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### *A systematic review on ankle injury and ankle sprain in sports*

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## Title Page

Title: A systematic review on ankle injury and ankle sprain in sports  
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## Abstract

This article systematically reviewed the epidemiology studies on sports injury which ankle injury was included. The time span started from 1977 to 2005. A total of 227 studies reporting injury pattern in 70 sports from 38 countries were included. The total included cases were 201600 with 32509 (16%) ankle injuries. A total of 11847 (84%) ankle sprains were recorded from 14098 cases with available ankle injury information. Results show that the ankle was the most common injured body site in 24 of the 70 included sports, especially in aeroball, wall climbing, indoor volleyball,

mountaineering, netball, and field events in track and field. Ankle sprain was the major ankle injury in 33 of the 43 sports, especially in Australian football, field hockey, handball, orienteering, scooter and squash. In general sports injury among countries, the ankle was the second most common injured body site after the knee, and ankle sprain was the most common type of ankle injury. The incidence of ankle injury and ankle sprain was high in court game and team sports, such as rugby, soccer, volleyball, handball, basketball, field hockey, dancing, American football, netball and lacrosse. This systematic review provides a summary of the ankle injury epidemiology in sports.

## **1. Introduction**

People from all around the world are participating in sports nowadays for personal interest, relaxation, health and fitness training. However, sports is one of the major causes of injuries which is comparable to traffic accidents, home and leisure accidents, occupational injuries, and violence<sup>[1-4]</sup>. Sports injuries result in pain, loss of playing or working time, as well as medical expenditure. Severe injuries may result in bone fractures, functional instability, limited mobility, disability, permanent cease of sports participation, psychological problem, and perhaps death. For world-class and commercial sports teams, absence of key players due to unexpected injuries may result in defeats in major games and huge economic loss. Due to these undesired adverse effects, scientists and medical specialists are actively working on sports injury prevention<sup>[5-7]</sup>. The aim is to prevent sports injury and let people enjoy sports participation.

The first procedure to tackle a problem is to identify the problem. In 1970, Roser and Clawson conducted an epidemiology study on football injuries in young athlete<sup>[8]</sup>. In

1971, MacIntosh conducted similar study on athletic injuries in University of Toronto<sup>[9]</sup>. In 1972 and 1973, Garrick conducted related studies in prevention of sports injuries<sup>[5]</sup> and prevention of ankle sprains<sup>[10]</sup>. To be more specific in identifying the problem, Garrick pioneered a series of ankle sprains epidemiology studies from 1977<sup>[11]</sup>. Subsequent studies by Garrick investigated ankle injuries in different sport events including aerobic dance<sup>[12]</sup>, children and adolescent skiing<sup>[13]</sup>, women gymnastics<sup>[14]</sup>, ballet<sup>[15]</sup>, and in all sports<sup>[16]</sup>. From 1980 afterwards, numerous epidemiology studies were conducted on different sports, population, gender, playing level and in different countries<sup>[3, 16-21]</sup>. These epidemiology studies generally reported that ankle is one of the most traumatized body sites in sports injuries in an overview on different sports, population, gender, playing level and in different countries. They reported that ankle injuries are accounting for 10-30% of all sports injuries. In some sports, the percentage of ankle injuries is even higher, such as 40% in mountaineering<sup>[22]</sup> and handball<sup>[23]</sup>, 41% in volleyball<sup>[24]</sup> and youth soccer<sup>[25]</sup>, 45% in female cheerleading<sup>[26]</sup>, 46% in artistic gymnastic<sup>[27]</sup>, 53%<sup>[28]</sup> and 54%<sup>[29]</sup> in softball, and 56% in women floorball<sup>[30]</sup>. In 1988, Garrick reported that the percentage can be higher in some sports<sup>[16]</sup>. From epidemiology data collected from 1979 to 1987, that percentage of ankle injuries was 74% in softball, 76% in racquet sports and football, 77% in weight-lifting and dancing, 79% in basketball, and 82% in volleyball. Ankle sprain is the most common type of ankle injury in most sports. It may account for more than 80% and even as much as 100% of ankle injury sustained in some sports, such as squash<sup>[31]</sup>, orienteering<sup>[32]</sup>, scooter<sup>[33]</sup>, soccer<sup>[34]</sup>, figure skating<sup>[35]</sup>, Australian football<sup>[36]</sup>, rugby<sup>[37]</sup>, field hockey<sup>[38]</sup>, handball<sup>[39]</sup> and volleyball<sup>[24]</sup>. In those sprains, about 77% of them are lateral sprains<sup>[40]</sup> and 73% of them involved rupture or tear to anterior talofibular ligament<sup>[41]</sup>. In a survey conducted in 1994 on 380 athletes with 563 sprained ankles, Yeung reported that most of these injured athletes were pursuing

running and jogging activities (25%), racquet sports (20%), ball games (19%), soccer (14%) and fencing (6%)<sup>[21]</sup>. The residual problem included pain (30.2%), instability (20.4%), crepitus (18.3%), weakness (16.5%), stiffness (14.6%) and swelling (13.9%). For ankle sprained once to four times, the major residual problem is pain (24-28%). For ankle sprained five times or more, instability problem arises and becomes the major sequale (38%).

In 1987, van Mechelen proposed a “sequence of injury prevention” which describes how sport injuries related studies stand together and form the whole research framework<sup>[42]</sup>. The first step is to identify the extent of the sports injury problem by epidemiology studies. The second step is to establish the aetiology and mechanism of injuries. The third step is to design and introduce preventive measures. Finally the effectiveness of the preventive measures is assessed by repeating the first step, which is the epidemiology study. Those epidemiology studies conducted by Garrick and other researchers<sup>[11-16]</sup> play an important role in locating the problem of ankle sprains in sports in the model of “sequence of injury prevention”. With this information, subsequent studies can be done to identify risk factors to injury<sup>[43]</sup> and injury mechanism<sup>[44]</sup>, to design prevention equipment<sup>[45, 46]</sup>, and to finally evaluate the effectiveness of these preventive measures<sup>[47, 48]</sup>. The purpose of this study is to systematically review the epidemiology studies on sports injury published by researchers in different sports and countries from 1977 to 2005 in order to identify the distribution of reported injuries among ankle and other body sites. Moreover the ankle injury types were also summarized. The time span starts from the first epidemiology study on ankle sprains published by Garrick in 1977<sup>[11]</sup>. The summarized findings will help sports medicine specialists to identify the patterns of ankle injury in sports, and to reassure the targets of future researches.

## **2. Methods**

Systematic literature search of Medline (from 1966), ISI Web of Knowledge (Science Citation Index Expanded, from 1985; Social Sciences Citation Index, from 1956; Arts & Humanities Citation Index, from 1975), PubMed (from 1950), and Sport Discus (from 1975) was conducted at the last week of January in year 2006. The search keyword string was “ankle AND (injury OR injuries OR sprain) AND (sport OR sports) AND (epidemiology OR epidemiologic OR epidemiological OR survey OR statistics OR patterns OR pattern)” appeared in title, abstract and keyword fields. The initial total number of identified articles from these databases was 744. After removing duplicates the count was reduced to 514. The title and abstract of each entry was read to identify and exclude non-epidemiology and non-related studies. Articles not written in English were excluded. After the trimming the count was reduced to 419. Online and library search for full text of these 419 articles was conducted. Articles not available in the library in The Chinese University of Hong Kong were requested from other libraries in local universities. The number of the article which full text was retrieved was 331.

