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Original Article

Sports injury pattern in school going children in Union Territory of Chandigarh[☆]

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ABSTRACT

Objective: To determine incidence of various types of sport injuries and other associated factors, among competitive sports playing school children of Chandigarh.

Design: This study is a survey based study, and spanned for a period of one year. School going students in age group 11–18 years of Chandigarh (Union Territory) India, who were in competitive sports, were included for this survey after taking informed consent from concerned school authorities. 33 schools consisting of 36,165 students were analysed in the study, 7230 students were found to participate in 40 different categories of sports.

Results: Total of 246 filled questionnaires were analyzed making it an injury frequency of 3.40% among 7230 participating young athletes in 12 months study duration. Estimated incidence rate, considering hours of exposure in practice, came out to be 48.07 injuries per 1000 h of exposure in practice among 246 injured cases.

40.2% of the injured children (99/246) attributed their injury to poor ground condition while other 30.5% (75/246) to faulty techniques. Rest attributed their injuries to poor fitness levels, improper use of equipment and other reasons. Of the 33 schools surveyed, 27.3% (9/33) had a doctor as health professional, 9.1% (2/33) had a physiotherapist while 66.6% of the schools (22/33) had no health care professional.

Conclusion: The incidence of sports injuries in the region is high as compared to the global data. The findings has highlighted the need for a nationwide surveillance system and then taking appropriate measures for future injury prevention and appropriate management.

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1. Introduction

Participation of school going children in sports has increased tremendously in recent times.¹ Usually considered as an effective method of physical fitness, recreation and lucrative career, more and more children are now engaging in competitive and organised sports. The participation in sports and related activities ensures a balanced development of the child and a good health.² However the increase in competitive activities has translated into a higher incidence of sports injuries in school going children. The problem is further compounded by the lack of proper resources and awareness regarding prevention and management especially in developing countries.

The age group which has been affected the most has been the bone of contention among many studies. A study conducted by Backous et al.³ showed that 14–17 years old is the high risk group for sports injury, while de Loes⁴ pointed out that 15–19 is the population most likely to experience sports injury. Studies on injuries among Indian school children and study on incidence of popular ball game injuries in Indian pre and post adolescent boys showed that higher the age, more the risk of injuries.⁵ However all these studies have summarized that sports playing school students are the population most susceptible to sports injuries, indicating that school sports injuries among students is a problem too important to overlook.

Identification of the problems in terms of incidence and severity of sports injuries constitutes the first logical step to direct measures at prevention. Most of the data available in literature is from western developed countries.^{1,3,4,6–9} This data cannot be generalised to all the countries especially the developing ones due to cultural and sports diversity. This study aims to bring out the statistical data of prevalent sports and sports related injuries and their incidence among sports playing school children of various age groups; so that potential preventive measures can be taken, development of appropriate resources and infrastructure can occur to manage the commonly occurring injuries and also to facilitate better utilization of the available medical resources for the potential young sportsperson.

2. Material and methods

This study was a cross sectional survey study based on filling the questionnaire by the enrolled schools. The study aimed at estimating the incidence and nature of sports injuries suffered by school going children spanned over a period of one school session from May 2010 to April 2011. All the school going students who were in competitive sports in age group of 11–18 years of the city and adjoining areas of Union Territory of Chandigarh, India were included in the study.

Sports injuries have been ambiguously defined in literature^{10,11} For the purpose of this study, an injury was defined as that extent of damage which prevented the player from training, playing or studying due to pain or other symptoms.

A Self measured assessment questionnaire (Table 1) was developed and standardized after conducting a pilot study

Table 1 – Questionnaire administered to the school for the survey.

