

Epidemiological Study on Sports Injury in Hong Kong

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ABSTRACT

This epidemiological study reported on (1) the sports injury pattern in relation to the types of sports participation (i.e. practice, stimulated competition, competition, and recreation); (2) the relationship between injuries and types of sports (team sports, individual sports and individual sports with opponent); and (3) the level of sports participation (i.e. professional, Hong Kong Team, amateur, or recreational) in relation to the practice and knowledge of "proper" warm-up among the Hong Kong sport population. It also provided information about the types of injury commonly occurred in various sports. The usual management for the injuries and the limitations caused by the injury were discussed. A total of 309 sports injured patients (189 males and 120 females) were included in this study with mean age 22.9 ± 7.8 .

The result of this study showed that most sports injuries occurred in the lower limbs (68.0%) where knee and ankle were the two most vulnerable sites (53.3% and 22.9% of all lower limb injuries). In addition, knee was the most commonly injured area in this study group (36.2% of all injuries). More than half (58.9%) of knee injuries were ligamentous sprains (46.8% of all sprains). It was found that more serious knee injuries, e.g. complete ligament torn plus/minus meniscus injury, occurred more during tournament whilst partial knee ligament injury occurred more during recreational activities. Among all injuries, ligamentous sprain (45.6%) and overuse (25.6%) were the two most common causes of sports injury in this study group. More serious injuries, such as complete ligament torn, dislocation/fracture, occurred in team sports more than that in individual sports with/without opponent ($p < 0.05$). It was statistically significant that fewer recreational players performed regular warm-up ($p < 0.05$) and that they usually spent less time in warm-up exercise than the other three groups ($p < 0.05$). Nearly one-third of athletes (32.7%) had sought more than one source for injury management. These included a combination of general physician, massage, bone setter, or others (acupuncture, physiotherapy, chiropractor, etc.).

More direct body contact is involved in team sports, especially if there is foul play. This resulted in more serious injuries that required hospitalization. It is suggested that a strict observation to rules and regulation is important in order to avoid foul play or unnecessary body contact which might result in serious sports injuries. A proper warm-up before sports activity is essential to prevent sports injuries. However, it was found that the function and procedure of a "proper" warm-up has not been fully understood by most athletes especially those recreational athletes. Although the concept of warm-up is somewhat better in elite and professional athletes, it is still inadequate. Education should be provided to coaches as well as to the general sports population in the importance and the correct way of warm-up. Around one-third of athletes had consulted more than one medical source for treatment of their injury since it usually takes months before they could consult an orthopedic specialist or sports medicine doctor. A better appointment system to arrange the injured athletes to consult the sports medicine specialist should be established. This would help athletes to return to sports more rapidly.

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I. INTRODUCTION

In recent year, sports activities become more and more popular in Hong Kong. Majority of people in Hong Kong participate in various types of sports either for recreational or amateur purpose. There are also a comparatively small number of elite athletes and professional athletes. Previous studies on sports injuries in Hong Kong have provided information on the types of injuries in certain sports, as well as the condition and areas of injuries³⁻⁵. However, a comprehensive report on sports injuries related to different categories of sports participation or a report in comparing different types of injuries among different sports is lacking.

The aim of this study is to provide a deeper insight into sports and their related injuries. The injury pattern in relation to the types of sports participation (i.e. practice, training competition, competition, and recreation) when injury occurred would be investigated. The relationship between injuries and types of sports (team sports, individual sports, and individual sports with opponent) would be analyzed. The level of sports participation (i.e. professional, Hong Kong Team, amateur, or recreational) in relation to the practice and knowledge of a "proper" warm-up would be questioned and data would be analyzed.

It is hoped that the information provided in this study can assist coaches, sports instructors, physical educator to have a better understanding in various sports and their related injuries. This information is important when they are coaching because they will be more aware of the possible causing/risk factors in certain sports and take precaution accordingly. Coaches and physical instructors also need to educate the sports population on the importance of warm-up and sports injuries prevention program.

II. METHODOLOGY

This study was carried out at the Sports Injury Clinic in the Prince of Wales Hospital and the Sports Medicine Department in the Hong Kong Sports Institute from August 1994 to April 1995. All clients who attended the Sports Injury Clinic in the Prince of Wales Hospital and the Sports Medicine Department in the Hong Kong Sports Institute are requested to complete a questionnaire. The research assistant will be there to ask all questions and record all the answers. This helps avoid misinterpretation in any parts of the questionnaire. Patients from the hospital represent more of the general sports population, whilst athletes from the Sports Institute represents more of the elite and professional groups in the Hong Kong sports field.

A questionnaire used for data collection had been designed. The initial design consisted of 15 questions covering three aspects of an injury: the background of the patient, nature of the injury, and the process that involved. A pilot study was conducted to refine the draft questionnaire. It was carried out on 32 patients. The draft was then modified according to the identified needs.

The final modified questionnaire consists of 20 questions (Appendix I). This questionnaire consists of four main parts: Part 1, demographic data, such as gender, age, sports type, etc.; Part 2, injury data, such as nature and body part of injury, definitive diagnosis, etc.; Part 3, information related to the corresponding sport activity, such as years of experience, the practice of warm up exercise, the use of protective aids, surface ground played, etc.; and Part 4, injury management, such as types of treatment and consultancy, and restrictions to activities, etc.

