

SPORTS INJURIES IN STUDENTS AGED 12-18 DURING PHYSICAL EDUCATION CLASSES IN ISRAEL

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Abstract. A retrospective study was made of sports injuries occurring in physical education classes in 51 junior and senior high schools in Israel during a period of 14 months (2000-2002). The survey covered a total population of 11439 students aged 12 to 18, 52% male, 48% female. The aim of the study was to assess the incidence, types and risk factors involving sports injuries among students in physical education classes. Physical education teachers were asked to complete questionnaires recording injuries that occurred during their lessons. Data included: socio-demographic parameters (gender, age, height and weight of the injured students), area and type of injury, time of injury during the class, type of sport activity, previous injuries, assessment of sport capabilities and performance. A total of 192 injuries were recorded in the survey (1.70%). Male and female students had fairly similar injury rates (49% female, 51% male). 12-14 year old students showed the greatest number of injuries (52%). The ankle was the most common site of injury in both genders (48%) mostly involving ankle sprain. Athletics was the most common sport involving injury (38%). 45% of injuries were reported to occur in the start of the class, whereas 26% of injuries were repeat injuries. This survey showed that the incidence of injuries during supervised physical education classes in high schools in Israel is relatively low and is similar to that of other Western countries.

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Introduction

The potential for injury is high in organized school sports and physical education activities. Sports-related injuries account for a significant proportion of all injuries among adolescents [1,2,7,14,16,18,19]. The injury incidence and type depends to a large degree on the specific sporting activity with team sports, especially contact team sports, providing the highest percentage of injuries [1]. High levels of sports participation are significantly associated with increased risks of injury in general and sports related injury in particular [18]. It is difficult to compare figures regarding the incidence or risk factors for sports injuries owing to the wide differences in types of organized sports and physical education classes in different countries. American football as a team sport, for example, is virtually restricted to North America, whereas countries with cold climates may have skiing, skating, ice-hockey, which are not relevant sports activities in hot climates. Many sports, such as horse-riding or alpine skiing, which have very high injury rates [10], may not be relevant in urban environments, especially in tropical or subtropical climates. Despite the great variability in types of organized or team sports and athletics, it is fairly universal for school-aged children of both genders to undergo some sort of compulsory gymnastic, physical fitness, or physical education classes. School physical education classes can be a major source of sports injuries [1,2] and in fact some studies have shown that physical education classes may result in twice as many injuries as organized sports [19]. It has been estimated that one-fourth of all sports injuries may be avoidable, without changing the nature of the sport or limiting participation in it, but by incorporating minimal safety precautions [19]. There is considerable potential for reducing the number of injuries in physical education classes, where many avoidable injuries occur.

Whereas boys tend to sustain many more organized sports injuries and more severe injuries than girls, [4,10,18], there appear to be fairly similar injury rates in physical education for both boys and girls [11,13]. Factors of physical fitness, height, weight, and percentage of body fat, are not considered as predictive of injury [15,16]. A direct correlation has, however, been noted between performance level of high school track and field athletes and incidence of injuries [17].

The percentage of sports injuries in schoolchildren increases with age with greater incidence of injuries in senior high school rather than in junior high school [19]. The lower limbs are the sites of the most common sports injury, and in particular the ankle [1,2,4,5,11,15,17]. In contrast, the upper limb has also been reported as the most injured area [10,13,18], especially in terms of fractures, in physical education classes [2]. 80% of all sports-related orthopaedic injuries



involve the upper limb. Injuries requiring orthopaedic treatment to the lower limb occur especially in football and gymnastics [3]. Sprains and strains are the most common types of sports injury observed, especially of the foot and ankle [5,11,15,17].

Sports injury in the present study was defined as a single event occurring during a physical education (PE) class, which resulted in hospital or medical referral. The aim of the study was to assess the specific types, incidence and risk factors related to sports injuries among physical education school students aged from 12 to 18.

Material and Methods

Subjects: 213 physical education teachers in junior and senior high schools in the Tel Aviv area were invited to participate in a retrospective study of student injuries in physical education classes over a period of 14 months during the academic school years 2000-2002. They were asked to complete questionnaires with regard to the incidence and type of sport injuries occurring during their classes, the physical characteristics of the injured student and risk factors for the sports injury. The survey included a total population of 11439 students from 51 different schools with an age range of 12 to 18. 5954 (52%) were male students (average age 14.5 ± 1.94) and 5485 (48%) female students (average age 15.5 ± 1.4) (Table 1).