Sports injury performa (demographics and questionnaire)

- 1) Name?
- 2) Age (in years)?
- 3) Sex (gender)?
- 4) Height (in centimetres)?
- 5) Weight (in kilograms)?
- 6) Residence (address)?
- 7) Telephone no?
- 8) Educational qualification?
 - a) Self-
 - b) Father's-
 - c) Mother's-
- 9) Present school name?
- 10) Is in your school/club?
 - a) Physician
 - b) Physiotherapist
 - c) Both A and B
 - d) Other health professional (please specify)
 - e) None
- 11) Is in your school?
 - a) A coach
 - b) A physical trainer
 - c) Others (please specify)
 - d) None
- 12) Nature of sports/sports name, please specify?
- 13) Level of sports in which the athlete is in?
 - a) Inter-school
 - b) Inter-district
 - c) Inter-state
 - d) Inter-national
 - e) Any other level (please specify)
- 14) Hours (duration) of training per week?
 - a) Personally (individually)-
 - b) With team-
- 15) Number of days participating in games?
 - a) Per month-
 - b) Per year-
- 16) Date of injury (DOI)?
- 17) Time of injury?
- 18) Place of injury?
- 19) Were you properly trained for the level of sports you are in?
 - a) Yes
 - b) No
- 20) Name the injured body part (e.g. hip, knee, arm etc.)? please specify?
- 21) Nature (name) of injury?
 - a) Bruising
 - b) Ligament injury (sprain)
 - c) Muscle, tendon injury (strain)
 - d) Others (if known please specify)
 - e) Don't know
- 22) Injured during?
 - a) Training
 - b) Competition
- 23) Injured during training?
 - a) In the start
 - b) In the middle
 - c) In the end
- 24) Injured during competition?
 - a) In the start
 - b) In the middle
 - c) In the end
- 25) Had proper warm-up (exercise session) before competition?
 - a) Yes
 - b) No

Table 1 – (continued)

26) Had proper cool-down (exercise session) after competition?
a) Yes
b) No
27) You think injury was caused due to?
a) Poor ground conditions
b) Improper use of protective sports wear
c) Poor fitness level
d) Faulty techniques
e) Others (please specify)
28) Number of days lost in school due to injury?
29) Is the present injury old one (re-current) or new one?
a) Old one (re-current injury)
b) New one
30) Have you suffered previously any other sports injuries?
a) Yes
b) No
31) If yes, please specify the injured area (body part, e.g. hip, knee, arm etc.)?
32) Got treatment following injury from?
a) A physician
b) A physiotherapist
c) Both A and B
d) Others (please specify)
e) Got no treatment
33) Variable treatment?
a) Examined and send home
b) Got initial treatment and sent home
c) Treated and followed up
d) Admitted to the hospital
34) Cost of medical treatment, approximate in rupees?
35) Are you satisfied with the treatment facilities available?
a) Yes
b) No
38) Suggestions (if any) you would like to give for the betterment of sports in future?

consisting information on demographics and injury statistics. These were sent to various schools in the region and were distributed among injured students involved in competitive sports through physical education (sports) teachers of the schools. An informed consent was taken from school authorities as well as from the guardians of the children. For children less than 14 years of age, the questionnaires were filled from parent, guardian, or school sports teacher, because of younger children's poor recall reliability.¹²

An incidence rate was calculated and analysis done separately for each sport. Result of this survey considered clinical incidence and epidemiologic incidence proportion as same because we have not taken account of total number of injuries but total number of injured cases.

2.1. Statistical analysis

Data was analyzed descriptively and are presented in frequencies of survey responses. Statistical software program of SPSS version 17 was used for data analysis.

3. Results

A total of 45 schools were randomly selected. Of these, 6 schools due to administrative reasons did not permit to carry

the survey and 6 other schools were not included because of non return of questionnaires. 33 schools were included in the final analysis, which consisted of 36,165 students in the age group 11–18 years, out of which 7230 were found to be participating in 40 different categories of sports. Amongst these, 246 were found to have injuries during the current year of school.

The injury frequency of 246 young injured sports children was calculated to be 3.40% among 7230 participating young athletes in 12 months study duration. This Injury rate may also be expressed as persons-year-at-risk i.e. 0.034 injury rate of 246 injured cases stood at 34.02 per 1000 persons-year-at-risk. Estimated incidence rate, considering hours of exposure in practice, came out to be 48.07 injuries per 1000 h of exposure in practice among 246 injured cases.