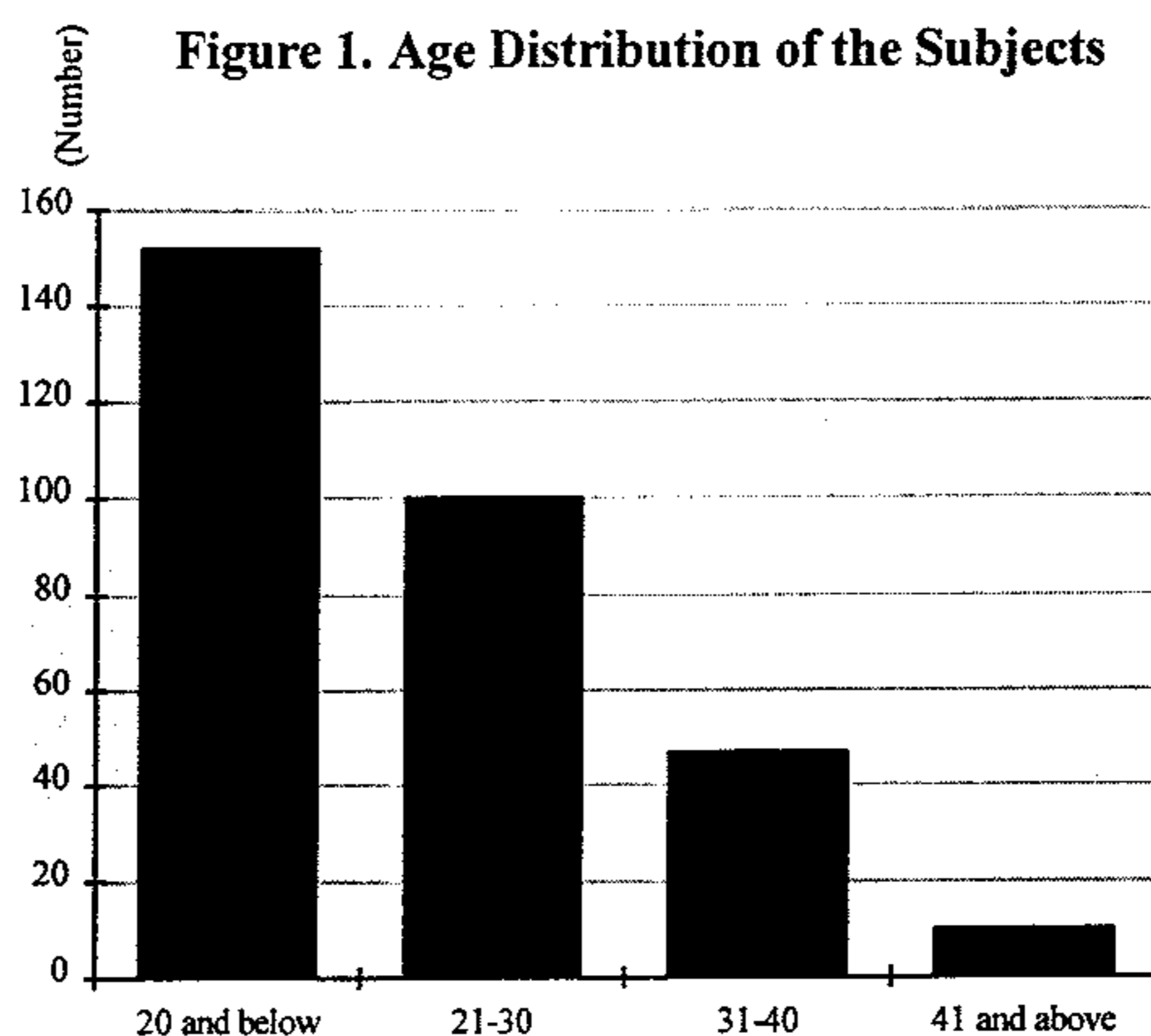
Data Analysis

Data collected was analyzed by the computer software SPSS 5.0 (Statistical Package for the Social Sciences). Descriptive data, e.g. frequency counts, percentages, means and standard deviation were computed. Chi-square test was used to test for any significant difference between groups. Statistical significance was set at $p < 0.05$ in this study.

III. RESULT

DEMOGRAPHIC DATA

In this study, a total of 309 injury data was collected for data analysis. All subjects involved in this study were from the Sports Injury Clinics in the Prince of Wales Hospital and the Hong Kong Sports Institute. All of them reported that they had sustained injury either during exercise or sports activities. There were 189 male subjects and 120 female subjects. Their mean age was 22.9 ± 7.8 years, 63.1% of the subjects were between 17-30 years old, with age ranging from 9 to 55 years. (Figure 1).



