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Epidemiology of Sprains in Greek Facilitation Classes

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Abstract: The aim of the present study was to record the sprains that occurred in students of the Athletic Facilitation Classes (AFC). The study was carried out at National Level from September 2006 to May 2007. During this period, 7455 male and 4921 female student-athletes were in close supervision of the researchers. The data were recorded by the physical education teachers of the AFC were registered in SPSS and they were analyzed with χ^2 non-parametric test. During the study 248 sprains were recorded (21.9%, $\chi^2 = 40.3$, $df = 17$, $p < 0.05$). One hundred and forty sprains (56.5%) occurred in the male and one hundred and eight (108) (43.5%) in female student-athletes ($p < 0.001$). The rate of sprains was 1.88 per male per year and 2.52 per female student-athlete per year. Most sprains were recorded in the male than in female student-athletes that attended in AFC, which functioned in the capital of prefectures (68.1 vs. 31.9, $\chi^2 = 12.0$, $df = 1$, $p < 0.001$). A significant number of sprains occurred during the months of November, December, January, February and March, while the sports in which most sprains occurred were basketball, volleyball and football. The training surface on which most sprains occurred was the parquet and the synthetic floor. It is concluded that the frequency of the sprains in the AFC is higher in males-athletes than in females occurred more in the sports of basketball, track and field, volley ball and soccer.

Key words: Joint sprains, athletic facilitation classes, injuries

INTRODUCTION

Since 1990, the Hellenic Ministry of National Education and Religious Affairs (HMNERA) has developed the Athletic Facilitation Classes (AFC) within the middle and high school curriculum. Each selected school operates with at least two AFC. In each AFC, the minimum number of students-athletes should not be smaller than ten for team sports and seven for individual sports. The maximum number of students-athletes is fifteen for individual sports and eighteen for team sports. The students-athletes are enrolled in AFC after specific evaluations in various athletic activities. The purpose of AFC was to provide more training and competition opportunities to talented students-athletes for specific team and individual sports.

Although, sports are of high importance for adopting health-related behaviors and lifestyles, training and participation in competitive sports put students at a greater risk of injury than their peers (Sumilo and Stewart-Brown, 2006).

Over the past decades, numerous investigators examined the epidemiology of school sport-related injuries in European, Western and Asian countries (Johnson *et al.*, 1974; Zaricznyj *et al.*, 1980; Boyce *et al.*, 1984; Bremberg and Gerber, 1988; Gallagher *et al.*, 1984;

Taketa, 1984; Watson, 1984; Jacobsson *et al.*, 1986; Tursz and Crost, 1986; Evans and Sheps, 1987; Sheps and Evans, 1987; Backx, 1989; Bremberg and Gerber, 1989; Guyer and Ellers, 1990; Backx *et al.*, 1991; Schelp *et al.*, 1991; Gratz, 1992; Lenaway *et al.*, 1992; De Lões and Marti, 1995; Sørensen *et al.*, 1996; Weir and Watson, 1996; Di Scala *et al.*, 1997; Laflamme *et al.*, 1998; Stergioulas and Mandilas, 2003). It is a very well documented fact that athletic participation is associated with high incidence of sport-related injuries (Nelson *et al.*, 2007). Several studies indicated that the sprains appears to be the most frequently injured of high school athletes (McGuine *et al.*, 2000; Nelson *et al.*, 2007; Pontell *et al.*, 2006). Moreover, patterns of sport-related injury can differentiate according to age, sport, gender (Beynon *et al.*, 2005; DeHaven and Lintner, 1986; Adirim and Cheng, 2003), practice and/or game conditions (Messina *et al.*, 1999) and training-competition surface (Meyers and Barnhill, 2004).

Most of prior sprains injury investigations among high school athletes included single sports with limited sample sizes (Messina *et al.*, 1999; Verhagen *et al.*, 2004) and ankle was one of many injured body sites (Powell and Barber-Foss, 2000; Burt and Overpeck, 2001). However, no epidemiological study investigated the details of the sprains in AFC. Therefore, the aim of the present

investigation was to record: (a) the rate and frequency of the sprains in the AFC, (b) the frequency of sprains in relation to place of residence, sport, class, training surface, (c) the joints that suffered a sprain injury and (d) the differences in the above mentioned parameters amongst male and female students-athletes.