The full text of each of the 331 retrieved articles was read in order to determine inclusion or exclusion in the analysis. To be included in the analysis, the study should report epidemiology findings of injury sustained in one or more sports activities, and should fulfill either one of the two following criteria: (1) the study reported injury at ankle joint, with either prevalence percentage among other body sites, or the incidence rate among the surveyed sample, (2) the study reported ankle sprain injury, with either prevalence percentage among other ankle injury types, or the incidence rate among the surveyed sample. Review articles, case report and current concepts

from specialists were excluded. After the screening process the final number of articles included in the analysis was 227.

Demographic data of the included studies were summarized. It included the geographical location where the study was conducted, period of the study, population investigated, prospective or retrospective nature of the study and case number. Geographical location was summarized in country and continent where the study was conducted. Period of study was categorized as before 1980, 1981-85, 1986-90, 1991-95, 1996-00 and 2001-05. Population investigated was categorized as (1) team, which the subjects were from sport teams or clubs, (2) public, which the subjects were from public population attending accident and emergency department in hospitals or sports medicine clinics, (3) event, which the subjects were from competition events and games, (4) school, which the subjects were student athletes from schools and universities, and (5) military, which the subjects were military recruits. Case number was categorized in 5-year intervals as 1-100, 101-500, 501-1000, 1001-2000, 2001-5000, 5001-10000 and >10000. Some studies reported data in a period of time overlapping two or more 5-year intervals were counted in all period included and made the total counts exceeding the total number of study.

The 227 included studies reported a total of 255 epidemiology reports, as some studies reported epidemiology in more than one sport. All epidemiology reports were categorized in sports. Epidemiology studies reporting general sport injury patterns in a country but not on specific sport were categorized in countries.

In each sport and country, the most common injured body sites and ankle injury types ranked by weighted prevalence percentages were shown in tables. Eleven body site



group were categorized: (1) ankle, (2) foot, (3) leg / shin / calf, (4) knee, (5) thigh / hamstring, (6) hip, (7) trunk / back / spine, (8) shoulder, (9) arm / elbow, (10) hand / fingers, and (11) head / neck / face. Some studies reported the percentage of injury of several body sites, such as foot and ankle, hip and thigh, or arm and shoulder. For these studies the combined percentages were divided evenly for each included site. Some studies combined the whole upper or lower extremity and made the distribution pattern among each body site too superficial. In these cases the study will be excluded as it failed to comply with the inclusive criteria that the study should report injury pattern in different body sites with ankle injury reported. However if ankle and hand injury were separately reported from lower and upper extremities, the study was included and the percentages of lower and upper extremity were considered in the leg (leg / shin / calf) and arm (arm / elbow) categories. Ankle injury type was classified into 11 categories: (1) sprain, (2) fracture, (3) strain, (4) abrasion, (5) contusion, (6) tendinitis, (7) blister, (8) impingement, (9) cramp, (10) bruise, and (11) laceration.

Among injured body sites, prevalence of ankle injury was represented by weighted percentages calculated by the sum of the percentage of injury in a specific body site times the number of all injuries in each included study, then divided by the sum of the total number of all injuries. Among ankle injury types, prevalence of ankle sprain was represented by weighted percentages calculated by the sum of the percentage of ankle injury type times the number of all ankle injuries in each included study, then divided by the sum of the total number of all ankle injuries. The calculations were shown in the following mathematics formula.

$$\text{weighted percentage (body site)} = \frac{\sum_{i=1}^n \text{total case} \times \text{percentage (body site)}}{\sum_{i=1}^n \text{total case}}$$

$$\text{weighted percentage (ankle injury type)} = \frac{\sum_{i=1}^n \text{total ankle injuries} \times \text{percentage (ankle injury type)}}{\sum_{i=1}^n \text{total ankle injuries}}$$

where  $n$  = number of epidemiology reports in one specific sport or country

In addition, incidence rate of ankle injuries and ankle sprain were reported in incidence per 1000 person-hours / person-year / person-season / person-exposure.

### 3. Results

#### 3.1 Demographic data

Two-hundred-twenty-seven epidemiology studies were included. Some studies reported injury epidemiology in two or more countries and thus made the total count 255. Most studies were conducted in Europe (45.5%), North America (30.2%) and Australasia (11.8%). Only a few studies were from Asia (4.3%), South America (2.0%) and Africa (0.4%). Distribution of geographical location of the included studies is shown in Table 1. Among countries, results showed that most studies were conducted in the United States (24.3%), followed by the United Kingdom (13.3%), Australia (8.2%), Sweden (7.1%) and Denmark (6.3%).

The period of study, population investigated, nature of study and the case number were summarized in Table 2. Most epidemiology studies were published from 1986-2000 with even distribution among this time span. Thirty-seven studies (12.9%) did not report the duration of study. The population investigated was mostly from sports team and clubs (40.5%), followed by public participants (29.5%), competition

event (15.4%), schools (11.0%), and military (0.9%). Six studies (2.6%) did not describe the population investigated. Nature of study was identified to be prospective (75.3%) or retrospective (18.9%). Thirteen studies (5.7%) did not describe the study nature. Most studies had case volume from 101-500 (49.8%). The total case number of sports injury included was 201600, and the number of ankle injuries included was 32509.

### **3.2 Prevalence of ankle injuries among sports**

The total number of sports included in the analysis is 70. The weighted percentage of the most common injured body sites were shown in Table 3. Among these 70 sports, ankle ranked first in the most popular injured body site in most studies (24 sports, 34.3%), followed by knee (14 sports, 20.0%), head (8 sports, 11.4%), trunk (6 sports, 8.6%) and hand (6 sports, 8.6%). Figure 1 showed the weighted percentage of ankle injury in all 70 included sports. Ankle injury was most common in aeroball (80.0%), wall climbing (60.0%), indoor volleyball (45.6%), mountaineering (40.0%), netball (39.8%) and field events in track and field (39.2%). The prevalence of ankle injuries was over 20% in 25 sports.

### **3.3 Prevalence of ankle sprains among sports**

Information about ankle injury was available in 43 sports, as shown in Table 4. The total case number of sports ankle injury included in analyzing the ankle injury type was 14098, and the number of ankle sprains was 11847. Ankle sprain was most common (33 sports, 76.7%), followed by fracture (7 sports, 16.3%). Figure 2 showed the weight percentage of ankle sprain in the 43 included sports. In some sports, all reported ankle injuries were ankle sprain (100%). These sports included Australian football, field hockey, handball, orienteering, scooter and squash. In addition to these

six sports, ankle sprain percentage was also higher than 80% in indoor volleyball, American football, martial arts, basketball, aeroball, ultimate, flag football, cheerleading, indoor soccer, ice hockey, lacrosse, badminton and netball.

### **3.4 Prevalence of ankle injury and ankle sprains among countries**

Epidemiology data in general sports were available in eight countries as shown in Table 5. In general, the knee was the most popular injured site (16.0-27.0%), followed by the ankle (11.2-20.8%), with an exception that the hand was most popular in Sweden (19.8%) and Holland (21.8%). For Holland, ankle ranked second (20.8%) after the hand (21.8%). For Sweden, ankle ranked third (15.6%) after the hand (19.8%) and the knee (16.0%) Ankle injury type information was available in three countries. Sprain was the most popular type of ankle injuries (33.0-73.0%), followed by abrasion (25.2%) and fracture (7.4-16.0%).