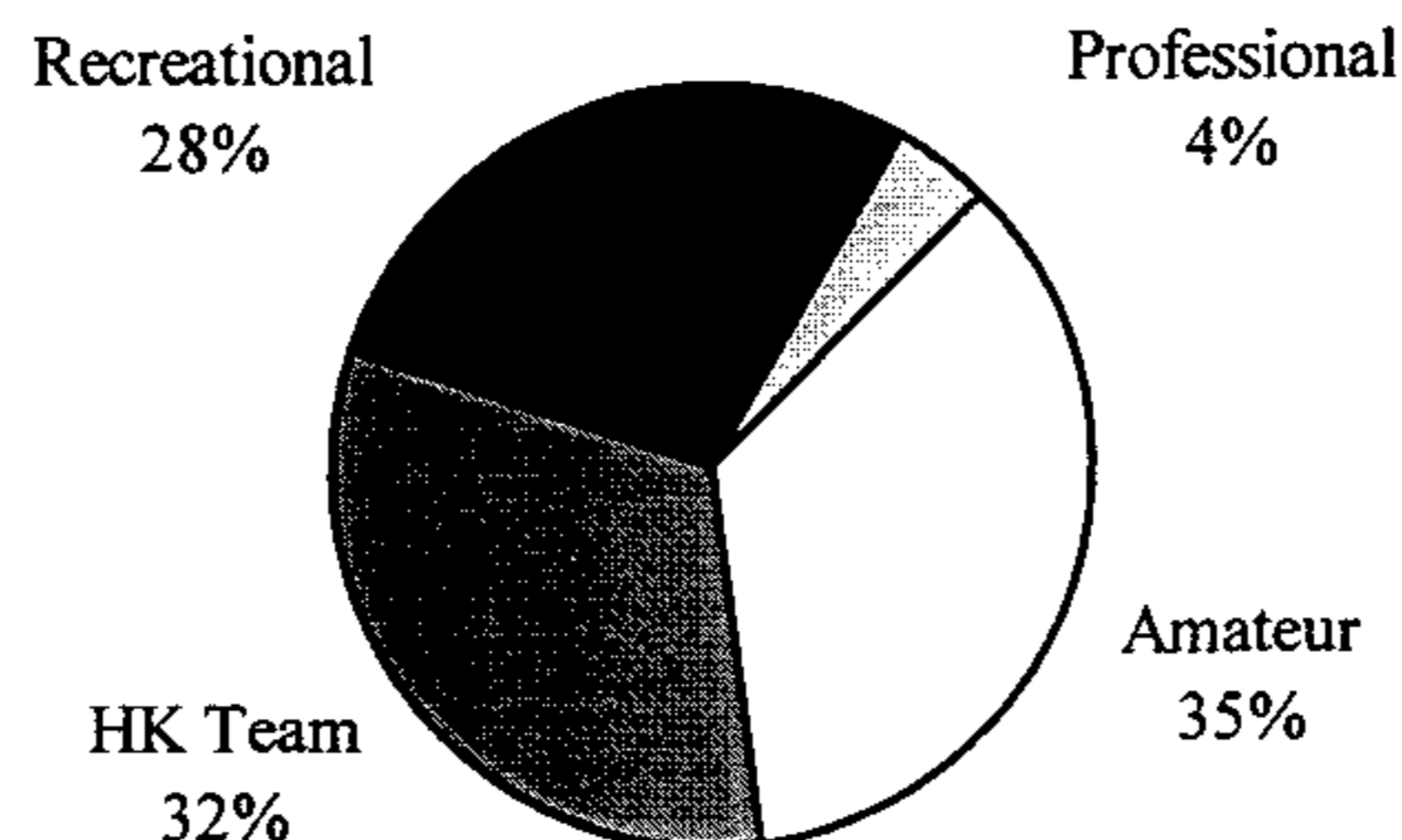
CLASSIFICATION

In this study, these 309 subjects participated in a total of 38 different sports. The five most common sports with injuries in this study were soccer, badminton, basketball, gymnastics and track (Table 1). All these sports are classified into three main categories according to the nature of the sports: (1) Individual sports with opponent ($n = 79$), (2) Individual sports ($n=122$), and (3) Team sports ($n = 108$) (Table 1). The subjects are also classified into either one of the four types of athlete's group according to the competitive level: (1) professional athlete, (2) elite athlete representing Hong Kong Team, (3) amateur team players representing league/university/school/etc., or (4) recreational player. (Figure 2)

Table 1. Different Type of Sports Involved in Each Category (n = 309)

	Number of sample, n	Percent, %
Individual Sport with Opponent (n = 79)		
Badminton	35	44.3
Tennis	12	15.2
Fencing	12	15.2
Squash	10	12.7
Table Tennis	4	5.1
Judo	4	5.1
Boxing	1	1.3
Taekwondo	1	1.3
Individual Sport (n = 122)		
Gymnastics	22	18.0
Track	21	17.2
Rowing	19	15.6
Cycling	9	7.4
Field	7	5.7
Swimming	6	4.9
Windsurfing	6	4.9
Skiing	5	4.1
Horse Riding	4	3.3
Bowling	3	2.5
Wushu	3	2.5
Hiking	2	1.6
Dancing	2	1.6
Weight Lifting	2	1.6
Rock climbing	2	1.6
Triathlon	2	1.6
Roller-skate	1	0.8
Orienteering	1	0.8
Ice Shutting	1	0.8
Shooting	1	0.8
Minicar Racing	1	0.8
Trampoline	1	0.8
Duathlon	1	0.8
Team Sport (n = 108)		
Soccer	62	57.4
Basketball	26	24.1
Volleyball	12	11.1
Handball	3	2.8
Hockey	2	1.9
Softball	2	1.9
Netball	1	0.9