MATERIALS AND METHODS

A full school year in Greece consists of two semesters: the Fall (September-January) and the Spring (February-June). During the 2005-06 school year, the researchers took the permission from the Central Committee of AFC-HMNERA to conduct the research project. At the end of the same school year, the researchers sent the research package to the Director of Physical Education (PE) at the HMNERA. The package included a cover letter, the injury report form and a questionnaire. In the cover letter the researchers explained the purpose of the study. At the beginning of the next school year (2006-07), the director of the department of PE informed all PE teachers of the AFC by e-mail the details about the study and their duty to record and send injury reports weekly to the department of PE at the HMNERA. The present study was prospective in nature and involved all students-athletes that attended the AFC at a national level during the 2006-07 school year. During the study period, 1302 AFC were functioning and 12376 students-athletes attending the program for 39 different sport activities. Certified P.E. teachers (n = 1302) participated in the study as data reporters.

Definition of term sprain and collection of data: After an extensive literature review and taken into consideration the injury report forms of (a) Incident Report Form (Stark *et al.*, 1996), (b) Student Injury and Incident Report for use in Swedish schools (Laflamme *et al.*, 1998), (3) Student Accident Report Form (Yang *et al.*, 1998) and (d) Student Accident Report Form (Sun *et al.*, 2006), the research team constructed the final report form for the present study.

In the final report form the research team included: (a) anthropometric characteristics of the male and female students-athletes of AFC (region of residence, class, sex, age, height, body mass, body mass index, (b) information regarding the sport (training years, training surface, hour of training per week in the AFC and in the athletic club they belong, stretching, supplements of diet, kind of athletic shoes, preventive taping, number of matches played) and (c) information about sprains (month of injury, pattern, degree, preliminary diagnosis and first aid).

The second report form included the diagnosis of the sprain, the treatment (surgery, time of rehabilitation, time of absence from school and time absence from training and competition). Physical education teachers recorded all sprains that occurred in the AFC during training, as well as those that occurred during competition for individual (track and field, fencing, judo, etc.) and team sports (soccer, volleyball, handball, etc.).

As reportable sprain was defined an injury to a ligament of a particular joint, that occurs during participation in a sport (training, competition) and limits students-athlete’s participation the day following the injury or requires further medical attention (Gomez *et al.*, 1996).

All sprain data were coded for male and female student-athletes using month, place of residence, sport, class of enrollment and playing surface as categorical variables. Statistical analyses were carried out using Statistical Package for Social Sciences (version 14, SPSS inc. Chicago) software. Frequencies of sprains were calculated for the aforementioned categorical variables. Statistical significance of differences among the variables was estimated using the non-parametric χ^2 test (applying Fisher’s exact test where appropriate). Statistical significance was set at $p < 0.05$ for all analyses.

RESULTS

From the beginning of the Fall semester (September, 2006), until the end of the School year (June, 2007), 1135 injuries occurred. Two hundred 248 (21.9%) of these were sprains ($\chi^2 = 40.30$, $df = 17$, $p < 0.05$). One hundred sprains (56.5%) suffered the male and 108 the female student-athletes (43.5%, $p < 0.04$). Most of the sprains occurred during the months of November, December, January and February. Significant difference in frequencies was observed between male and females athletes during the month of February (76.7 vs. 23.3%, $\chi^2 = 7.47$, $df = 1$, $p < 0.006$, Table 1).

Table 1: Frequencies of sprains suffered by the male and female student-athletes of the AFC during the study according to recorded month and significance between them (χ^2)

Month	Males N (%)	Females N (%)	χ^2 (df = 1)	p-value
September 2006	2 (40.0)	3 (60.0)	1.32	NS
October 2006	5 (50.0)	5 (50.0)	0.93	NS
November 2006	24 (77.4)	7 (22.6)	2.34	NS
December 2006	24 (64.9)	13 (35.1)	0.02	NS
January 2007	24 (57.1)	18 (42.9)	1.01	NS
February 2007	32 (48.5)	34 (52.5)	7.47	<0.006
March 2007	12 (48.0)	13 (52.0)	3.07	<0.01
April 2007	6 (54.5)	5 (45.5)	0.48	NS
May 2007	11 (52.4)	10 (47.6)	1.36	NS

NS: Not significant

Table 2: Frequencies of sprains suffered by the male and female student-athlete of the AFC during the study according to place of residence and significance between them (χ^2)