### **3.5 Incidence of ankle injuries**

Incidences of ankle injuries were shown in Table 6. In terms of incidence per 1000 person-hours, hurling and camogie had the highest general incidence (32.88), followed by rugby (8.14), soccer (6.52), basketball (5.20) and triathlon (4.70). In game, the incidence was highest in soccer (34.83), followed by rugby (14.00), American football (13.80) and indoor soccer (11.68). In training, soccer showed the highest incidence rate (2.74). In terms of incidence per 1000 person-year, field hockey showed the highest incidence rate (1000.00), followed by orienteering (571.43), dancing (466.20), gymnastics (425.90) and gaelic football (374.70). In terms of incidence per 1000 person-season, soccer showed the highest incidence in general (1200.00), game (143.40) and training (64.00). Australian football also has comparable game incidence (111.10). In terms of incidence per 1000 person-exposure,

tennis showed the highest incidence (11.30), followed by basketball (9.17) and netball (5.26). In game, netball showed the highest incidence (45.60), followed by rugby (8.88), American football (6.38), basketball (3.77) and wrestling (2.71).

### **3.5 Incidence of ankle sprains**

Incidences of ankle sprains were shown in Table 7. In terms of incidence per 1000 person-hours, rugby had the highest general incidence (4.20), followed by soccer (2.52), volleyball (1.99), handball (1.59) and basketball (1.00). In game, the incidence was highest in soccer (11.68), followed by Australian football (4.86) and soccer (4.59). In terms of incidence per 1000 person-year, field hockey showed the highest incidence rate (1000.00), followed by rugby (233.40), basketball (173.50), dance (155.40) and American football (60.60). In terms of incidence per 1000 person-season, soccer showed the highest incidence in general (1200.00), while Australian football showed the highest incidence in game (111.10). In terms of incidence per 1000 person-exposure, lacrosse showed the highest incidence (2.56), followed by basketball (1.90), Alpine skiing (1.60), soccer (1.15) and field hockey (0.90). In game, netball showed the highest incidence (40.06), followed by rugby (6.31), American football (6.06) and basketball (3.45).

## **4. Discussion**

This is a large scale systematic review which involved 227 published studies from 38 countries, reporting injury pattern in 70 different sports with a total of 201600 included injury cases and 32509 included ankle injury cases. A total of 14098 ankle injuries were included in analyzing the most common ankle injury type, and 11847 ankle sprains were included in this study. The time span covered the past 29 years from 1977 to 2005 inclusive. With such large coverage on the published data

contributed from researchers all around the world, this literature research should attract attention from researchers in identifying the problem of sports injury in injury prevention research. Although the details of injury in each sport cannot be listed out in this paper, researchers may learn the overview of published epidemiology data and identify the relevant articles for further information from this review. However, readers should pay attention that only those epidemiology studies with ankle injury reported were included in this analysis. This study can be a deputy in only ankle injury patterns in sports but not in general injury patterns.

Most epidemiology studies included in this analysis were from English speaking countries in North America, Europe and Australasia. There were fewer studies from Asia, South America and Africa. However, literature search showed epidemiology studies published from these countries in their own language. However as a result of language barrier, these studies are not included. Moreover, due to higher education level, scientific research activities were more active in those developed countries in North America, Europe and Australasia. Therefore most of the included studies were contributed by these countries and made the analysis more representing the injury pattern in these countries rather than a global fact. This is a limitation from the language and level of scientific research activities.

Some studies, especially those published in older years, did not describe full demographic details of the study. The information was obvious but the authors sometimes just did not report them. For example, some authors did not report the location which the study was conducted<sup>[11, 12, 15, 49-57]</sup>. Some may only report the city or town name and it was sometimes impossible for international reader to identify its exact location<sup>[16, 58, 59]</sup>. The nature of study, the period of data collection, and the

participants investigated were also often missed, as indicated in Table 2. Although these data might not be always important to every reader, reporting this information enriches the completeness of the published epidemiology study.

From the period of study reported, there were not many published epidemiology studies reporting sports with ankle injury before 1980. After 1981, the number of these studies increased and remained in a steady amount of published studies until 2000. From 2001 to 2005 the number of recorded studies dropped. This may reflect a decline of interest of epidemiology researches, a shift in sport event of interest which involves no ankle injury, or maybe a total vanish of ankle injury in some sports in recent years. The populations investigated were mainly team athletes (40.5%) and public participants (29.5%), which should well represent organized and recreational sports participation. Three fourth (75.3%) of the studies were prospective, which are expected to better represent the real injury patterns from better experimental control and data collection procedure. Most studies (49.8%) were with included cases from 101-500, which was quite enough for epidemiology data reporting. Therefore the authors believed that the summarized findings are representative and should have significant value in helping readers to identify the ankle injury patterns.

Within the 70 included sports, ankle injury was most common in 24 sports, with highest weighted percentage in aeroball (80.0%), wall climbing (60.0%), indoor volleyball (45.6%), mountaineering (40.0%), netball (39.8%) and field events in track and field (39.2%). Within the 43 sports with information about ankle injury, ankle sprain was most common in 33 sports. The percentage of sprain among all ankle injuries reached 100% in 6 sports, over 80% in 19 sports, over 60% in 26 sports, and over 40% in 34 sports. Among the eight countries included in this study, the knee was

the most popular injured site (16.0-27.0%), followed by the ankle (11.2-20.8%), with an exception that the hand was most popular in Sweden (19.8%) and Holland (21.8%). Sprain was the most popular type of ankle injuries (33.0-73.0%) from the information from three included countries. From the results, ankle injury was concluded to be one of the most commonly injured body sites in sports, and ankle sprain was the most dominating type of ankle injury in most of the sports.

In studying the weighted percentage of the injured body sites, reader should note that the higher percentage did not necessarily mean higher incidence of injury to this site. The figures only represented the distribution of the recorded injury in different sites. For example a 80.0% ankle injury rate in aeroball did not mean a more frequent injury occurrence to a 21.2% ankle injury rate in soccer, as the incidence rate of injury in soccer (71.13 incidence per 1000 person-year) was much higher than that in aeroball (1.37 incidence per 1000 person-year). From this review, the incidence of ankle injury and ankle sprain were high in court game and team sports, such as rugby, soccer, volleyball, handball, basketball, American football, Australian football, Gaelic football, tennis, netball, lacrosse and field hockey. Moreover, the incidence was also high in gymnastics, orienteering, dancing and skiing. In general, incidence in competitive games was higher than in general.

Moreover, reader should be aware that a higher incidence rate did not necessarily mean higher severity of the sports injury. It only reported the frequency of injury occurrence but did not report the severity of each injury. In ankle sprain, the severity can be ranked in grades, such as Grade 1, 2 and 3. However there were several kinds of rating scale for ankle sprain. Moreover, such information was rarely reported in the epidemiology studies and thus was not summarized in this review study.



The high incidence did not yet show the whole fact of the sports injury. For example, among the listed sports with high ankle injury and ankle sprain incidence, soccer may have the highest ankle sprain case amount as it was a very popular sport in the world. Although lacrosse showed a higher ankle sprain incidence (2.56 incidence per 1000 player-exposure) than soccer did (1.15 incidence per 1000 player-exposure), the total case amount of ankle sprain sustained in lacrosse sport may be fewer as the sport was less popular. Such information of total amount of incidence was not available from this review. Garrick and Requa<sup>[16]</sup> conducted a prospective epidemiology studies in the United States from 1979 to 1987 with 19 sports with 17750 included cases. Among these cases, most of them were sustained during running (about 4200, 24%). The total number of ankle injuries were highest in running (about 350), followed by ballet (about 220), basketball (about 130), tennis (about 90) and soccer (about 70). Although the percentages of ankle injuries were higher in soccer and basketball in Garrick and Reque's study<sup>[16]</sup>, the total case number was fewer than that of running as a result of smaller participation rate. From the results from this study, the incidence rate per 1000 player-hours was 0.02 for running, 5.20 for basketball and 6.52 for soccer. This showed that with we should also consider the popularity of a specific sport, or the total participants in this specific sport, in order to decide which sport we should select to implement injury prevention measures.