Amongst total children surveyed, the largest group was constituted by children of 15–16 years of age. However the injury frequency was highest in age group 17–18 years (Table 2). Basketball was the most commonly played game while Kabaddi carried the highest risk of injury (Table 3). Sprain was the commonest type of injury suffered by the players (Fig 1) and knee was the most common anatomical site of injury (Fig 2).

40.2% of the injured children (99/246) attributed their injury to poor ground condition while other 30.5% (75/246) to faulty techniques. Rest attributed their injuries to poor fitness levels, improper use of equipment and other reasons. Of the 33 schools surveyed, 27.3% (9/33) had a doctor as health professional, 9.1% (2/33) had a physiotherapist while 66.6% of the schools (22/33) had no health care professional. There was a mean loss of 19.2 days of schooling after the trauma in injured children.

The last question was an open ended question to which multiple answers were allowed, asking injured players about their individual suggestion so that measures can be taken for the betterment of sports in all aspects in future. 146 out of 246 injured cases responded to that question. 98 responses emphasized improvement in playing ground conditions, 76 responses were in demand of more advanced training, 62 responses were regarding better treatment facilities with more manpower, 49 responses said that the medical treatment expenses should be borne by the respective schools or clubs concerned, 35 responses were concerned about the politics in sports (mainly selection process) and demanded that the same should not be there, 34 responses demanded more financial aid in other sports than cricket alone, again 34 responses emphasized proper coaching and training, 32 responses demanded more sports quota in different spheres of

Table 2 – Demographic characteristics of the study population, age wise distribution and incidence.

Age group (in years)	No. of students in each group	Number of injuries	Incidence
11–12	8973	2	0.02%
13–14	9411	38	0.4%
15–16	11,260	103	0.91%
17–18	6521	103	1.57%
Total	36,165	246	

competition, 23 responses included better sports infrastructure as a suggestion, and 22 responses emphasized proper warm up and proper cool down as a measuring step for betterment of sports.

4. Discussion

Sports injury can be defined in varied ways. It can be defined as any injury sustained during sporting activity or exercise.¹⁰ A Sports injury may also be labelled so if it requires treatment by a health care professional, either in person or by telephone.¹¹ We however feel that both these definitions don't allow estimating the true incidence because the former will always overestimate and the latter underestimate the incidence. We defined the sports injury that prevented a child to be away from the game and/or studies due to the symptoms of the injury. Almost all descriptive studies on

paediatric sports injuries epidemiology vary in study design, population under study, and criteria to define injury. These together with the limited number of such studies render the comparison and summative analysis virtually difficult and meaningless.

In the present study an overall participation rate of 19.99% in 40 different sports was observed to be quite lower as compared to the western countries. A study reported overall sports participation of as high as 79% in children aged 5–15 years in UK.¹³ This indicates that in our set up, there are some factors which make the sports less popular amongst the school going children. However the present comparison can be biased because the present study is only specific region based thus there is a need for larger multicentre studies spread across the larger geographical regions of the country. A study conducted by Mahoney¹⁴ with non Caucasian children in UK emphasized religious, cultural, linguistic, and traditional issues for sports participation.

Table 3 – Popularity of various sports and incidence of injuries in each.

S. No.	Sport	No of children playing	% Popularity of the game	No. of injured children	Injury incidence
1	Basketball	894	12.36%	40	4.47%
2	Football	711	9.83%	29	4.07%
3	Cricket	706	9.76%	37	5.24%
4	Athletics	475	6.56%	37	7.78%
5	Volleyball	380	5.25%	4	0.01%
6	Taekwondo	320	4.42%	6	1.87%
7	Hockey	294	4.06%	10	3.40%
8	Handball	288	3.98%	12	4.16%
9	Chess/Carom	279	3.85%		
10	Roller skatnig	223	3.08%	9	4.03%
11	Badminton	193	2.66%	5	2.59%
12	Dodgeball	187	2.58%	3	1.60%
13	Kho–Kho	182	2.51%	4	2.19%
14	Table tennis	180	2.48%	1	0.55%
15	Gymnastics	179	2.47%	6	3.35%
16	Netball	168	2.32%		
17	Boxing	137	1.89%	10	7.29%
18	Lawn tennis	128	1.77%	9	7.03%
19	Ball badminton	115	1.59%		
20	Kabbadi	108	1.49%	15	13.8%
21	Softball	108	1.49%	1	0.92%
22	Karate	106	1.46%		
23	Base ball	102	1.41%		
24	Wrestling	91	1.25%	2	2.19%
25	Yoga	90	1.24%		
26	Swimming	78	1.07%	2	2.56%
27	Fencing	73	1.01%		
28	Throwball	70	0.96%		
29	Kick boxing	59	0.81%	2	3.38%
30	Squaymrshal	59	0.81%		
31	Judo	53	0.73%	1	1.88%
32	Table soccer	46	0.63%		
33	Rifle shooting	27	0.37%		
34	Archery	27	0.37%		
35	Wushu	24	0.32%		
36	Sepak tekkra	23	0.31%		
37	Cycling	15	0.20%		
38	Weight lifting	12	0.16%	1	8.33%
39	Soft-tennis	11	0.15%		
40	Cho-Kwan do	9	0.12%