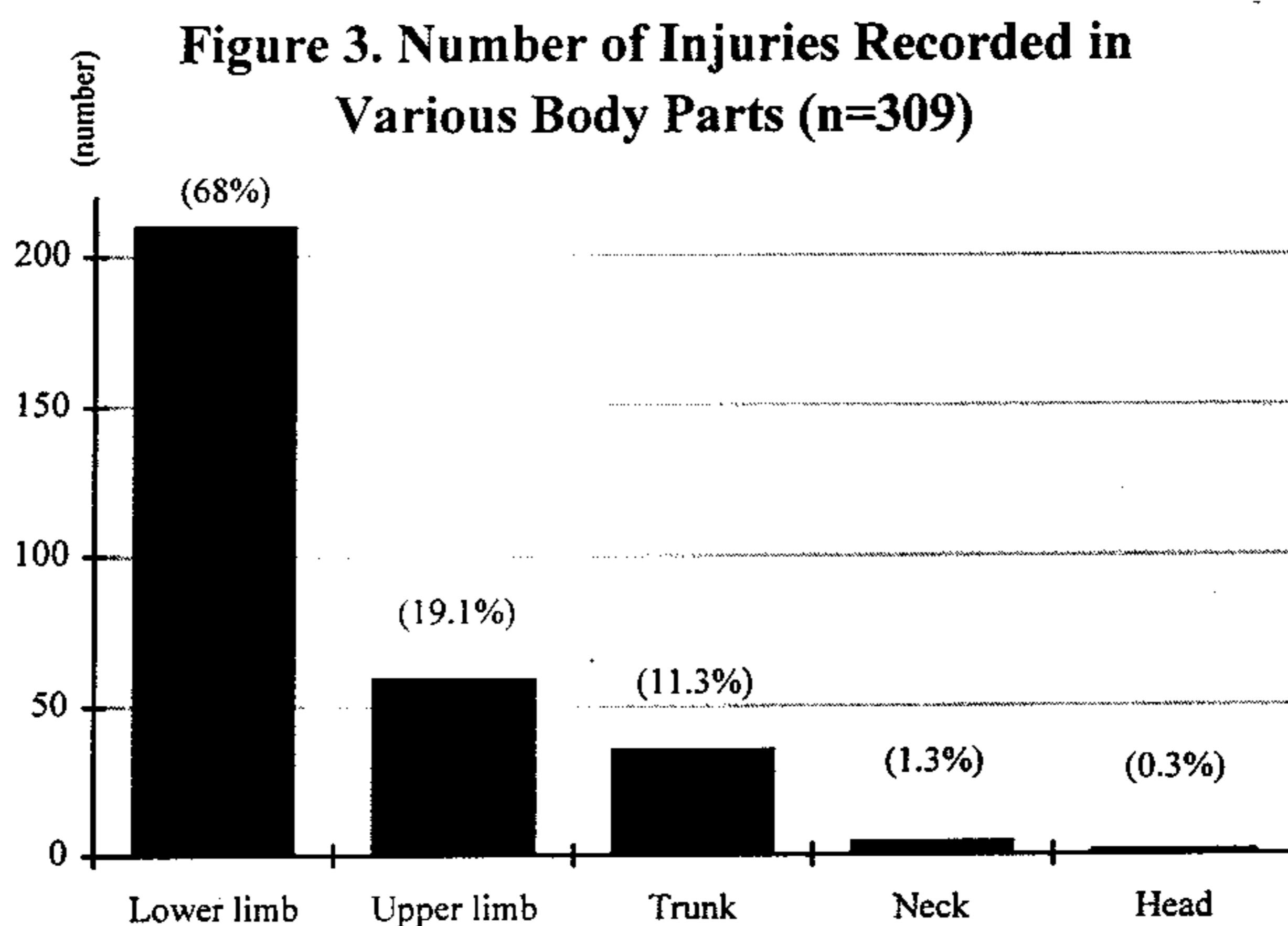
Figure 2. Classification of Athletes According to Their Competitive Level (n=309)