The results from this study may give sports medicine specialist some idea to decide their target sports for implementing injury prevention protocols to prevent ankle sprain. It also can serve as a standard or baseline for sports team to evaluate their injury pattern by comparing it to the reported data in this review. If a team or league recorded higher ankle injury or ankle sprain incidence than those found in the

literature, it may be necessary to closely examine the injuries, sports equipment, facilities and everything. Moreover, when injury prevention protocols were introduced to a certain population, sports medicine specialists can evaluate their effectiveness by investigating the injury patterns and incidence with the data reported in this study.

## **5. Conclusion**

Ankle injury was most common in aeroball, wall climbing, indoor volleyball, mountaineering, netball, and field event in track and field. Among ankle injury, ankle sprain was the most common injury type. In Australian football, field hockey, handball, orienteering, scooter and squash, all of the reported ankle injuries were sprain. Sprain was also very common in other sports, especially the court and team sports. In epidemiology of sports injury from general sports among countries, the knee was the most suffering body sites, preceding the ankle. In the United States, Holland and Hong Kong, ankle sprain was the most common ankle injury type. Ankle injury and ankle sprain incidences were highest in court game and team sports, such as rugby, soccer, volleyball, handball and basketball.

This systematic review provides a summary of the ankle injury epidemiology in sports. It helps sports medicine specialist in deciding which sport to implement injury prevention measures. However, one should also pay attention on the popularity of sports as a high participate rate would also significant increase the total injury cases. We suggested that ankle sprain prevention should be implemented in rugby, soccer, volleyball, handball and basketball. We should also implement ankle sprain prevention in running, as it is the most popular sport in the world with most participants.

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Table 1 – Distribution of geographical location of the included studies.

Continent	Countries
Europe (116)	United Kingdom (34), Sweden (18), Denmark (16), Holland (9), Finland (7), Germany (7), Norway (6), France (3), Greece (3), Iceland (2), Croatia (2), Czechoslovakia (1), Turkey (1), Switzerland (1), Austria (1), Belgium (1), Ireland (1), Italy (1), Spain (1), Poland (1)
N.America (77)	United States (62), Canada (11), Mexico (2), Guatemala (1), Dominica (1)
Australasia (30)	Australia (21), New Zealand (9)
Asia (11)	Hong Kong (4), Japan (2), Korea (1), Saudi Arabia (1), Singapore (1), Lebanon (1), Iran (1)
S.America (5)	Argentina (2), Brazil (2), Trinidad and Tobago (1)
Africa (1)	Nigeria (1)
N/A (15)	
Total (255)*	

\*Note: Total count exceeds the number of studies as some studies reported epidemiology findings in more than one country.

Table 2 – Period of study, population investigated, nature of study and the case number of the included studies.

Period of study	Population		Nature of study		Case		
Before 1980	17	Team	92	Prospective	171	1-100	52
1981-85	36	Public	67	Retrospective	43	101-500	113
1986-90	53	Event	35	N/A	13	501-1000	25
1991-95	56	School	25			1001-2000	13
1996-00	61	Military	2			2001-5000	13
2001-05	26	N/A	6			5001-10000	10
N/A	37					>10000	1
Total	286*		227		227		227

\* Total count exceeds the number of studies as some studies reported epidemiology findings in more than one period of time.

Table 3 – Most common injured body sites in different sports and countries

Sport	Most common injured body sites					References
Adventure Racing	Ankle (23.0)	Shoulder (11.5)	Arm (11.5)	Knee (11.0)	Trunk (11.0)	[60]
Aeroball	Ankle (80.0)	Knee (9.2)	Foot (6.4)	Hand(3.7)	Head (2.8)	[61]
American Football	Knee (21.0)	Ankle (17.0)	Shoulder (8.4)	Trunk (5.8)	Thigh (4.9)	[50,55,56,58,62-68]
Australian Football	Thigh (19.6)	Knee (12.3)	Ankle (7.9)	Leg (4.5)	Head (3.8)	[36,69-72]
Badminton	Ankle (23.5)	Knee (14.0)	Foot (12.5)	Arm (8.0)	Leg (5.4)	[73-76]
Baseball	Head (41.0)	Hand (29.0)	Leg (8.0)	Arm (6.0)	Ankle (3.5)	[58]
Basketball	Ankle (15.9)	Knee (10.7)	Trunk (6.5)	Thigh (5.4)	Leg (5.0)	[23,57,58,64,77-88]
Cardio Kickboxing	Trunk (20.0)	Knee (18.0)	Hip (11.0)	Shoulder (10.0)	Thigh (8.0)	[89]
Cheerleading	Ankle (26.2)	Knee (10.4)	Trunk (9.4)	Arm (7.0)	Head (6.9)	[26,90,91]
Cricket	Ankle (17.9)	Knee (15.8)	Shoulder (14.7)	Trunk (12.6)		[92]
Cycling	Knee (24.3)	Hand (17.7)	Leg (11.9)	Foot (11.8)		[64,77,93,94]
Dancing	Leg (19.5)	Ankle (17.4)	Trunk (13.9)	Foot (12.0)	Knee (10.4)	[12,15,49,95-99]
Equestrian	Arm (22.3)	Head (21.7)	Hand (15.6)	Thigh (8.8)	Leg (7.0)	[87,100]
Fell Walking	Head (28.8)	Ankle (24.0)	Leg (13.6)	Hand (9.1)	Trunk (7.2)	[101]
Field Hockey	Head (34.4)	Ankle (34.0)	Arm (13.6)	Knee (4.1)	Trunk (1.1)	[38]
Figure Skating	Ankle (24.5)	Leg (18.0)	Knee (15.6)	Head (9.8)	Arm (9.2)	[35,102]
Flag Football	Hand (39.0)	Knee (18.0)	Thigh (9.0)	Ankle (8.0)	Foot (4.0)	[103]
Floorball	Ankle (26.8)	Knee (17.9)	Trunk (8.3)	Head (7.8)	Foot (5.1)	[30,104]
Gaelic Football	Ankle (21.0)	Knee (13.0)	Thigh (13.0)	Shoulder (12.0)	Trunk (7.5)	[105]
Golf	Trunk (25.6)	Arm (21.2)	Shoulder (15.8)	Hand (14.9)	Head (6.1)	[106,107]
Gymnastics	Ankle (32.3)	Arm (25.9)	Knee (9.4)	Trunk (6.8)	Hand (4.4)	[14,27,87,108-112]