Fig. 1 – Pie chart depicting nature of injury.

Fig. 2 – Figure depicting the anatomical area involved.

In the present study, injury incidence, expressed in persons-year-at-risk, was found to be 34.02 per 1000 persons-year-at-risk. This result of present study is somewhat higher than the result of a study by Abbas Esmaeili et al.¹⁵ which showed an overall incident rate of 22.2 injuries per 1000 persons-year-at-risk among senior secondary pupil of Iranian community. This difference in results may be due to the fact that the present study is regarding incidence of injuries in

active competitive sports, while the study conducted in Iranian community is regarding incidence of injuries in physical education classes, which are supposed to be having better professional training.

We found the general trend of increasing injury rate with advancing age starting with an incidence of 0.02% in age group 11–12 years and increasing to 1.57% in 17–18 years of age (Table 2). A similar finding was reported by Sorenson et al.⁶ showing sports and physical activity related injury rates of 20 per 1000 children at the age of 6, to 120 per 1000 children at the age of 14. This preponderance of injuries in adolescent years reflects a number of maturational and skeletal changes which occur during this time.¹⁶ Reduced motor performance has been observed in the adolescent years,¹⁷ skeletal integrity may be compromised during this time of rapid growth with longitudinal bone growth occurring temporarily at the expense of bone strength, the onset of sex hormones which marks adolescence results in increased muscle bulk, particularly in males and this combined with increased aggression and risk taking behaviour, may also explain the increased risk of sports injury associated with contact or collision sports with increasing age.

We found that the most common type of injury was Sprain following by strain (Fig. 1). Similar injury pattern has been reported by Miller and Spicer.⁷ Abbas Esmaeili et al.¹⁵ observed that the majority of injuries in the school sports are mild and approximately one in 400 injury related fatalities among children 5–19 years occurred at school. Present result showed that only 2.43% of injured cases were admitted in the hospital and nobody died due to injuries. While we found that lower limb (56.6%) was the most commonly injured region followed by upper limb (33.7%), Schmidt and Hollwarth⁸ found that 43.8% of all injuries occur in the upper extremity, 34.5% in the lower extremity, and 16% in the head, and peak at the age of 12. This apparent contradiction might arise due to the difference in nature of the predominant sports played in the two studies.

As observed by others,^{9,18} sprain was observed to be the most frequent injury type occurred in lower extremities including mainly knee and ankle joints and sports which involve high degree of sudden turns and forceful jumping.

In our study, the major causes of sports injuries as recorded by the school going players have been found to be poor playing conditions and lack of proper training. This depicts a need for the development of basic infrastructure as concerns sports activities in the region. The study also revealed a serious and noteworthy deficiency of health care professionals in schools.

The present study has its own potential limitations. The study did not include in its scope the follow up of the injured sports persons. We observed that in some cases, the requirement of parental/guardian consent as a prerequisite in the execution of this study was a demotivating factor for some children to report their injuries due to fear of the parental pressure of not allowing them to participating in the sports in future. The other weakness is that the present study does not represent the whole of the population of our country.

Based on the results of the present study, we have drawn up a point by point suggestion list (Table 4) for the public

Table 4 – Point by point suggestion based on the study's observations.