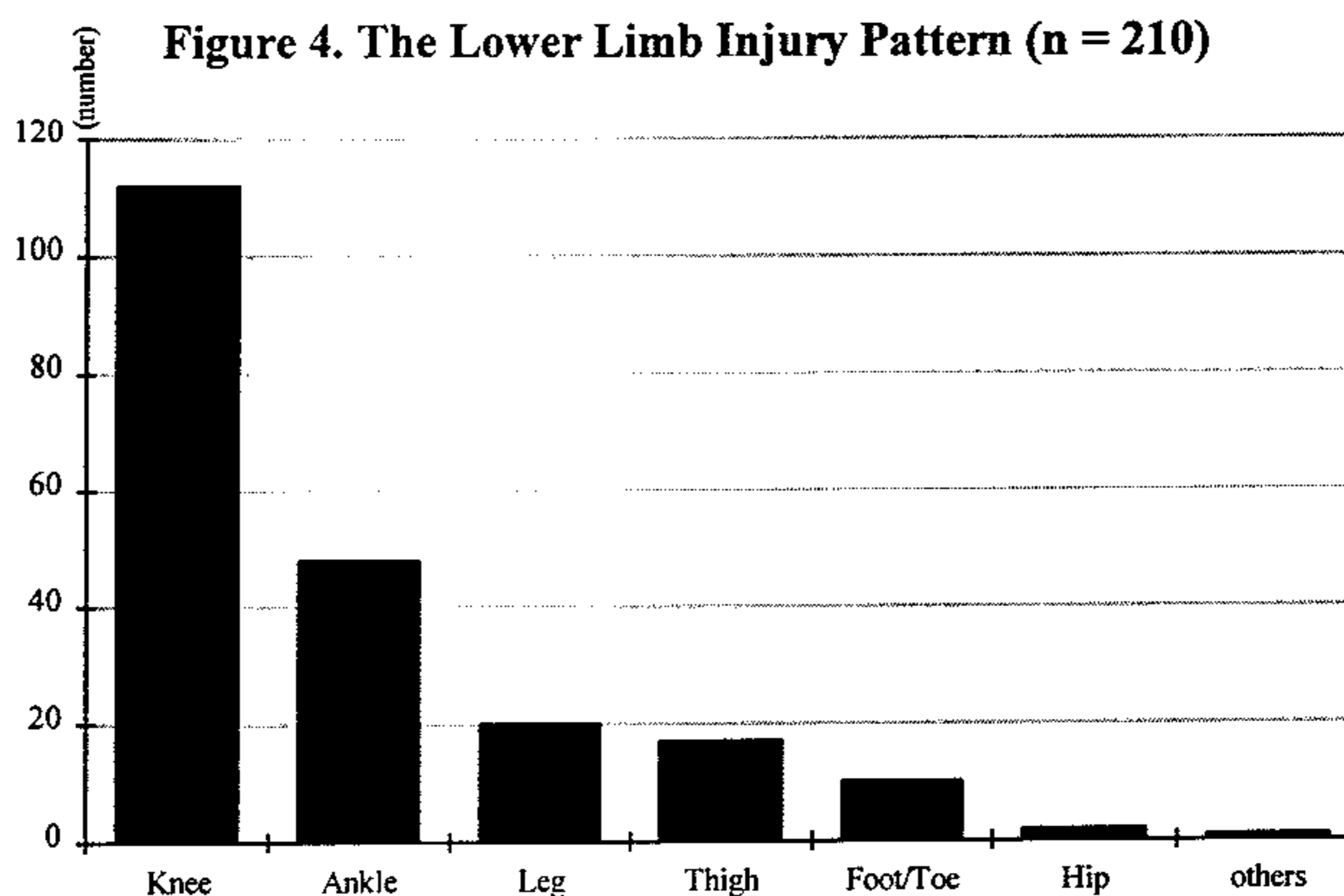
OVERALL INJURY PATTERN

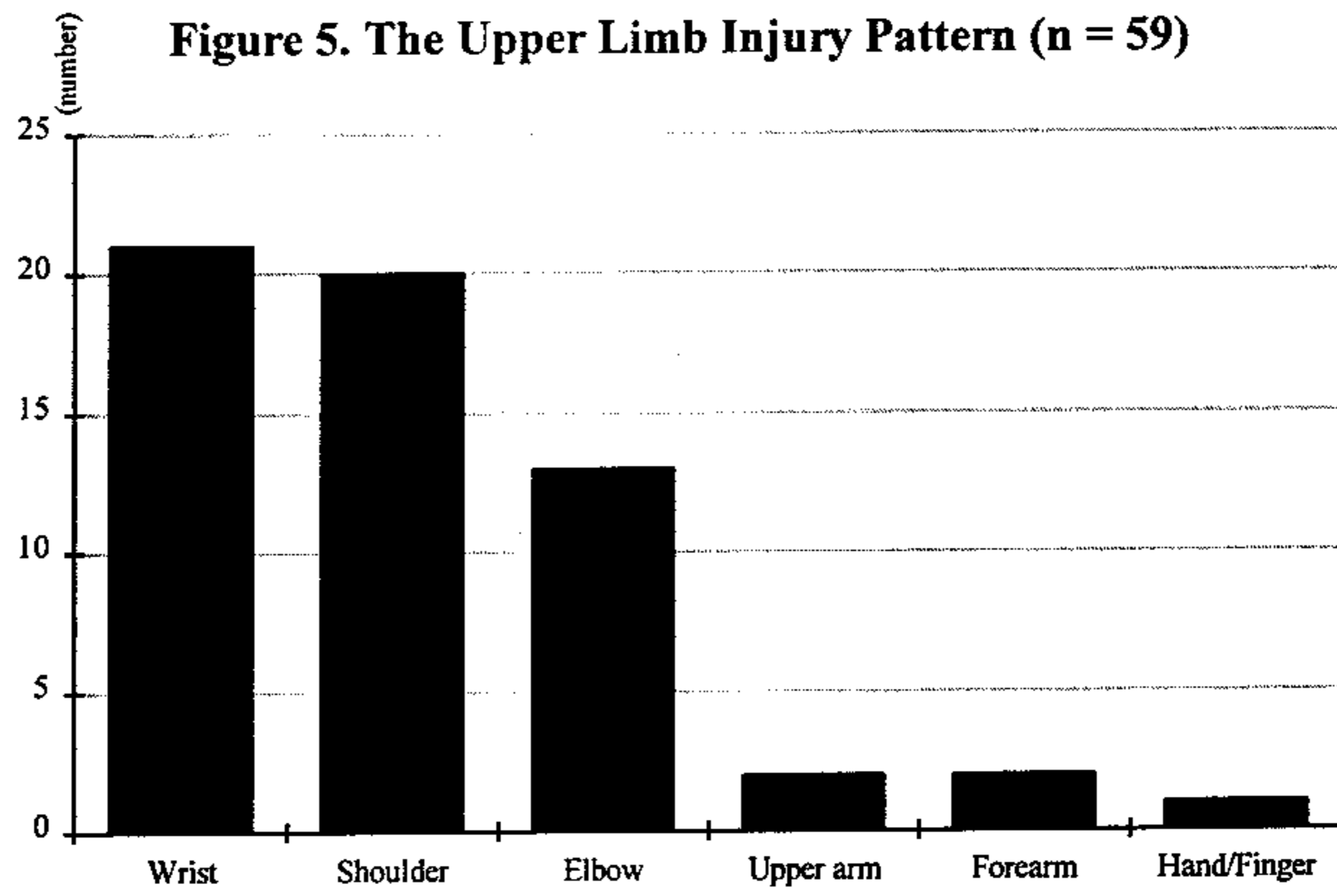
Injury Pattern in Relation to Body Parts