Place of residence	Males N (%)	Females N (%)	χ^2 (df = 1)	p-value
Rural region	24 (57.1)	18 (42.9)	1.01	NS
Urban region	26 (48.1)	28 (51.9)	6.37	<0.01
Capital of Prefecture Athens/Thessaloniki	62(68.1)	29(31.9)	0.50	NS
	28 (45.9)	33 (54.1)	9.30	<0.002

NS: Not significant

Table 3: Frequencies of sprains suffered by the male and female student-athletes of the AFC during the study according to sport and significance between them (χ^2)

Sport	Males N (%)	Females N (%)	χ^2 (df = 1)	p-value
Track and field	11 (30.6)	25 (69.4)	18.22	<0.001
Wrestling	8 (88.9)	1 (11.1)	2.32	NS
Alpine skiing	2 (66.7)	1 (33.3)	0.06	NS
Soccer	49 (100.0)	0	0	0
Basketball	37 (53.6)	32 (46.4)	3.62	<0.05
Volleyball	14 (34.1)	27 (65.9)	16.60	<0.001
Handball	11 (47.8)	12 (52.2)	2.82	NS
Gymnastics	1 (25.0)	3 (75.0)	2.74	NS

NS: Not significant

Table 4: Frequencies of sprains suffered by male and female student-athletes of the AFC during the study according to class and significance between them (χ^2)

Classes	Males N (%)	Females N (%)	χ^2 (df = 1)	p-value
First	45 (50.0)	45 (50.0)	8.36	<0.004
Second	50 (58.8)	35 (41.2)	1.23	NS
Third	45 (61.6)	28(38.4)	0.27	NS

NS: Not significant

Table 5: Frequency of sprains suffered by the male and female student/athletes of the AFC during the study in relation to playing surface and significance between them (χ^2)

Play surface	Males N (%)	Females N (%)	χ^2 (df = 1)	p-value
Natural grass	32 (100.0)	(0.0)	0.00	00
Tartan	10 (37.0)	17 (63.0)	8.95	<0.003
Earth	5 (41.7)	7(58.3)	2.75	NS
Synthetic floor	40 (53.3)	35 (46.7)	4.15	<0.04
Parquet	40 (49.4)	41(50.6)	8.18	<0.004
Cement	3 (100.0)	0 (0.0)	0	0
Tapi	7 (58.3)	5 (41.7)	0.25	NS

NS: Not significant

Most of the sprains occurred in the Females students/athletes, who attended the AFC, that operated in the urban regions (48.1 vs. 51.9, $\chi^2 = 9.35$, $df = 1$, $p < 0.002$) and in Athens/Thessaloniki (45.9 vs. 54.1%, $\chi^2 = 6.37$, $df = 1$, $p < 0.01$, Table 2). Sixty nine of the sprains recorded in the sport of Basket ball (53.6% in males vs. 46.4% in females students/athletes), forty one in volley ball (34.1% vs. 65.9%, $\chi^2 = 4.12$, $df = 1$, $p < 0.04$), thirty six in track and field (30.6 vs. 69.4%, $\chi^2 = 18.22$, $df = 1$, $p < 0.001$) and sixty nine in soccer (Table 3). Although, the frequency of the sprains was similar to all classes, significant difference between male and female was observed only in the number of the sprains suffered by male student-athletes, who attended the third (61.6% vs. 38.4%, $\chi^2 = 3.96$, $df = 1$, $p < 0.004$, Table 4). Most of the sprains occurred in playing surfaces such as grass,

Table 6: Frequencies of ankle sprains suffered by the male and female student-athletes of the AFC during the study according to sport and significance between them (χ^2)

Sports	Males N (%)	Females N (%)	χ^2 (df = 1)	p-value
Track and field	10 (26.3)	28 (73.7)	24.36	<0.001
Wrestling	5 (83.3)	1 (16.7)	0.91	NS
Alpine skiing	2 (50.0)	1 (50.0)	0.06	NS
Soccer	63 (100.0)	0	0	0
Basketball	41 (59.4)	28 (40.6)	0.80	NS
Volleyball	10 (30.3)	23 (69.7)	16.95	<0.001
Handball	10 (40.0)	15 (60.0)	6.60	<0.01

NS: Not significant

parquet and artificial grass where no significant differences were observed between male and female (Table 5). Most of the sprains that the females students-athletes suffered were of the first degree (80 vs. 75, $\chi^2 = 11.39$, $df = 1$, $p < 0.01$) (Table 6).