Handball	Hand (31.2)	Ankle (13.5)	Knee (10.7)	Arm (6.9)	Leg (6.6)	[23,39,87,113,114]
Hurling / Camogie	Hand (27.1)	Head (20.2)	Ankle (8.6)	Leg (8.4)	Head (6.5)	[115,116]
Ice Hockey	Head (21.4)	Knee (14.7)	Thigh (10.6)	Trunk (6.1)	Shoulder (5.6)	[87,117-121]
Jockey	Head (18.8)	Ankle (10.7)	Trunk (10.7)	Shoulder (9.6)	Knee (7.8)	[122]
Kitesurfing	Ankle (14.1)	Foot (14.1)	Head (13.7)	Trunk (12.9)	Knee (12.9)	[123]
Lacrosse	Knee (20.3)	Ankle (18.5)	Head (12.7)	Hand (9.9)	Shoulder (3.8)	[124]
Luging	Head (12.8)	Hand (11.3)	Trunk (8.9)	Shoulder (7.6)	Knee (7.6)	[125]
Marathon	Knee (31.7)	Foot (27.5)	Ankle (10.1)	Leg (6.8)	Thigh (1.3)	[126]
Martial Arts	Arm (45.0)	Ankle (21.0)	Head (20.0)	Trunk (5.0)	Knee (4.4)	[111,127]
Motorcycle Racing	Hand (22.4)	Arm (18.5)	Ankle (16.4)	Shoulder (14.6)	Knee (12.2)	[128,129]
Mountaineering	Ankle (40.0)	Knee (10.7)	Foot (7.9)	Leg (7.4)	Arm (5.6)	[22]
Netball	Ankle (39.8)	Knee (17.8)	Hand (10.5)	Head (8.7)	Leg (5.6)	[82,130-133]
Orienteering	Ankle (29.8)	Knee (18.1)	Leg (14.8)	Foot (13.3)	Thigh (5.0)	[134-137]
Parachuting	Ankle (32.9)	Leg (26.9)	Trunk (10.8)	Arm (3.1)	Hand (3.1)	[138,139]
Paragliding	Trunk (34.9)	Ankle (21.0)	Arm (13.4)	Knee (2.8)		[140]
Rodeo	Knee (16.9)	Trunk (12.4)	Head (11.6)	Shoulder (9.3)	Ankle (5.1)	[141]
Roller Skating	Arm (32.8)	Hand (30.6)	Ankle (7.5)	Head (3.7)	Shoulder (3.3)	[87,142-145]
Rollerblading / Inline Skating	Hand (30.7)	Arm (16.4)	Knee (12.8)	Head (10.4)	Ankle (3.6)	[58,146-148]
Rugby	Head (13.7)	Thigh (12.7)	Ankle (11.6)	Knee (9.7)	Leg (8.4)	[37,68,149-155]
Running	Knee (28.9)	Ankle (20.2)	Foot (10.5)	Leg (7.6)	Thigh (4.7)	[78,79,93,156,157]
Scooter	Ankle (30.5)	Arm (25.6)	Hand (20.7)	Knee (4.9)	Head (2.5)	[33,158]
Skateboarding	Arm (24.5)	Hand (19.8)	Head (14.2)	Ankle (13.1)	Thigh (5.0)	[87,159]

Skiing (Alpine)	Knee (32.2)	Head (11.0)	Ankle (7.6)	Leg (7.1)	Shoulder (6.5)	[13,160-167]
Skiing (Nordic / Telemark)	Knee (25.0)	Hand (13.4)	Shoulder (11.8)	Ankle (10.4)	Head (6.2)	[164,168,169]
Snowboarding / Snowblading	Hand (17.9)	Ankle (15.6)	Knee (13.9)	Head (11.0)	Shoulder (8.9)	[160,162,163,170-172]
Soccer	Ankle (21.2)	Knee (16.3)	Thigh (12.2)	Leg (9.0)	Hip (4.3)	[23,25,34,51,52,58,64,77-79,87,111,113,173-197]
Soccer (Indoor)	Ankle (23.7)	Knee (22.0)	Head (13.2)	Leg (7.4)	Foot (6.3)	[198,199]
Softball	Ankle (18.3)	Knee (11.1)	Hand (6.6)	Leg (4.4)	Head (2.2)	[28,29,200]
Speed Skating	Knee (23.4)	Ankle (14.0)	Trunk (13.5)	Leg (12.6)	Hip (11.0)	[201]
Squash	Knee (20.8)	Trunk (15.9)	Ankle (12.6)	Shoulder (7.1)	Leg (2.5)	[31,73]
Swimming	Leg (34.9)	Foot (34.9)	Ankle (8.8)	Shoulder (6.9)	Hand (5.9)	[77,93]
Taekwondo	Leg (35.0)	Trunk (11.0)	Head (10.0)	Shoulder (10.0)	Ankle (8.0)	[202]
Tennis	Trunk (16.1)	Shoulder (11.0)	Thigh (8.6)	Ankle (8.0)	Foot (7.0)	[73,203,204]
Touch	Ankle (22.6)	Leg (16.4)	Knee (14.7)	Trunk (13.0)	Thigh (8.5)	[205]
Track and Field (General)	Knee (21.8)	Leg (18.4)	Foot (13.0)	Ankle (11.2)	Hand (9.9)	[59,77,156]
Track and Field (Track)	Leg (28.1)	Thigh (18.9)	Trunk (18.7)	Ankle (9.4)	Foot (9.4)	[156]
Track and Field (Fields)	Ankle (39.2)	Thigh (26.1)	Trunk (17.4)	Knee (17.4)	Leg (8.7)	[156]
Trampoline	Arm (48.1)	Head (6.3)	Ankle (6.2)	Leg (5.3)		[206,207]
Triathlon	Knee (22.5)	Trunk (11.8)	Foot (8.7)	Shoulder (8.2)	Ankle (7.8)	[93,208,209]
Tug of War	Trunk (42.0)	Knee (17.0)	Arm (12.0)	Shoulder (11.0)	Ankle (3.5)	[210]
Ultimate	Thigh (21.2)	Knee (15.1)	Ankle (12.2)	Leg (6.2)	Foot (6.2)	[211]
Ultramarathon	Ankle (30.9)	Knee (27.0)	Leg (13.0)	Thigh (11.0)	Foot (4.0)	[212,213]
Volleyball (Indoor)	Ankle (45.6)	Arm (15.4)	Knee (11.4)	Shoulder (4.8)	Hand (4.3)	[24,53,78,79,111,214-217]
Volleyball (Beach)	Knee (18.6)	Trunk (16.4)	Shoulder (14.6)	Ankle (12.4)	Hand (8.0)	[54,215,218]



Wakeboarding	Head (57.2)	Trunk (14.4)	Ankle (8.2)	Foot (6.4)	Knee (5.3)	[219]
Wall Climbing	Ankle (60.0)	Shoulder (10.9)	Arm (7.3)	Hand (5.5)	Trunk (5.5)	[220]
Water Skiing	Trunk (27.0)	Head (25.1)	Arm (13.0)	Knee (10.5)	Thigh (8.7)	[219]
Windsurfing	Foot (17.7)	Knee (9.4)	Trunk (8.9)	Ankle (8.6)	Head (7.4)	[221]
Wrestling	Knee (21.0)	Shoulder (13.9)	Head (11.0)	Ankle (9.0)		[79,222]

\* Items with weight prevalence percentage smaller than 1.0% are omitted.