Of these 309 injury cases, 68.0% of the cases were lower limbs injuries, 19.1 % were upper limbs injuries. While trunk, neck and head injuries accounted for 11.3%, 1.3% and 0.3% of the total number of injuries respectively. (Figure 3)



Among all lower limb injuries, knees and ankles were the two most commonly injured areas which accounted for 53.3% and 22.9% of all lower limb injuries and 36.2% and 15.5% of the total number of injuries respectively (Figure 4). In upper limb injuries, wrist and shoulder were the two commonly injured areas which accounted for 35.6% and 33.9% of all upper limb injuries and 6.8% and 6.5% of the total number of injuries (Figure 5).

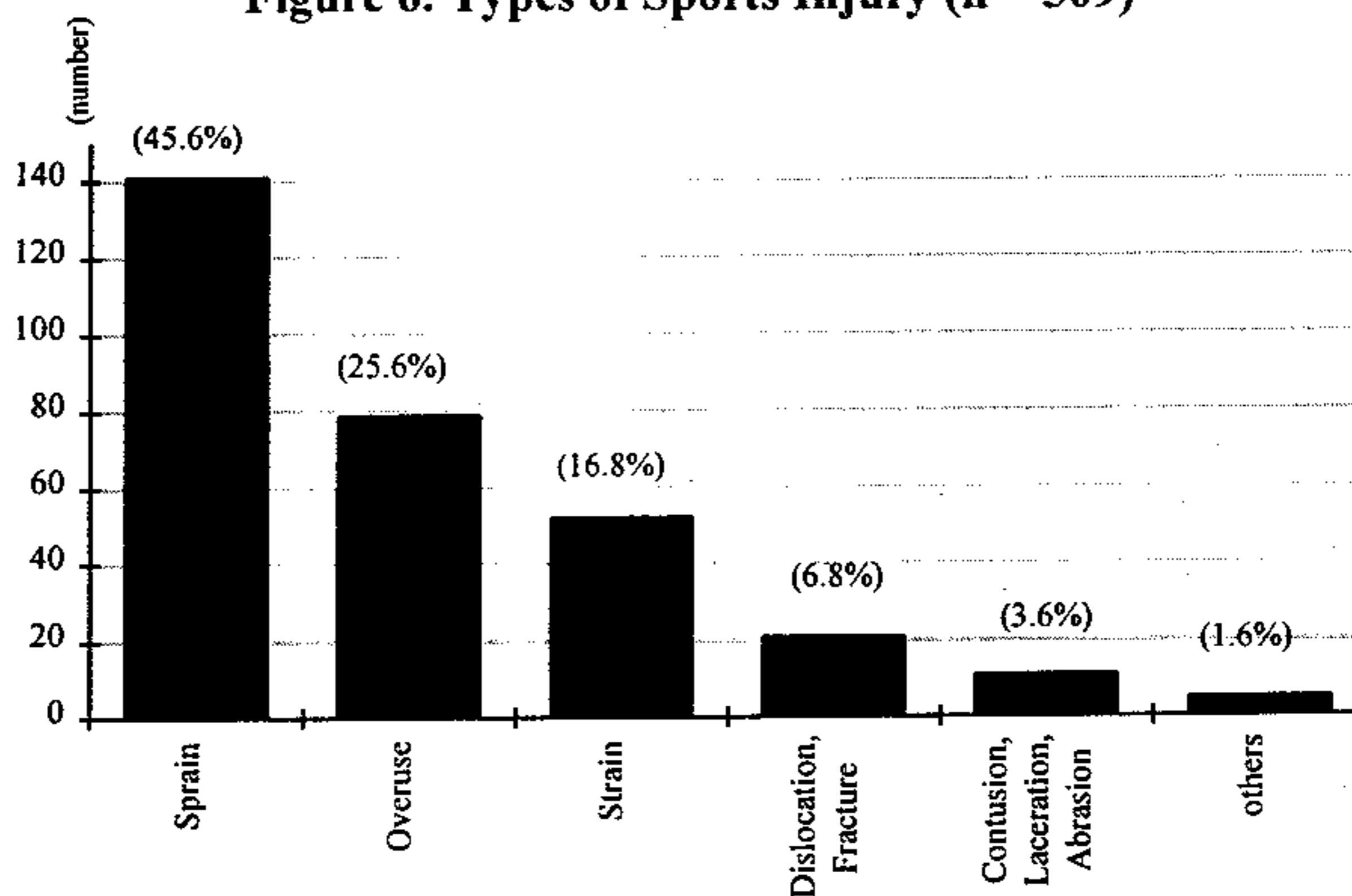




Types of Injury

In this study, ligamentous sprains were the most common type of injury, which accounted for 45.6% of all injuries. Overuse injuries were the second common injury which accounted for 25.6% of all injuries. Muscle strain, dislocation/fracture, contusion/laceration/abrasion accounted for 16.8%, 6.8% and 3.6% of all injuries respectively. (Figure 6)

