone interviewer-administered questionnaire was used to collect data from the athletes.

Data were summarized in tables and figures. Bivariate and multivariate logistic regression were performed to identify independent predictors of injury. Data were analyzed with STATA version 14.0.

Result: The overall injury prevalence estimated was thirty-eight percent. Dislocations and sprains (46.7%) and closed wounds (1.5%) were the common and least injury types recorded. Likewise, ankle and elbow were the most and least body region to be affected respectively. Individual factors such as nature of sports and years of playing experience were the identified predictors of adolescent injuries.

Conclusion: Adolescent sports injury prevalence is high in Kumasi metropolis among second-cycle institution. Dislocation and sprains were the most common injuries. These were mostly associated with contact sports.

Key Words: Prevalence, Injury, Senior high school, Athletes, Sportsmen

Introduction

The importance and benefits of participation in sports and other physical activities are well known and documented globally. Both youth and adult participation in sports is widespread due to the physical, psychological and social importance attached to the field¹⁻³. Participating in sports regularly is associated with the reduction of an individual's risk to certain health conditions, and it improves cardiovascular functions⁴ and their overall quality of life⁵. The individual's body is strengthened through the uptake of various sporting activities while improving stamina, mental well-being, and self-esteem^{6,7}. Moreover, frequent engagement in rigorous sports like running and

football tends to improve metabolic fitness, muscular performance, postural balance, cardiac function and bone mineral density, making it critical for everyone^{8,9}. Whereas physical inactivity is associated with obesity and other coronary-related morbidities¹⁰.

The promotion of children and adolescent participation in sporting activities is becoming common worldwide, especially in the develop world. This is due to the belief that early involvement in sports enhances the individual success in the field. This factor which accounts for early engagement by majority of children before they reach puberty age. These children in some cases train up to twenty hours a week in their field of play in order to qualify for selection^{11,12}.

Despite the numerous benefits of active engagement in sporting activities, individual participants are at the peril of morbidity and bear the risk of injuries¹¹. The physiological and physical growth processes of young people make them more susceptible to injuries. For instance Maffulli & Caine (2005) reported that nonlinearity of growth, limited thermoregulatory capacity and maturity associated

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variation are the unique risk susceptibility factors associate with injury in young athletes who are usually focused on high performance.

Sporting events in schools in Ghana are encouraged for the known benefits previously mentioned. However, it is usually popular in second-cycle institutions because it is at this stage that most young athletes are identified, groomed and absorbed into the various national teams. High achievers and performers are those who usually earn places in these teams. Supervisors are therefore compelled to increase the intensity and seriousness attached to the rigorous training and grooming among the players, especially those in the second-cycle institutions¹³. The individual's participation in regular sporting activity whether for recreation or competition increases susceptibility to injuries irrespective of age. These sportsmen throughout childhood to youthful ages experience greater amount of injuries such as soft tissue, bone, ligament and nerve injury usually due to repetitive stress and direct trauma associated with rigorous training¹⁴⁻¹⁶.

Aside the pain and trauma to the individual, the society is also burdened with potential loss of talents, cost of treatment, rehabilitation, lost productivity, time and injury related disability, either temporal or permanent¹⁷⁻¹⁸. Recent data suggest that adolescent sports injuries are high and constitute a public health burden among nations. Sport and recreational-related injuries constitute 19% to 59% of all global injuries sustained by adolescent within the ages 11 to 15²⁰.

The magnitude of this burden in adolescent sports is alarming, which requires urgent attention and answers. Indeed, coming out with an investigation into the risk of injury among sportsmen, would be of great value to sports administration in second cycle institutions in Ghana. Availability of such information would not only be valuable to sports managers, but also to parents, supervisors, clinicians and the athletes themselves in their decision to participation and self-protection in their chosen field of play. The foregoing rationale underscores the need for a study to estimate the injury burden and identify the kind of injuries occurring to sports men and women in second cycle institutions.

Methods

Study Design

A cross-sectional study was conducted among second-cycle institution within the Kumasi metropolis from March, 2018 to July 2018. Quantitative techniques were used to solicit for information on sport injuries. Ashanti region has about 94 public and 24 private second-cycle institutions. The study was restricted to schools in the regional capital, Kumasi. Some of the public schools are mixed (boys and girls) while others are only single gender. The private schools are mainly mixed schools.