Table 4 – Most common ankle injury types in different sports and countries

Sport	Most common ankle injury types					References
Aeroball	Sprain (90.0)	Fracture (10.0)				[61]
American Football	Sprain (94.4)	Fracture (1.3)				[50,63,68]
Australian Football	Sprain (100.0)					[72]
Badminton	Sprain (86.5)	Fracture (8.6)	Strain (5.4)			[74,75]
Basketball	Sprain (91.0)	Fracture (2.1)	Abrasion (0.7)			[23,77,80,84,86,88,223]
Cheerleading	Sprain (88.0)					[91]
Cycling	Abrasion (45.5)	Contusion (36.4)	Sprain (9.1)	Cramp (9.0)		[77]
Dancing	Sprain (50.5)	Fracture (5.6)				[49,96]
Field Hockey	Sprain (100.0)					[38]
Figure Skating	Sprain (77.0)	Fracture (23.5)				[102]
Flag Football	Sprain (88.9)	Strain (11.1)				[103]
Gymnastics	Impingement (55.6)	Sprain (44.4)				[112]
Handball	Sprain (100.0)					[23,39]
Ice Hockey	Sprain (87.7)	Fracture (8.3)				[118,119,121]
Kitesurfing	Sprain (77.8)	Fracture (22.2)				[123]
Lacrosse	Sprain (87.5)					[124]
Luging	Sprain (35.0)	Fracture (22.2)				[125]
Martial Arts	Sprain (91.7)	Fracture (8.3)				[127]
Motorcycling	Sprain (31.3)					[128]
Mountaineering	Fracture (65.0)	Sprain (35.0)				[22]
Netball	Sprain (85.9)	Fracture (7.9)				[130,131]

Orienteering	Sprain (100.0)					[32,134,135]
Parachuting	Fracture (100.0)					[138]
Roller Skating	Fracture (86.5)	Sprain (13.5)				[142,143]
Rollerblading / Inline Skating	Fracture (83.3)	Sprain (16.7)				[147]
Rugby	Sprain (74.9)					[37,68,152,153]
Scooter	Sprain (100.0)					[33]
Skiing	Sprain (76.9)	Fracture (11.0)				[13,165]
Skiing (Nordic / Telemark)	Sprain (69.0)	Fracture (31.0)				[169]
Snowboarding	Sprain (53.6)	Fracture (42.5)				[170,172,224]
Soccer	Sprain (76.8)	Bruise (2.8)	Tendinitis (2.2)	Fracture (1.1)		[23,34,51,77,176,179,186,188,190,191,193-196,225,226]
Soccer (Indoor)	Sprain (87.8)					[198,199]
Softball	Fracture (74.6)	Sprain(25.1)				[28,29,200]
Speed Skating	Sprain (50.0)					[201]
Squash	Sprain (100.0)					[31]
Swimming	Cramp (66.7)	Abrasion (33.3)				[77]
Tennis	Sprain (66.7)					[204]
Track and Field (General)	Sprain (48.9)	Abrasion (17.0)	Cramp (17.0)	Strain (17.0)		[59,77]
Trampoline	Fracture (100.0)					[206]
Ultimate	Sprain (89.9)	Bruise (3.4)	Strain (3.4)	Fracture (2.0)	Laceration (1.7)	[211]
Volleyball (Indoor)	Sprain (99.3)	Fracture (0.7)				[24,217]
Wall Climbing	Fracture (57.6)	Sprain (42.4)				[220]
Windsurfing	Sprain (58.6)	Fracture (14.0)				[221]

\* Items with weight prevalence percentage smaller than 1.0% are omitted.

Table 5 – Most common injured body sites in different countries

Country	Most common injured body sites					References
Canada	Knee (20.9)	Ankle (14.0)	Head (10.0)	Trunk (8.5)	Leg (7.5)	[227]
Finland	Knee (24.3)	Ankle (12.5)	Leg (9.0)	Trunk (6.8)	Shoulder (3.3)	[228-230]
Holland	Hand (21.8)	Ankle (20.8)	Foot (13.4)	Knee (13.2)	Thigh (4.1)	[231,232]
Hong Kong	Knee (27.0)	Ankle (11.2)	Foot (10.0)	Leg (10.0)	Hand (9.1)	[77,78,233]
Saudi Arabia	Knee (27.0)	Ankle (12.0)	Arm (11.0)	Thigh (10.0)	Hand (10.0)	[234]
Sweden	Hand (19.8)	Knee (16.0)	Ankle (15.6)	Foot (15.6)	Leg (6.6)	[1]
United Kingdom	Knee (18.3)	Ankle (15.1)	Hand (8.6)	Thigh (6.2)	Trunk (6.2)	[235-239]
United States	Knee (22.1)	Ankle (12.3)	Leg (7.0)	Shoulder (5.8)	Trunk (4.9)	[80,240-244]
Sport / Country	Most common ankle injury types					References
Holland	Sprain (73.0)	Fracture (16.0)	Contusion (5.0)			[232]
Hong Kong	Sprain (33.0)	Abrasion (25.2)	Cramp (17.4)	Contusion (13.0)	Strain (11.3)	[77]
United States	Sprain (68.3)	Fracture (7.4)				[12,40,80,240,241]

Table 6 – Ankle injury incidence rate in different sports (game incidence and training incidence in bracket)

Sport	Ankle injury incidence rate			
	per 1000 person-hours	per 1000 person-year	per 1000 person-season	per 1000 person-exposure
Adventure Racing	(Game: 0.30 <sup>[60]</sup> )			
Aeroball		1.37 <sup>[61]</sup>		
American Football	0.54-4.15 <sup>[55,62,65]</sup> , 13.80 <sup>[66]</sup> )	(Game: 26.30-72.00 <sup>[50,63,67]</sup>		0.71 <sup>[245]</sup> , (Game: 1.23-6.38 <sup>[56,68]</sup> )
Australian Football	1.30-2.31 <sup>[69,71]</sup> , 3.91-4.86 <sup>[36]</sup> )	(Game:	(Game: 111.10 <sup>[72]</sup> )	
Badminton	0.68 <sup>[75]</sup>			
Baseball				0.14 <sup>[245]</sup>
Basketball	1.00-5.20 <sup>[23,81,83,85]</sup>	178.60 <sup>[223]</sup>		0.47-9.17 <sup>[57,84,245,246]</sup> , (Game: 3.62-3.77 <sup>[82,88]</sup> )
Cheerleading	0.28-0.33 <sup>[26,90]</sup>			0.21-0.34 <sup>[91,245]</sup>
Cricket	1.21 <sup>[92]</sup>			
Dancing	0.32-2.66 <sup>[12,96,98]</sup>	117.10-466.20 <sup>[95,99]</sup>	131.40 <sup>[15]</sup>	
Equestrian		0.04-10.30 <sup>[100]</sup>		
Field Hockey		1000.00 <sup>[38]</sup>		
Floorball	0.87 <sup>[30]</sup>			
Gaelic Football		374.70 <sup>[105]</sup>		
Golf			20.60 <sup>[107]</sup>	
Gymnastics	0.12-0.62 <sup>[27,110]</sup> , 1.03 <sup>[109]</sup> )	(Training: 230.80-425.90 <sup>[108,112]</sup>	40.80-46.70 <sup>[14]</sup>	