Figure 6. Types of Sports Injury (n = 309)



It was found that ligamentous sprains occurred more often around knee, ankle, wrist, and lower back. Overuse injuries commonly occurred in knee, lower leg, elbow and shoulder regions. Muscle strain usually occurred in the thigh area. Dislocations/fracture occurred more around the shoulder region (35% of shoulder injuries were dislocation/fracture).

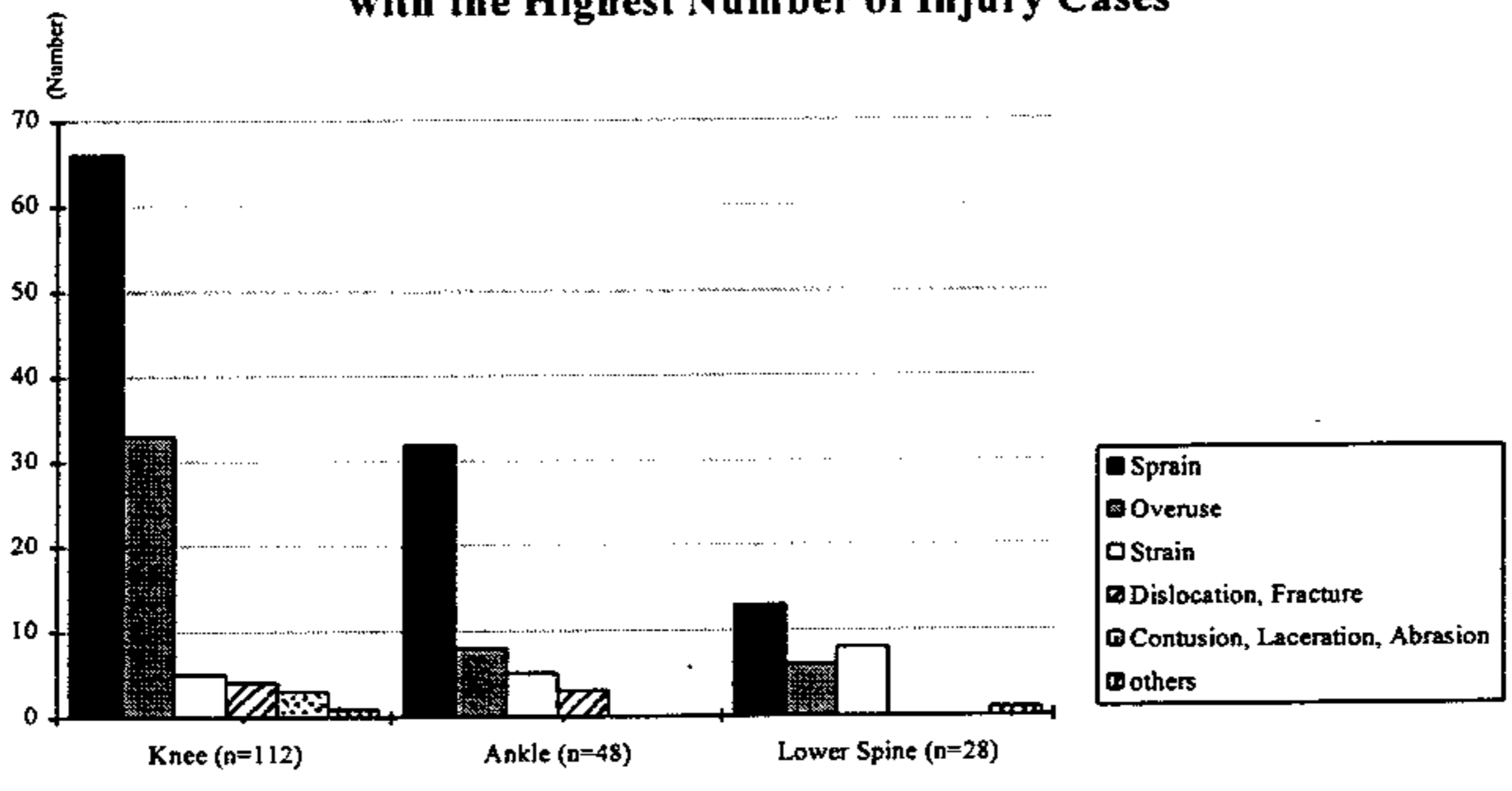
The Areas of Injury

Knee was the most commonly injured area in this study group. Knee injuries accounted for 36.2% (112 cases) of the total number of injuries. 58.9% (66 cases) of knee injuries were ligamentous sprains. Among these 66 cases, there were 29 cases of partial ligament torn and 37 cases of complete ligament torn ± meniscus injury. Besides sprain, there were 33 cases (29.5%) of overuse injury in the knee, five cases (4.5%) of muscle strain around the knee joint and four cases (3.6%) of dislocation/fracture around the knee joint. (Figure 7)

