

Sports injuries in adolescents' ball games: soccer, handball and basketball

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In a prospective study of 302 adolescent players in three ball games (soccer, handball and basketball), 119 incurred injuries. The injury incidence (number of injuries per 1000 playing hours) was 5.6 in soccer, 4.1 in handball and 3.0 in basketball.

Ankle sprains accounted for 25 per cent of the injuries, finger sprains 32 per cent, strains in the thigh and leg 10 per cent, and tendinitis/apophysitis 12 per cent. The most serious injuries were four fractures, one anterior cruciate ligament rupture, and two meniscus lesions. The most serious injuries, with the longest rehabilitation period, occurred in soccer. In soccer, many injuries occurred during tackling and contact with an opposing player, while the injuries in handball and basketball were often caused by ball contact and running.

Keywords: Soccer, handball, basketball, epidemiology, traumatology

Introduction

Almost all kinds of children's daily activities include a risk of sustaining injuries. In a study of accidental injuries of children in a French health care centre Tursz *et al.* found that sports related injuries represented 11 per cent of all accidents. As children's participation in sports has increased over the past few decades, so have the physical injuries¹⁻³. In any assessment of the advantages and disadvantages of sports, this risk of injuries must be the major item on the debit side of the ledger. This is especially so in children, where the process of growth and maturation is incomplete⁴. Concern about the increasing number of injuries and the risk of permanent damage to the developing skeleton in sports such as gymnastics and swimming practiced at international level has been expressed. But even in some ball games a rigorous and result-orientated training, often encouraged by parents, is seen in teams of seven to 14 year old children.

Many studies of soccer, handball and basketball have shown that the injury incidence as well as the seriousness of injuries is greatest in soccer and least in basketball⁵⁻¹¹.

The purpose of this prospective study was to calculate the incidence of injuries, to register injury patterns

and to analyse injury situations and mechanisms in three popular and widespread ball games – soccer, handball and basketball – in adolescent players aged between six and 18 years old. These three ball games are interesting to examine because they differ from each other in various ways. For example, soccer is played with the legs and feet, while the rules allow more body contact in handball than in basketball.

Materials and methods

The study was undertaken in a Danish sports club. The players were followed during one season; soccer from 1 February to 30 October 1986, and handball and basketball from 1 September 1985 to 30 May 1986. By making weekly visits to the club all injuries were registered and examined, and the injured players interviewed by the authors. In addition, records of absence from matches or training were held by the coach of each team. To ensure the registration of injuries, questionnaires were sent to all players on two occasions.

An injury was defined as an incident occurring during a match or training in the club, causing the player to miss at least one match or one training session. Players with absences caused by injuries in other sports were not included. The injuries were not treated by any of us, and we had no influence on the time of return to play.

In the club handball, basketball and soccer are played under controlled conditions. Each team has a coach who organizes training twice a week (two to three hours weekly) and accompanies the team to all matches, usually once a week (Table 1). All teams took part in tournaments. These tournaments were organized in leagues as in adult sport except for the youngest players (< 10 years) in handball and basketball teams.

Statistical analysis was carried out using Chi-square test with Yates correction. P-values less than 0.05 were considered to be statistically significant.

Results

Epidemiology

The total population consisted of 302 children: 152 soccer playing boys, 40 handball playing boys, 54 hand-

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Table 1. The age distribution in three ball games: soccer, handball and basketball

Number	<10y	<= 14y	<= 18y
Soccer	65	43	44
Handball	21	24	49
Basketball	9	13	34
Total number	95	80	127

ball playing girls, with basketball played by 27 boys and 29 girls. The age distribution is shown in *Table 1*. It is noticeable that in soccer many young boys are involved.