Study Population

The study population consisted of active sportsmen in second-cycle institutions. The study included sporting activities such as football, volleyball, athletics, basketball, badminton and hockey. Information was gathered retrospectively on all sporting activities and injuries attributed to them within the study period. A sports injury was operationalized as any physical damage caused by an accident during sports activities in the school, both organized and non-organized.

Inclusion Criteria

Those recruited were active athletes who had participated in a school sporting event, have consistently trained with any of the school team and considered to be a member of at least one team. Both sports organized by either the school or Ghana Education Service were considered as well as other informal sporting events.

Exclusion Criteria

Students who were not considered to have participate in any sports were excluded from the study.

Sampling procedure and sample size

The study adopted a multi-stage cluster sampling technique. In the first phase, a sampling frame of all eligible schools that had participate regularly in the second-cycle inter-school sports festival or had participated at least twice in the last two years was created. Simple random sampling was used to select 16 out of the 24 public second-cycle institutions in the Kumasi metropolis for the study. In the second phase, a comprehensive list of sports girls and boys was obtained from the school sports masters. The students were assigned unique numbers and excel random generator was used to select respondents for interviewing. Simple random sampling was employed to select participants for interviewing. With prevalence of 0.16, margin of error 0.037 and design effect of 1.5, an estimated sample size of 600 was used for the study.

Data collection

A structured questionnaire was designed to measure the burden of injury among Second-cycle Sportsmen. The questionnaire was program and uploaded into a mobile phone using the Open data kit (ODK) software designed for Android operating system (OS). Each trained research assistant (RA) was provided with a basic smartphone with good functionality in Android OS (version 7.1). The smartphone was uploaded with the questionnaire template and used to capture the information from respondents. Information collected was saved on the phone once the interview was complete and later submitted to the server. The ODK was password-protected for data safety and confidentiality.

Pre-testing

The questionnaire was piloted in Ghana my Secondary School which shares similar characteristics with schools that participated in the actual study. This was done to ensure the validity and reliability of the data collection instruments.

Ethics Approval

Ethical approval for the study was sought from the Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital Committee of Human Research Publication Ethics (CHRPE). Administrative approval was also obtained from Ghana Education Service (GES). Each participant signed a written informed consent, after the RA had explained the purpose of the study before proceeding with interviewed. Confidentiality of their identity was assured and respondents were free to withdraw from the study or refuse to answer any questions they so deemed. Personal identity characteristics such as names were not collected.

Data management

Data were captured electronically using a mobile phone with an open data kit (ODK) software uploaded with questionnaire template. Data collected was submitted to ONA server and downloaded into a personal desktop computer as excel csv format with access to the investigators only. The data were checked daily for completeness and consistency using pre-determine program. Errors were checked daily as the data were being downloaded from the server. The data on the cloud server were deleted after the completion of data collection.

Statistical analysis

Data cleaning and analysis were performed using STATA version 14.0 statistical software. Categorical variable and continuous variable were summarized using proportion and means, respectively.

Univariate and multivariable logistic regression were performed to determine independent risk factors for sustaining an injury among athletes in second-cycle institutions. The multivariable logistic regression model incorporated variables that were independently significant in the univariate analysis ($p \leq 0.05$) as well as variables that were considered to be important or potentially confounding. The non-significant but important characteristics were controlled for in the backward regression model. The fit of the model was assessed using the log maximum likelihood test, significance level of 0.05 was considered with a 95% confidence interval.

Results

The mean age of the athletes sampled was 17.21 ± 1.3 years, with a range of 14-20 years. More than half (62.8%) of the respondents were male and a little over seventy percent (70.5%) attended mixed schools.

Half of the students (50.2%) had been actively engaged in sporting activity for two years or more (Table 1). About 37.9% of the athletes were footballers while badminton (4.9%) was the least participated sport.

About 41.2% of the students in the injured group were aged between 14-16 years, while the least were in age 14-16 years. Similarly, male students (39.9%) and mixed schools (40.6%) constituted greater part of the injured population (Table 1).