DISCUSSION

During a school season from the beginning of the October 2006 up to the end of 2007, we prospective and strictly followed 7455 males and 4921 females students/athletes sport activities in all AFC.

The results of the present study showed that the most sprains suffered by the male and female student-athletes of AFC occurred during the winter months. Moreover, more sprains were recorded in (a) male and female student-athletes that participated in basketball, soccer, volleyball and track and field activities, (b) male and female student-athletes who studied in capitals of prefectures, (c) students that attended AFC for first time and (d) students that practised on natural grass, parquet and synthetic floor.

When the injuries are analyzed epidemiologically, particular attention should be given to the subjects that are exposed to the risk, the term of what is sprain, it's seriousness, the elapsed absence time by the injured student-athlete and his participation time in the trainings or in the games. These all variables, can lead to the confused results.

In the present study we selected a definition for the sprain that had been used by previous researches (DeLee and Farnley, 1992; Gomez *et al.*, 1996).

The collection of data in weekly basis and their transmission via e-mail to the Department of Physical Education in the HMNERA minimized the possibility to forget recordings of student-athletes, the first degree sprains as we see it in retrospective studies. Moreover, the physical education teachers with the second form that supplemented, gave all the information that was related to the rehabilitation process of the students-athletes and their return to School. Since, there are no published studies in classic athletic schools, as they functioned in the past in the Eastern European countries, we tried to

compare our results with the other researches, who conducted similar studies in the school age population.

We found that of all injuries 21.9% were sprains and the rate of 1.88 ankle sprains per male per year and 2.52 per female student-athlete per year. This rate was lower in comparison with the Gomez *et al.* (1996) study. These researchers investigated the injuries that occurred in 890 student-athletes from 80 schools and found out that 31% of injuries were ankle sprains.

The investigation by Kelm *et al.* (2004), showed different results. This research team analyzed prospectively 234 injuries during physical education classes and they found that the most common injuries were ankle sprains (female students 36.8%, male students 24.5%). This rate is again higher in comparison with our study results. Moreover, soccer (21.2%) and basketball (19.8%) showed most prevalence for ankle sprains.

Similar were the results of the Messina *et al.* (1999) study, which prospectively investigated the frequency of the injuries in a number of 100 classes during a school year. They concluded that the ankle sprains were the most common injuries.

In a recent study by Borowski *et al.* (2008), that was carried out in the USA, the data were collected via Reporting Information Online. The periods of study were the 2005-2006 and 2006-2007 academic years and included 100 nationally representative US high schools. The results showed that the 39.7% of injuries occurred in ankle joint a percentage higher from our study.

In a similar study Nelson *et al.* (2007) investigated the incidence rates of ankle injuries by sex, type of exposure and sport. They reviewed ankle injury data collected over the 2005-2006 school year. The data were registered by an injury surveillance system. They concluded that the ankle injuries occurred at a significantly higher rate and the sport that had the highest rate of ankle injury was basketball.

Most of the sprains were occurred in the winter months. It seems that the cold weather affects the biomechanics of the ligaments and become more prone to injuries.

Also, it was observed that a 40% incidence of sprains occurred in male/female student-athletes that attended the AFC, which functioned in capitals of prefectures. A possible reason for this increasing rate is the school environment, since many schools operate in two and more floors.

We found that sprain rates were higher for males than the female students-athletes at all classes. These results are in line with the study of Boyce *et al.* (1984), Taketa (1984), Sheps and Evans (1987) Lenaway *et al.* (1992), Laflamme and Eilert-Petersson (1998a, b) and Laflamme *et al.* (1999).

Validity and reliability: We believe that PE teachers are the most appropriate authorities to record injuries, since in our country there are no school nurses or school doctors. PE teachers are with student-athletes every day throughout the entire academic year and they know them very well. All PE teachers manifests very good responsibility and a high sense of duty.

CONCLUSION

Present prospective cohort study in AFC revealed that the sprains were the most common injuries with male student-athletes to suffer more than female. Also, more sprains occurred in the team sports such as soccer, basketball, volleyball and handball. These sprains of AFC male and female student-athletes are a cause for concern. So, the preventive measures should concentrate on specific target areas using schemes based on separate athletic school and constructing a credible system of monitoring of their effectiveness.

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