A total of 119 injuries were recorded: soccer 62, handball 36 and basketball 21. The injury incidence according to time related exposure (number of injuries per 1000 playing hours) is shown in *Figure 1*. There was no statistical difference between injury incidence in the three ball games ($p > 0.05$). The overall injury risk – percentage of injured players in each sport is shown in *Figure 2*. In the age groups under 15 years old the injury risk is significantly greater in soccer ($p < 0.05$). The risk increases with age. There was no statistically significant difference between the boys' and girls' injury rates in handball and basketball ($p > 0.05$). Of all injuries, 18 per cent (soccer 39 per cent, handball 14 per cent and basketball 5 per cent) were intrinsic injuries, especially tendinitis/apophysitis and muscle strains of the femur. Eleven out of 12 muscle strains and 11 out of 14 tendinitis/apophysitis were caused by soccer, and amounted to 36 per cent of all soccer injuries.

The localization of injuries in each sport is shown in *Table 2*. In soccer, nearly all injuries were located in the lower extremities, while handball and basketball caused many injuries to fingers. The injury types in the three ball games are seen in *Table 3*. No fractures involved the epiphysal plates. One third of the ankle

sprains were grade 3 lesions. The knee injuries consisted of one anterior cruciate ligament rupture, two meniscus lesions, one Osgood-Schlatter apophysitis, and four chondromalacia of patellae.

In basketball, four children had previously sustained an injury to the same location, but all were fully recovered, while 10 out of 15 re-injuries in handball still had residual problems when they occurred (six ankle sprains, two chondromalacia of patellae and two finger sprains). In soccer, we found 10 re-injuries, of which four were not completely rehabilitated.

The injury mechanisms

The situation and contact pattern under which the injuries occurred are shown in *Figure 3* and *Figure 4*. Many injuries (between 27 and 33 per cent) were caused by running. Shooting in handball and basketball caused more injuries than shooting in soccer where tackling was the main cause of injury. In *Figure 4* we see that between 19 and 49 per cent of the injuries happened without extrinsic violence. Most of these were overload injuries, such as muscle strains and tendinitis.

In soccer, 10 out of 15 ankle sprains were caused by tackling. In handball, seven out of 14 sprains occurred during running, four during shooting, and three in defence positions. In basketball, four out of seven

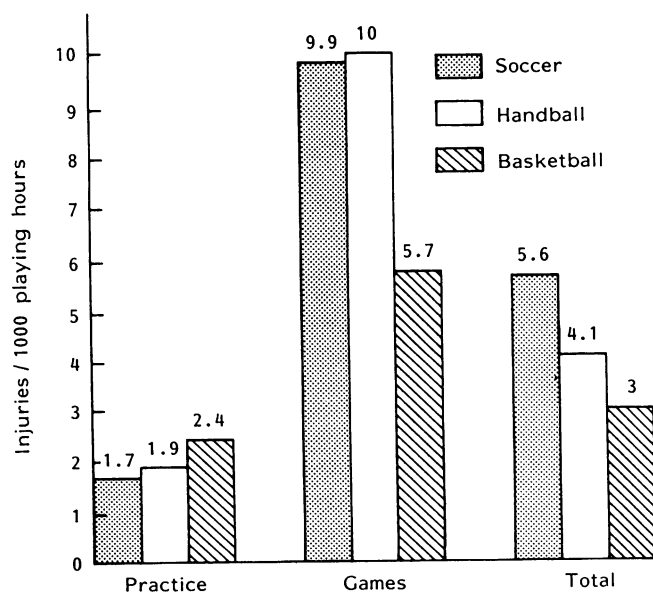
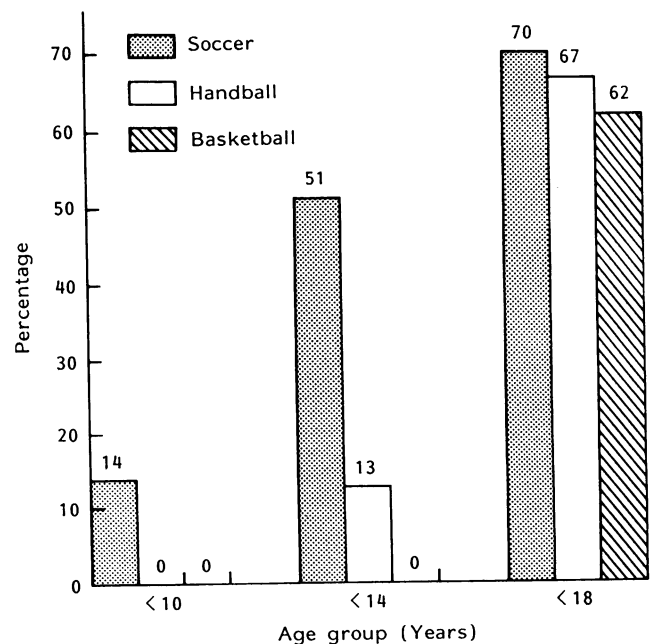
**Figure 1.** Injury incidence (injuries per 1000 playing hours) in adolescents' ball games: soccer, handball and basketball**Figure 2.** Injury risk (percentage of players) in adolescents' ball games: soccer, handball and basketball