Table 1

Students in survey according to age and gender

	% Students (11439)	% Males (5954)	% Females (5485)
Age group	100%	52%	48%
12-13	16	12	4
13-14	20	12	8
14-15	20	13	7
15-16	16	5	11
16-17	14	5	9
17-18	14	5	9



Methods: A structured questionnaire was specifically designed for the study. The reliability and the validity of the questions were evaluated. Internal consistency is the extent to which items within a scale are correlated with each other. Thus, Chronbach's α coefficient used, and a magnitude of at least 0.7 were regarded as an index of reliability.

The questionnaire included questions regarding: number of classes each teacher had, grade and number of students in each class, gender composition of the class, gender, age, height, weight and grade of the injured students, site and type of injury, time when the injury occurred during the lesson, type of sports activity involved, previous injury, and assessment of physical capability of the injured student.

The standards to classify the subject's body composition were based on Amsterdam Growth and Health Longitudinal Study [8].

Informed consent to conduct the survey was approved by the Wingate Institute Review Board.

Statistics: Data were collected from the questionnaires and SPSS version 7.2 for Windows 2000 software was used to analyze them. Descriptive statistics were computed for simple baseline comparisons. Bivariate comparison of students with and without injury was made using the two-tailed Student's *t*-test for continuous variables and the chi-square test for categorical variables. For variable with more than 5% missing data, two separate analyses were performed: First, characteristics with missing data assumed to be negative. Second, students with missing data were excluded. Since the two strategies produced nearly identical results, only results of the first analysis are reported. Significant differences between groups as well as between males and females injuries, was set as ($P < 0.05$).

Results

34% (72 out of 213) of the questionnaires sent out were returned and analyzed in the study. The total number of sports injuries reported for the 14 months covered by the study was 192 (1.7%). The overall incidence of injuries during physical education classes was 0.78%.

Most of the injuries (52%) occurred between ages 12-14 in both males and females (Table 2). Male and female students sustained almost similar numbers of injuries: 99 in males (51%) and 94 in females (49%). However, injuries tended to be more common in the older females. Table 2 summarizes the sport characteristics and the clinical findings of the injured students.



Table 2

Characteristics of sports injuries in students (n=192)

F – female; M – Male (percentages rounded up)

Age and gender	12-13	27% (47% F; 53% M)
	13-14	25% (52% F; 48% M)
	14-15	11% (49% F; 51% M)
	15-16	13% (48% F; 52% M)
	16-17	16% (50% F; 50% M)
	17-18	8% (47% F; 53% M)
Area injured	Ankle	48%
	Hand	19%
	Knee	10%
	Thigh	7%
	Arm	5%
	Shoulder	4%
	Head	4%
	Leg	3%
Type of injury	Sprain	61% (62% F; 38% M)
	Fracture	23% (25% F; 75% M)
	Strain	9%
	Cuts	7%
Sports activity	Athletics	38%
	Ball games	32%
	Gymnastics	15%
	Fitness	9%
	Leisure activities	6%
Time of injury	First 15 min	45%
	Mid-class	25%
	Last 15 min	30%
History of injuries	First time injured	74%
	Recurrent injury	26%



Sports capability	Above average	32%
	Average	63%
	Below average	5%
Anthropometric data:		
Height	Above average	18%
	Average	75%
	Below average	7%
Weight	Above average	19%
	Average	66%
	Below average	14%
Body mass (BMI)	Above average	20%
	Average	71%
	Below average	9%

The most common site of injury (48%) was the ankle in both genders, with a greater incidence in females. The hand was the second most common site to be injured (19%), followed by knee (10%), thigh (7%), arm (5%), shoulder and head (4%), and leg injuries (3%).

The most common type of sports injury involved sprains (61%) and in more females than males; 23% of the injuries were bone fractures and more among males, 9% were strains and 7% cuts.