More than half of the athletes playing handball (53.3%) and hockey (60.0%) were in the injury group, while fewer badminton players (20.0%) also experienced injuries.

The prevalence and types of sports injuries

More than thirty-eight percent 195 (38.5%) of the athletes had experienced at least an injury in the last 12 months prior to the study. Dislocation and sprains (46.6%) were the most experienced injury among the athletes sampled for the study. Closed wound and fracture were the least reported injury. A little over twenty-eight percent of the athletes suffered superficial injuries and there were twelve percent of unspecified injuries reported as well (Table 2)

The majority of the body regions affected in the injury episodes were the lower extremities, with twenty percent reporting ankle injuries, while eighteen percent also have their knees affected. The elbow (1.5%) and the waist (2.5%) were the least body regions to suffer from injuries (fig. 1). Other body regions like the head (7.1%), shoulders (10.7%) and finger (5.5%) also suffered some form of injury (*Fig 1*).

Half (50.5%) of the athletes who engaged in the contact sports had dislocation and sprains, while sixty percent experienced concussion. More than 3-in-4 of the contact sports athletes experienced superficial injuries (76.7%) while majority of them (83.3%) also had some form of fractures. The least injuries were recorded among those who engaged in non-contact sports. Twenty-nine percent suffered from other non-specified injuries (Table 3).

Treatment mechanism and outcome.

Majority of the injured athletes were treated and discharged same day (98.4%). Majority of treatment duration (83.5%) lasted less than a month. A handful (1.5%) of the injuries lasted for over three months before the athlete recovered. An average of a week (7.9 days) of student's academic life was lost. Forty-five percent of the injured athletes lost 6-14 days of academic activities in school while eleven percent of the athletes lost up to 30 days. due to injury (Table 2).

The predictors of sports injuries among athletes in second cycle institutions.

The effects of the risk factors due to injury occurrence were examined and has been summarized in Table 4.

In the univariate analysis, nature of sports and years of experience in sport were significantly associated with injury occurrences, while other factors such as age, gender and type of school were not significant. In the multivariable analysis, athletes in contact sports were at higher risk of sustaining injury [aOR=4.50; 95% CI=

2.35-8.63] compared with those in non-contact sports. Consequently, athlete with two years or more sporting experience were twice at risk of injury [aOR=2.08; 95% CI= 1.09-3.96] compared with those with lesser years of experience [aOR=0.26; 95% CI= 0.09-0.71].

Table 1: Socio demographic characteristics of student athletes

Variables		Injuries		Overall (%)
		No n=351(%)	Yes n=143(%)	
Age group				
	14-16	94 (68.1)	44 (31.8)	138 (27.3)
	17-19	207 (58.8)	145 (41.2)	352 (69.6)
	20+	10 (62.5)	6 (37.5)	16 (3.2)
	Mean (SD)	17.21±1.3		
Sex				
	Female	120 (63.8)	68 (36.2)	188(37. 2)
	Male	191 (60.1)	127 (39.9)	318(62.9)
School type				
	Mixed	212(59.4)	145(40.6)	357(70.6)
	Single	99 (66.4)	50 (33.6)	149(29.5)
Sporting experience (Years)				
	Less than a year	84(68.9)	38(31.2)	122 (24.1)
	1 year	86(66.2)	44(33.9)	130(25.7)
	2 years or more	141(55.5)	113(44.5)	254(50.2)
Type of sport				
	Athletics	78(61.9)	48(38.1)	126(24.9)
	Badminton	20(80.0)	5 (20.0)	25(4.9)
	Football	125(65.1)	67 (34.9)	192(37.9)
	Basketball	23(65.7)	12(34.3)	35(6.9)
	Handball	14 (46.7)	16(53.3)	30(5.9)
	Hockey	18(40.0)	27(60.0)	45(8.9)
	Volleyball	33(62.3)	20(37.7)	53(10.5)