Table 2. Frequency of site injured in three types of ball game and percentage of different injuries in each games

Number	Shoulder/arm	Hand/fingers	Thigh/leg	Knee	Ankle	Foot	Other
Soccer 62	1 2%	1 2%	15 24%	12 19%	17 27%	12 19%	4 7%
Handball 36	2 5%	9 25%	2 5%	5 14%	14 40%	2 6%	2 5%
Basketball 21	0 0%	9 43%	1 5%	1 5%	7 33%	0 0%	3 14%

Table 3. Anatomical site of different type of injuries with percentage of 119 injuries in three ball games

Site	Contusion	Sprain	Fracture	Strain	Tendinitis	Other	
Shoulder/arm	1	0	1	0	0	0	2%
Hand/fingers	1	14	2	0	0	0	17%
Thigh/leg	5	0	0	8	3	0	16%
Knee	6	1	0	0	1	7	15%
Ankle	0	26	1	0	0	1	28%
Foot	4	3	1	1	8	0	17%
Other	0	0	0	1	0	4	5%
%	17	44	5	10	12	12	100%

ankle sprains were caused by shooting, and three whilst running. Finger injuries, mostly sprains were especially frequent in basketball (43 per cent), followed by handball (25 per cent), and were caused by ball contact in different situations.

Consequences of the injuries

Absence from participation in training and games is illustrated in Figure 5. The basketball injuries were all healed during six weeks rest from playing, while the rehabilitation periods for handball and soccer in five and 11 per cent of cases lasted for more than six weeks. These lesions consisted of four fractures, seven knee injuries, and five ankle sprains.

Forty-five per cent of the injuries incurred did not receive authorized treatment, whereas 55 per cent

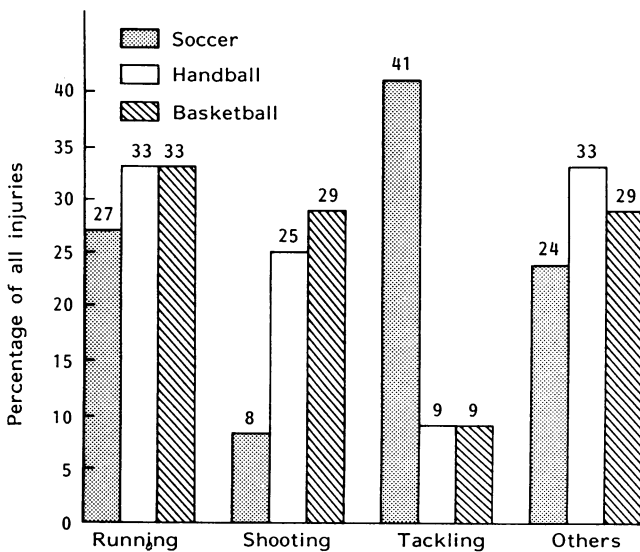


Figure 3. Injury situation in adolescents' ball games: soccer, handball and basketball