Handball	0.38-1.59 <sup>[23,39,114]</sup> , 1.32 <sup>[113]</sup>	(Game:		
Hurling / Camogie	32.88 <sup>[116]</sup>			
Ice Hockey	0.12-0.20 <sup>[118,119]</sup> , (Game: 1.53 <sup>[118]</sup> ; Training: 0.18 <sup>[118]</sup> )			0.46-0.71 <sup>[117,121]</sup>
Jockey		(Game: 64.81 <sup>[122]</sup> )		
Kitesurfing	2.0 <sup>[123]</sup>			
Lacrosse				0.47-2.66 <sup>[124]</sup>
Luging				0.45 <sup>[125]</sup>
Motorcycle Racing	3.73 <sup>[129]</sup> , (Game: 2.85-6.15 <sup>[129]</sup> ; Training: 0.00 <sup>[129]</sup> )	(Game: 4.50 <sup>[128]</sup> )		
Netball	3.27 <sup>[132]</sup>			5.26 <sup>[82]</sup> , (Game: 45.60 <sup>[130]</sup> )
Orienteering	0.82 <sup>[136]</sup> , (Game: 3.80 <sup>[32]</sup> )	571.43 <sup>[137]</sup>		(Game: 1.03 <sup>[135]</sup> )
Parachuting		0.38 <sup>[139]</sup>		0.45 <sup>[138]</sup>
Rodeo				(Game: 0.75 <sup>[141]</sup> )
Rugby	0.23-8.14 <sup>[152,153]</sup> , 5.77-14.00 <sup>[150,155]</sup> ; 0.26 <sup>[149]</sup> )	(Game: 233.40 <sup>[37]</sup> Training:		(Game: 2.72-8.88 <sup>[68,151]</sup> )
Running	0.02 <sup>[157]</sup>	62.50-111.00 <sup>[156]</sup>		
Skiing (Alpine)				0.13-3.18 <sup>[13,164,165]</sup>
Skiing (Nordic / Telemark)				0.07 <sup>[164]</sup>
Snowboarding / Snowblading				0.97 <sup>[160]</sup> , (Game: 0.13 <sup>[172]</sup> )
Soccer	0.17-6.52 <sup>[23,51,174,177-181,183,185,187,192-</sup>	71.13 <sup>[34]</sup>	10.99-1200.00 <sup>[25,182,186,190,226]</sup> ,	0.55-0.76 <sup>[245]</sup>

	197], 0.00-34.83 <sup>[113,174,176,184,191]</sup> [52] [173,177,181,188,225], 0.21-2.74 <sup>[174,177]</sup> )	(Game: [52] Training:	(Game: 39.79-143.40 <sup>[182,190]</sup> , Training: 36.35-64.00 <sup>[182,190]</sup> )	
Soccer (Indoor)	(Game: 11.49-11.68 <sup>[198,199]</sup> )			
Softball		41.70 <sup>[200]</sup>		0.41 <sup>[245]</sup>
Speed Skating		168.40 <sup>[201]</sup>		
Tennis				11.30 <sup>[203]</sup> , (Game: 0.30 <sup>[204]</sup> )
Touch	1.10 <sup>[205]</sup>			
Track and Field (General)		29.90-102.00 <sup>[59,156]</sup>		0.13-0.14 <sup>[245]</sup>
Track and Field (Track)		0.00-111.00 <sup>[156]</sup>		
Track and Field (Fields)		158.00-286.00 <sup>[156]</sup>		
Trampoline		0.02-0.05 <sup>[206]</sup>		
Triathlon	1.49-4.70 <sup>[208]</sup>			
Ultimate		(Game: 14.75 <sup>[211]</sup> )		
Volleyball (Indoor)	0.60-2.01 <sup>[24,214,215,217]</sup> , 5.50 <sup>[216]</sup> )	(Game:		0.68 <sup>[245]</sup>
Volleyball (Beach)	0.20 <sup>[215]</sup> , Training: 0.13 <sup>[218]</sup> )	(Game: 0.57 <sup>[218]</sup> ;		
Wall Climbing				0.02 <sup>[220]</sup>
Windsurfing				0.09 <sup>[221]</sup>
Wrestling				0.09-0.86 <sup>[245,247]</sup> , (Game: 2.71 <sup>[247]</sup> , Training: 0.63 <sup>[247]</sup> )





Table 7 – Ankle sprain incidence rate in different sports (game incidence and training incidence in bracket)

Sport	Ankle sprain incidence rate			
	per 1000 person-hours	per 1000 person-year	per 1000 person-season	per 1000 person-exposure
Aeroball		1.23 <sup>[61]</sup>		
American Football		59.40-60.60 <sup>[50,63]</sup>		(Game: 6.06 <sup>[68]</sup> )
Australian Football	(Game: 3.69-4.86 <sup>[36,248]</sup> )		(Game: 111.10 <sup>[72]</sup> )	
Badminton	0.53 <sup>[75]</sup>			
Basketball	1.00 <sup>[23]</sup>	173.50 <sup>[223]</sup>		0.42-1.90 <sup>[84,249]</sup> , (Game: 3.45 <sup>[88]</sup> )
Cheerleading				0.18 <sup>[91]</sup>
Cricket				
Dancing	0.08-0.30 <sup>[96,98]</sup>	155.40 <sup>[99]</sup>		
Field Hockey		1000.00 <sup>[38]</sup>		0.90 <sup>[249]</sup>
Floorball				
Gymnastics		102.60 <sup>[112]</sup>		
Handball	0.38-1.59 <sup>[23,39]</sup>			
Ice Hockey	0.05-0.12 <sup>[118,119]</sup>			0.35-0.62 <sup>[117,121]</sup>
Kitesurfing	0.4 <sup>[123]</sup>			
Lacrosse				0.39-2.56 <sup>[124,249]</sup>
Luging				0.16 <sup>[125]</sup>
Motorcycle Racing		(Game: 1.40 <sup>[128]</sup> )		
Netball				(Game: 40.06 <sup>[130]</sup> )
Orienteering				(Game: 1.03 <sup>[135]</sup> )

Parachuting				0.00 <sup>[138]</sup>
Rugby	0.15-4.20 <sup>[152,153]</sup>	233.40 <sup>[37]</sup>		(Game: 6.31 <sup>[68]</sup> )
Skiing (Alpine)				0.36-1.60 <sup>[13,165]</sup>
Snowboarding / Snowblading				(Game: 0.13 <sup>[172]</sup> )
Soccer	0.15-2.52 <sup>[23,51,174,178,179,181,193-196,250]</sup> , 0.34-4.59 <sup>[174,188,191,225,251]</sup> ; Training: 0.21 <sup>[174]</sup>	71.13 <sup>[34]</sup>	54.79-1200.00 <sup>[186,190,226]</sup>	0.73-1.15 <sup>[249]</sup>
Soccer (Indoor)	(Game: 9.65-11.68 <sup>[198,199]</sup> )			
Softball		41.7 <sup>[200]</sup>		
Speed Skating		84.20 <sup>[201]</sup>		
Tennis				(Game: 0.20 <sup>[204]</sup> )
Track and Field (General)		29.90 <sup>[59]</sup>		
Trampoline		0.00 <sup>[206]</sup>		
Ultimate		(Game: 13.30 <sup>[211]</sup> )		
Volleyball (Indoor)	1.37-1.99 <sup>[24,217]</sup>			
Volleyball (Beach)				
Wall Climbing				0.01 <sup>[220]</sup>
Windsurfing				0.05 <sup>[221]</sup>