Table 2 Injury Burden and treatment outcome among student athletes

Variable		Frequency (n=506)	Percentage (%)
Injury experience			
	Non-injured	311	61.5
	injured	195	38.5
Injury type			
	Concussion	15	7.7
	Fracture	6	3.1
	Superficial injury	56	28.7
	Dislocation and Sprain	91	46.7
	Closed wound	3	1.5
	Other Unspecified	24	12.3
Treatment outcome			
	Treated and discharged same day	192	98.5
	Hospitalized	3	1.5
Treatment duration			
	Less than a month	163	83.6
	1-2month	29	14.9
	Above 3 months	3	1.5
Lost school days			
	1-5days	23	43.4
	6-14 days	24	45.3
	15-30 days	6	11.3
Mean (SD)	7.90 (7.66)		

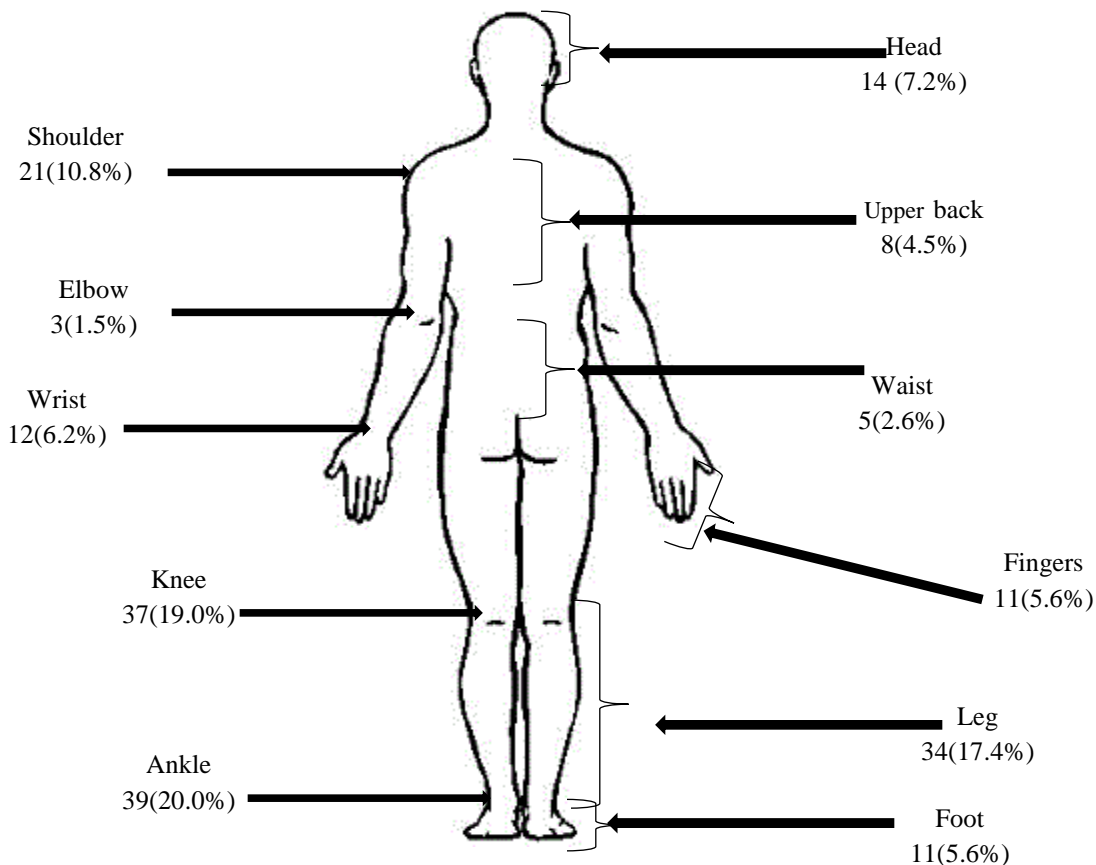


Fig 1. Body region affected by injury

Table 3: Injury burden by nature of sports of student athletes

Nature of sport	Injury Type					
	Dislocation and Sprain <i>n</i> (%)	Concussion <i>n</i> (%)	Fracture <i>n</i> (%)	Superficial injury <i>n</i> (%)	Closed wounds <i>n</i> (%)	Unspecified Injuries <i>n</i> (%)
‡ Contact sports	46 (50.5)	9 (60.0)	5(83.3)	43(76.7)	2(66.6)	17(70.8)
# Non-contact	45 (49.4)	6 (40.0)	1(16.6)	13(23.2)	1(16.6)	7(29.1)
Total	91 (100.0)	15 (100.0)	6 (100.0)	56 (100.0)	3(100.0)	24(100.0)