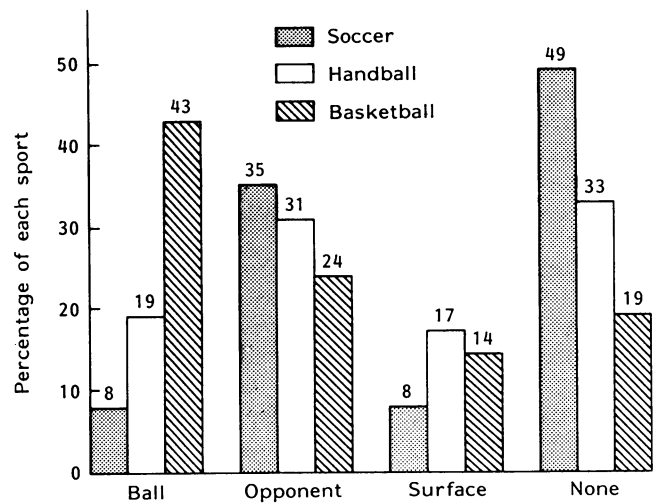


Figure 4. Injury contact in adolescents' ball games: soccer, handball and basketball

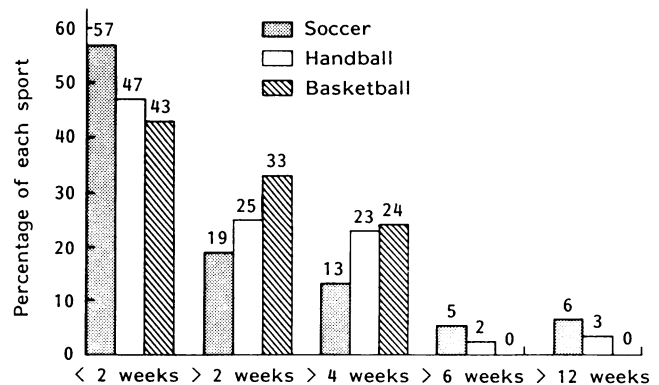


Figure 5. Duration of injuries defined by time lost from participation in sport

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were treated in the public medical care units. Many handball players (70 per cent) consulted a doctor. Only four were hospitalized; one anterior cruciate ligament rupture, two meniscus lesions and one calcaneal exostoses.

Discussion

Previous reports varied in their methods of evaluation^{3,5,9,12}, therefore comparison with these studies is difficult.

The registration of injuries in this study was done prospectively by the coaches and the authors. By our definition of injury, the overall injury rate was 5.6 in soccer, 4.1 in handball and 3.0 in basketball. These incidences are a little less than those reported in adults^{6,7,11}.

One of the problems in this study was the estimation of time related exposure. Each team has substitutes, and in handball and basketball, exchanging can be performed as often as required. Therefore calculation of exposure time cannot be exact.

In the younger age groups, (< 14 yr) the injury risk is greatest in soccer. Traditionally, soccer is played, even by the youngest children, with great intensity. The speed in handball and basketball is slower because these ball games require more ball control and technical skill than soccer. Over the age of 14 years these differences are not significant.

Only a few serious injuries were seen in this study; one anterior cruciate ligament rupture and two meniscus lesions. Ankle sprains were a frequent lesion and can result in chronic instability. No epiphyseal fractures were seen, and the fractures were of minor importance.

Soccer was characterized by acute over-use injuries (36 per cent) and non-contact injuries (49 per cent). Furthermore, tackling is an important injury situation; 89 per cent of injuries were located on the legs.

Handball was characterized by many finger and ankle injuries. Running and shooting are the most frequent injury situations.

Basketball was characterized by many ankle and finger injuries. Here, ball contact, running and shooting are the most significant injury situations.

In handball and basketball, preventive measures must be concentrated on ankle and finger injuries. The size of the ball is important, as well as training in grasping technique and the strength of fingers. The surface of the field, type of shoes worn and strength training of ankle joints are other aspects which must be considered.

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