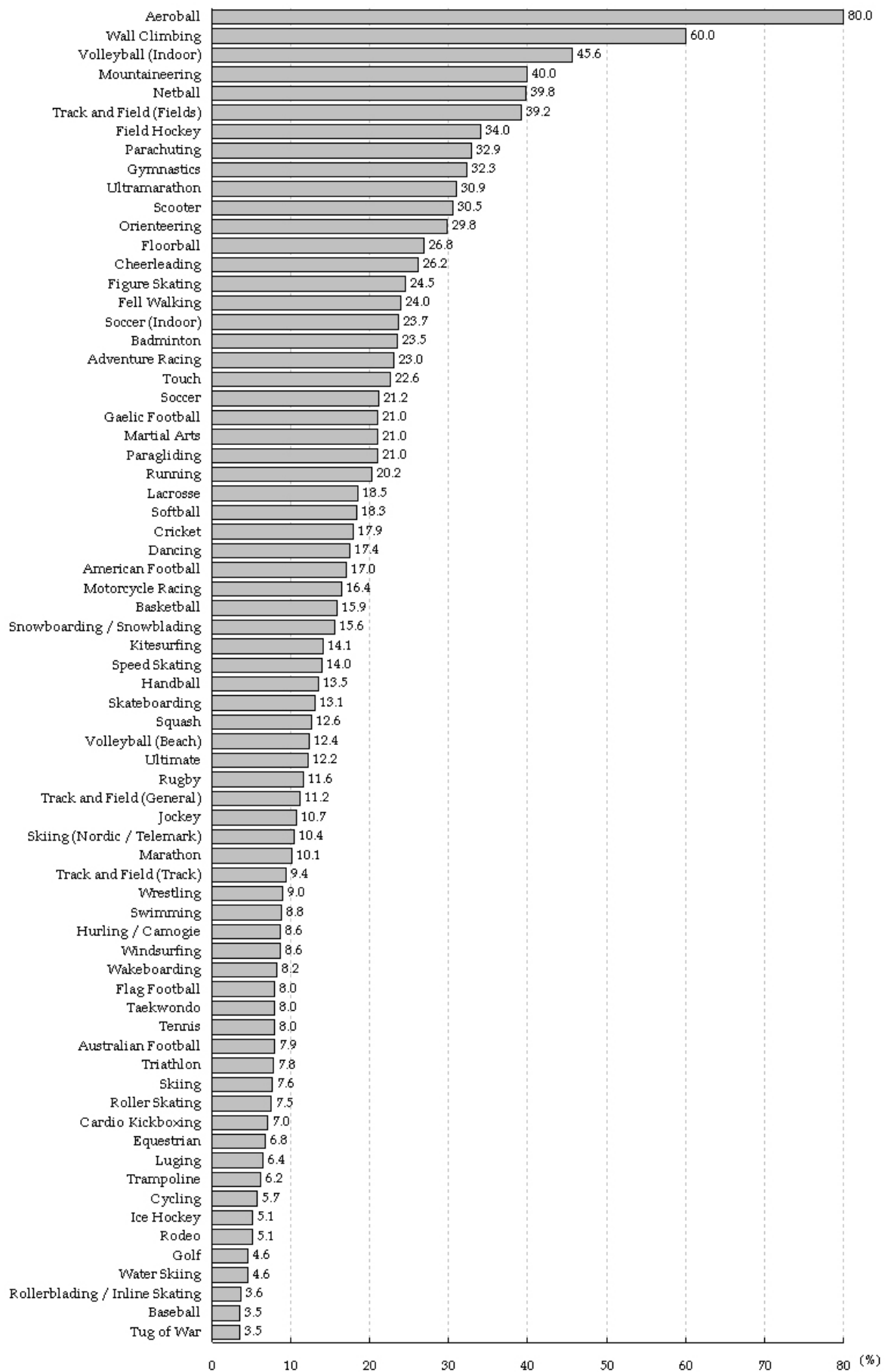


Figure 1 – Weighted percentage of ankle injury in the 70 included sports

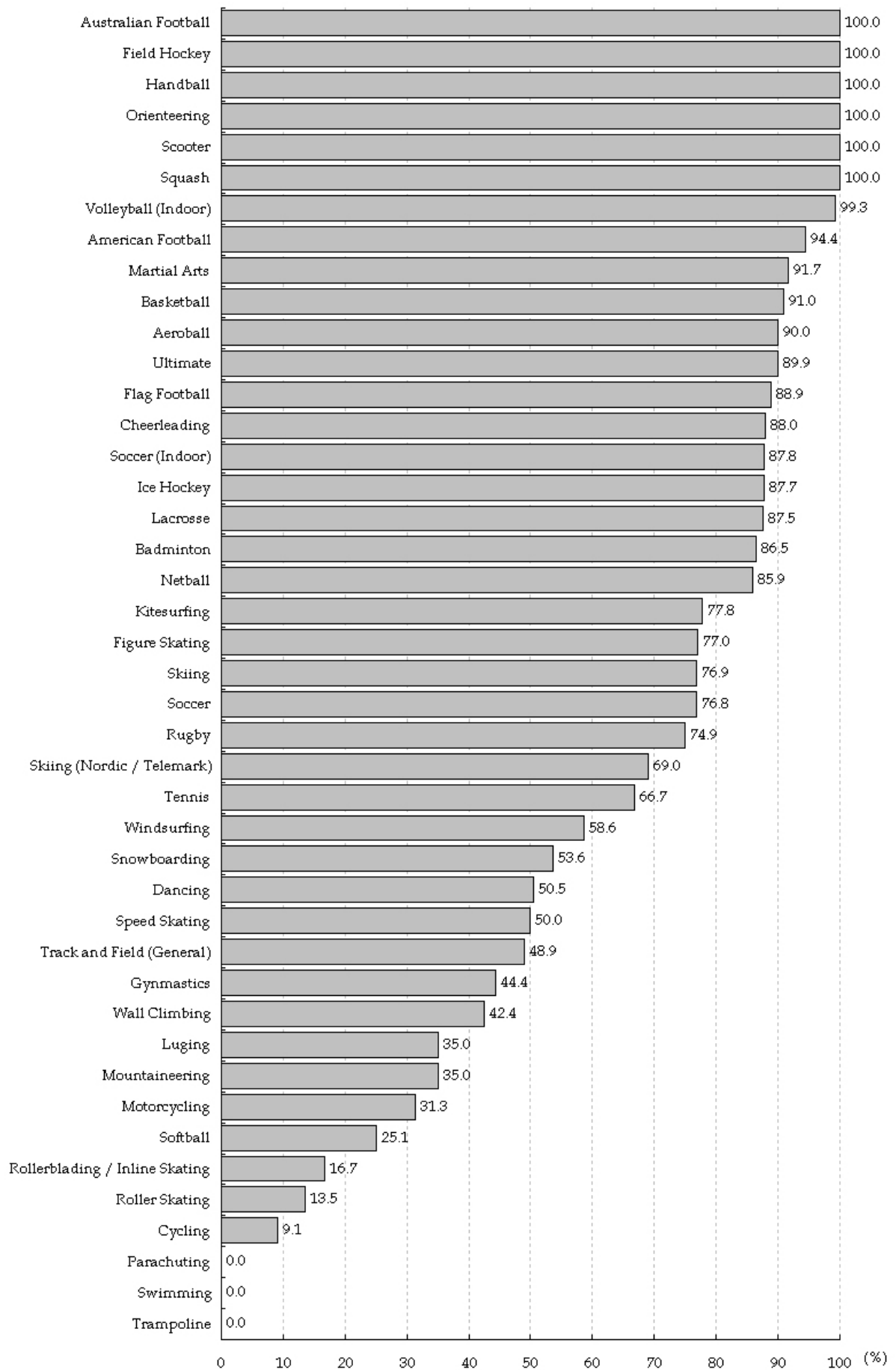


Figure 2 – Weighted percentage of ankle sprains in the 43 included sports