‡ Football; basketball; hockey; handball
 # Athletics; volleyball; table tennis; badminton

Table 4 Univariate and multivariate analysis of risk factors for sports injuries among student athletes

Variables	Univariate logistics regression		Multivariate logistics regression	
	Crude Odds ratio (OR; 95% C.I)	P-value	Adjusted Odds ratio (AOR; 95% CI)	P-value
Age				
14-16	1.69(0.57-4.97)	0.34	-	-
17-19	1.77(0.58-5.40)	0.31	-	-
20+ (ref)	1			
Gender				
Female (ref)	1			
Male	1.09(0.74-1.57)	0.67	-	-
School type				
Mixed (ref)	1			
Single	1.24(0.83-1.83)	0.28	-	-
Nature of sport				
Non-contact (ref)	1			
Contact sport	4.94 (2.61, 9.34)	0.001*	4.50(2.35-8.63)	0.001
Experience in discipline				
Less than a year (ref)	1			
1year	0.23(0.88-0.63)	0.004*	0.26(0.09-0.71)	0.009
2 years and more	2.05(1.08-3.87)	0.027*	2.08(1.09-3.96)	0.026

Discussion

There has been a growing concern about adolescent participation in active sports and their susceptibility to injury. Anecdotal evidence suggest that adolescent athletes are exposed to more health risk than older ones in their field of play²⁰.

This study sought to estimate injury burden among athletes in second cycle institutions and explore the risk factors of sports injuries on the health of these athletes in the Kumasi metropolis of Ghana. The study found out that more than a third of athletes (38.5%) suffered from injuries such as superficial injury, concussion, dislocation and sprains. Lower extremities were the most anatomical parts to be affected, and on average, an athlete is rendered incapacitated for a week. The major risk factors identified to affect injury were engagement in contact sports and longer years of experience in sports participation.

The burden was estimated using self-reported injury episodes among the students in their field of play either

at trainings or competitions. The potential risk factors were predicted using independent variables such as student’s age, gender, school type, years of sporting experience and the type of sports engaged in.

The prevalence of injury in this study appears to be higher when compared to previous estimates elsewhere^{20,21}. Even though there has not been any national representative data on the extent of injury sustained by young athletes, the current prevalence equates figures reported by Pickett et al. (2005) from 32 countries²⁰. Likewise, the prevalence of injury among the athletes in this study is 1.1 times higher than the incidence in Spain, Malta and USA^{21,22}. The wide variation between current study and previous reports could be attributed to reasons that, rates from the present study was estimated from self-reported incidents against hospital records related injuries in other studies. The present study demonstrates a high burden of injuries among adolescent athletes. This confirms the perspective from injury experts who classify adolescent

sports as one of the leading causes of injury burden worldwide²².

Consequently, superficial injury, concussion, dislocation and sprains were the common injuries recorded by the athletes in this study. More than a third reported dislocation and sprains as the frequently occurring conditions they face. These injury types recorded could be attributed to the nature of sporting activities mostly engaged in by these students. The individual's limbs and joints are the frequently used body parts of athletes in contact sports and are usually stressed. For instance, the percentage of dislocations and sprains were more than half for athletes who are engaged in contact sports compared to those in non-contact sports in our study. According to Powell et al. (1999)²³, the legs, knee and ankle are the most reported anatomic part of athletes to be hurt in sports like hockey, wrestling, basketball and soccer/football. Sprains and strains constitute 20% to 31% of the main injury types that affect the lower limbs and subsequently affecting the knee, thigh and ankle respectively in adolescent sports²⁴. This could be due to the rigorous nature and the energy exerted in these sports.

Likewise, our study showed that the lower extremity was the body part to be affected with greater percentage of injury. The legs, which comprises of the knee, ankle and foot were mostly affected. This is an indication that these body parts are the most frequently used as recorded in similar studies in other parts of the world. Their frequent usage in sports places greater stress on them especially during the critical period they are still developing making them susceptible to injury. The affected part recorded in this study confirms earlier studies on high school sports injuries^{22,24,25}. These studies reported that knee, ankle and shoulders are the commonest body sites to be injured in adolescent sports in descending order.