Observation	Suggestion
Injury frequency highest in 17–18 years of age	Physical education classes can be made compulsory for students from all streams or else orientation programs can be started. These programs need to be started from age of 15–16 onwards for better targeting.
Kabbadi carried the highest risk of injury	Sports carrying a higher injury risk should be played after adequate training and under professional supervision.
Factors responsible for injury	As attributed by around two fifths of the students, the condition of playgrounds can be improved a lot in schools. If a school wise approach is impractical or there are issues with funding, schools can be clubbed into groups and provided with a common playground with state of art facilities. Faulty techniques and hence inadequate training has been attributed to be the second most common cause of injury. There is need for recruitment policy change for trainer sportspersons and special incentives can be provided to such people in educational institutions. More funds need to be diverted for infrastructure development in schools. Poor public funding can also be circumvented through involvement of NGOs.
Absence of a health specialist in two-thirds of the schools	A post of health specialist need to be created in each school. If funds are insufficient, a panel of health specialists including Orthopaedician, Paediatrician and a physiotherapist can be created by the local authorities and attached to group of geographically adjacent schools. A helpline can be established for immediate action.
Standard sports conditions are needed in all schools	Monitoring teams need to be created. The members of these teams can be elite sportspersons, trainers, educationists, NGOs and parents. These will regularly conduct checks of schools to make sure that all regulations are adhered to.

authorities which if implemented might be able to improve the neglected scenario of sports injuries in school going children.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES

- Sharma P, Luscombe KL, Maffulli N. Sports injuries in children. *Trauma*. 2003;5:245–259.
- Shephard RJ. Physical activity and the child. *Sports Med*. 1984;1(3):205–233.
- Backous DD, Friedl KE, Smith NJ. Soccer injuries and their relation to physical maturity. *Am J Dis Child*. 1988;142:839–842.
- de Loes M. Medical treatment and costs of sports-related injuries in a total population. *Int J Sports Med*. 1990;11(1):66–72.
- Sen J, Sensharma S. Activity profile of Indian college students. *Int J Appl Sports Sci*. 2004;16:13–21.
- Sorenson L, Larsen SE, Rock ND. The epidemiology of sports injuries in school aged children. *Scand J Med Sci Sports*. 1996;64(6):281–286.
- Miller TR, Spicer RS. How safe are our school? *Am J Public Health*. 1998;88:413–418.
- Schmidt B, Hollwarth ME. Sports accidents in children and adolescents. *Z Kinderchir*. 1989;44:357–362.
- Ekstrand J, Gillquist J. Soccer injuries and their mechanism: a prospective study. *Med Sci Sports Exerc*. 1983;15:267–270.
- Van Mechelen W, Hlobil H, Kemper HCG. Incidence, severity, aetiology and prevention of sports injuries. A review of concepts. *Sports Med*. 1992;14(2):82–99.
- Knowles SB, Marshall SW, Guskiewicz KM. Issues in estimating risk and rates in sports injury research. *J Athl Train*. 2006;41(2):207–215.
- Baranowski T. Validity and reliability of self-report of physical activity: an information processing perspective. *Res Q*. 1988;59:314–327.
- Rowley S. *The effect of intensive training on young athletes*. London: Sports Council; 1989:6–7.
- Mahoney C. 20-MST and PWC 170 validity in non Caucasian children in UK. *Br J Sports Med*. 1992;26:45–47.
- Esmaeili A, Vazirineja R, Ebrahiminejad A. One-year incidence rate of injuries among secondary school pupils in an Iranian community. *Pak J Med Sci*. 2008;24(2):236–240.
- Emery CA. Risk factors for injury in child and adolescent sport: a systemic review of the literature. *Clin J Sport Med*. 2003;13:256–268.
- Visser J, Geuze RH, Kalverboer AF. The relationship between physical growth, the level of activity and the development of motor skills in adolescents: differences between children with DCD and controls. *Hum Mov Sci*. 1998;17:573–608.
- Sen J. Incidence of popular ball game injuries in Indian pre and post adolescent boys. *Int J Appl Sports Sci*. 2005;17(2):1–8.