45% of the reported injuries occurred during the first 15 min of the physical education class, 25% occurred in the middle of the classes and 30% occurred during the final 15 min of the class. Athletics classes (track/running/jumping) accounted for 38% of the injuries, ball games (soccer and basketball) accounted for 32%, gymnastics 15%, physical fitness classes accounted for 9% and 6% occurred during general PE activities. 74% were first time injuries, whereas 26% were repeat or recurrent injuries. 63% of the injured students were assessed to have average levels of sport capabilities; 32% were estimated to have above average sports capabilities, whereas 5% were reported to have below average or weak capabilities. 75% of the injured students were estimated to be of average age-adjusted height, 18% above the average height and 7% below the average height. 66% of injured students were reported to have average age-adjusted weights, 19% were above the average weight and 14% were below the average weight. The Body Mass Index (BMI) measured by weight (kg) divided by height² (meter) was 71% average, 20% above average and 9% below average.



Discussion

The main aims of the study were to assess the risks of injury in schoolchildren during physical education (PE) classes based on data acquired retrospectively from questionnaires completed by PE teachers. We assessed PE class-related activity and several socio-demographic categories that may be correlated to sport injury. Our population of school children aged 12-18 was selected from several different, but typical, secondary schools in the Tel Aviv area of central Israel. PE classes in these schools are fairly uniform (each class lasts 50 min, twice a week). This study showed that ankle injuries were more common among female students than among males ($P < 0.05$). A similar gender trend was also observed for sprains, strains and fractures involving the foot and ankle. This tendency is in agreement with several other reports [4,5,11,15,17,19]. The overall incidence of 0.78% injury during physical education classes in our study was somewhat lower than might be expected, but this may be the result of the type of sports covered in Israel physical education classes, which are to a large degree low contact or non-contact, closely-supervised, sports, in contrast to team and contact sports, which have much higher injury rates in both genders [5].

Our data suggest that age may be a factor in injury with a greater incidence of the injuries occurring in the age-group 12-14 (52%). This age-group is very physically active, which may be associated with the spurt in skeletal growth and development. In the older age-groups our study showed that females sustained more injuries than males, though this result may be due to the fact that the population sample of the ages 15-18 contained more females than males.

It is however, important to indicate that, since no relationship was found between height, weight, and sport capability, it's rather difficult to support a conclusion that elder female will be sustained more injuries than elder males.

Sprains (61%) were the most common type of injury, and similar results were reported in other studies [5,11,13,15,17]. 26% of all injuries were shown to be recurrent, apparently caused by insufficiency in tendons.

The fact that some 45% of injuries occurred during the early stages of the physical education classes may point to a lack of sufficient warm-up. Other possible reasons that may account for injuries occurring during PE classes include: lack of safety precautions, poor floor surfaces or unsuitable mattresses, unsuitable shoes, and exercises involving high mechanical impact on the foot.

Type of sport activity: 38% of all injuries occurred in athletics classes, and 32% in ball games (basketball and volleyball). In the Israel high-school system, soccer or rugby are rarely practiced during PE, whereas athletics and ball games



(especially basketball) are the most common physical activities practiced. Our findings, therefore, are somewhat different to those reported in other studies [13-15] in which football was the major type for sports injuries.

Most of the injured students (63%) were graded as having an average level of ability in sports. No relationship was found between height, weight, sports capability and sports injury rate. Other studies support our findings by showing that physical fitness, sport specific skills, flexibility, height and weight, had no effect on the injury rate [15,16].

The limitations and reliability of retrospective sports injury studies need to be taken into account in drawing conclusions from the survey. The difficulties in gathering proper information about sports injuries have been discussed [14]. Overall, sports injuries in supervised high-school physical education classes in Israel are fairly low and tend not to be too serious. Our results lead us to hypothesize that during physical education classes the greatest risk is of ankle injury and the tendency for sports injuries will be greater among students aged 12-14, especially if they do not perform suitable warm-up exercises, or are out of practice. Despite the relatively low overall low incidence of sports injuries during physical education classes shown in the survey, these could be reduced even more if specific strategies for reducing risk were implemented. Improvements in basic safety precautions should include formulating improved preventive measures to reduce the number of new or recurring injuries [2,5,10,18,19]. Such measures include more widespread use of protective guards and appropriate athletic shoes, better technique and body control, better teaching, improved floor surfaces and mattresses. In order to reduce sports injuries, physical exercise and sports activities should be appropriate for the physical characteristics of the student [15]. Younger children should be discouraged from participation in technically advanced sporting activities that are inappropriate for their body status. Physical education teachers should continuously be aware of potential dangers and seek practical measures to reduce risks for student injuries.



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