Despite the pain and trauma that is associated with sports injuries, the athlete is also burdened with other forms of disabilities whether temporary or permanent. Engagement in sporting activities comes with its own price. Majority of adolescent athletes are rendered incapacitated for close to a month, due to sport-related disabilities. Similarly, forty-three percent of the athletes in the current study had an injury resulting in 5 days lost time of academic work, while a little over forty-five percent lost up to 14 days. Given the nature of the academic work in high schools in Ghana, this means that an athlete may have lost valuable lesson hours. These lost times may be difficult to regain unless a special arrangement is made for them, which comes with extra cost burden. Similar trends have been reported in various studies. On average, one to four weeks of activity of the athlete's time is lost in participation and other activities during their engagements in various sports worldwide²¹⁻²⁶.

In the multivariate analysis, after adjusting for the effects of covariates, nature of sports and the years of sporting experience were identified as extrinsic predisposing risk factors of sports-related injury among

adolescents. Most of the students played football, which is a contact type of sport. Our study revealed that athletes in contact sports had four times increased risk of injury compared with those in non-contact sports. The rate of collision, sprinting and general body contact in these types of sports are often high and increases the risk of injury. Football, basketball, hockey and handball are disciplines that require a lot of energy and force. Therefore, there is the possibility of body collisions during games. For instance, Darrow et al. (2009)²¹ and Emery et al. (2005)²⁷ reported in separate studies that contact with another player was the most general mechanism associated with 69.3% and 46.2% of severe injuries respectively. The current finding indicates that athletes in contact sports are at greater risk of injuries, and this requires a policy intervention.

The continuous engagement in sporting activities is meant to build athletes stamina among other things; however, findings from the present study indicate that individuals with long years in sports are twice at risk of injuries compared with those with less practicing years. Consistently playing one sport for a long period places the athlete at a greater risk of injury because the repetitive nature of the sporting event places more stress on the body parts leading to overuse injury. The risk is even higher in young bodies as they are still developing²⁴. The tendency of an athlete with previous injury history developing a new one is high compared with those who have never experienced any²⁷. Even though our study did not record injuries that were older than one academic year, there could be a likelihood that athletes with injury episodes may have had earlier injuries. This finding has been affirmed by sport injury experts that previous injury experience is a risk factor and exposes athletes to two-threefold greater risk of another injury^{28,29}.

The individual predisposing characteristics such as age and gender were not significant risk factors of sport injuries among the athletes. Contrary to our finding, it has been widely reported across majority of sports disciplines that, gender plays a lead role in injury occurrence with girls being more susceptible to injuries compared to boys^{12,21,30}.

Similarly, age has been cited as non-modifiable risk factor to adolescent sports injury in other studies^{27,31} but it was not significant in the present study. Generally, risk is believed to be greater among older boys compared with younger persons due to their biological make up, swiftness, and ability to exert more energy on contact with object or opponent in the field of play^{23,27,29,32}.

Limitation

This study has some limitations regarding the scope, participants, and data collection processes. The study involved only athletes within the Kumasi metropolis, without taking the perspective of health workers and other actors. The study recruited 600 athletes from 16 senior high schools to represent the entire athletes in the metropolis. The injury episodes reported by the athletes were limited to one academic

year. Therefore, there is a tendency of recall bias as participant may not recall injuries experienced in the previous term. Despite these limitations, this is the first study to look at injuries among athletes in second-cycle institution, and which warrants further study.

Conclusion

The study estimated the injury prevalence and identified the risk factors among athletes in second-cycle schools in the Kumasi metropolis. The injury prevalence was estimated to be 38.5%. Dislocation and sprains were the most common injuries, affecting mostly the lower extremities. The nature of sport discipline and the number of years engaged in sporting activities were identified risk factors of injury among the athletes. Developing a policy aimed at checking injury protection and management in Second-cycle schools could help improve health outcomes among adolescent athletes in Senior high schools.

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