The second commonly injured area was the ankle joint. It accounted for 15.5% (48 cases) of the total number of injuries. 66.7% (32 cases) of ankle injuries was ligamentous sprain, and 16.7% (8 cases) were overuse injuries (i.e. tendinitis) around the ankle region. There were three cases (6.3%) of dislocation/fracture around the ankle joint. (Figure 7)

The third commonly injured area was the lower back. It accounted for 9.1% (28 cases) of the total number of injuries. 13 cases (46.4%) of back injuries were ligamentous sprain and eight cases (28.6%) were muscle strain to the lower back. (Figure 7)

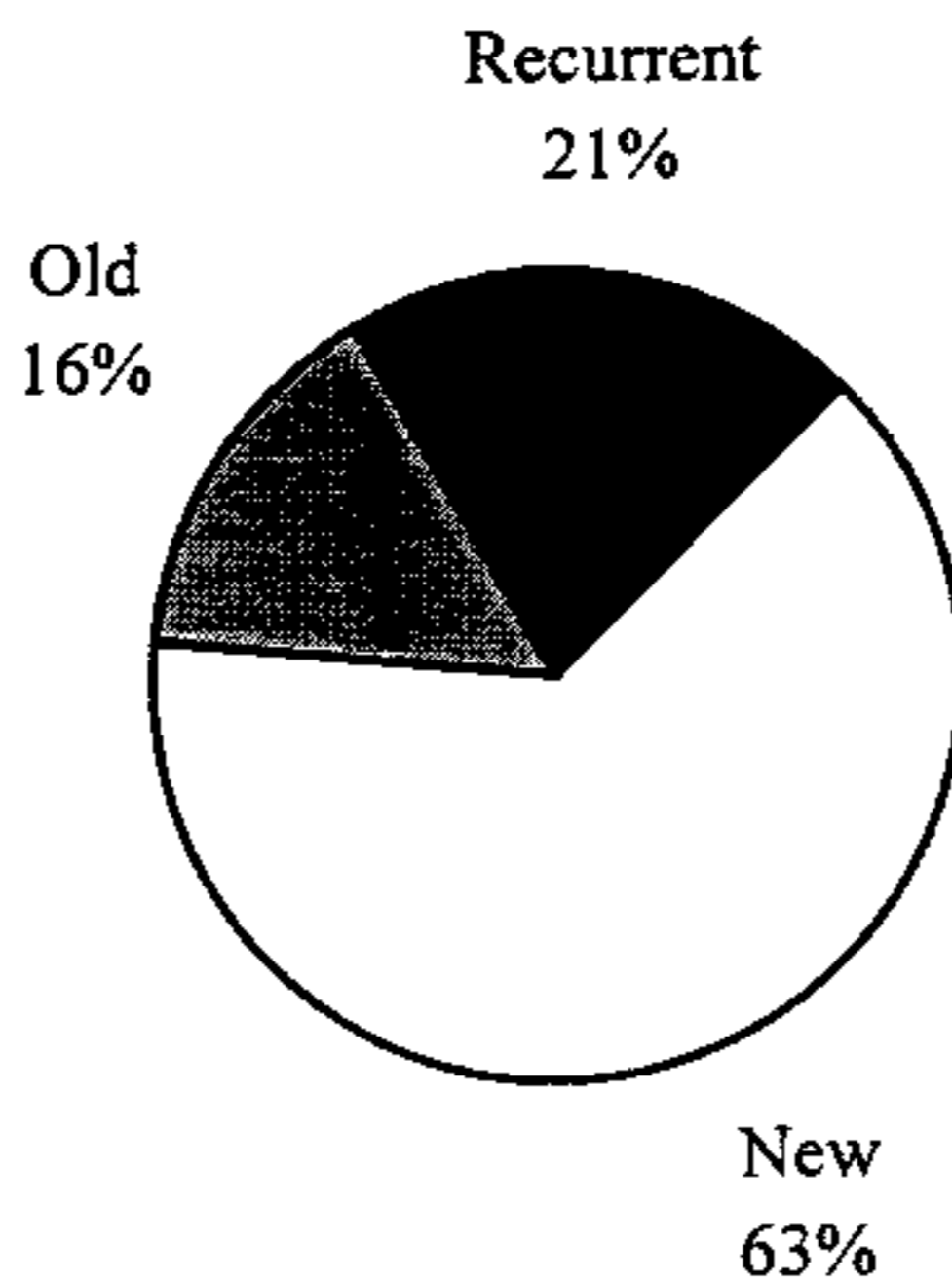
Figure 7. Types of Sport Injury in Three of the Locations with the Highest Number of Injury Cases



Nature of Injury

In this study, 63% of the injuries were new injuries, that is, the athletes had never sustained the same kind of injury before. Twenty-one percent of the injuries were recurrent, of which 10.7% (33 cases) had recurrent injury to same area for at least three times or more. Sixteen percent of the injuries were of the chronic type. (Figure 8)

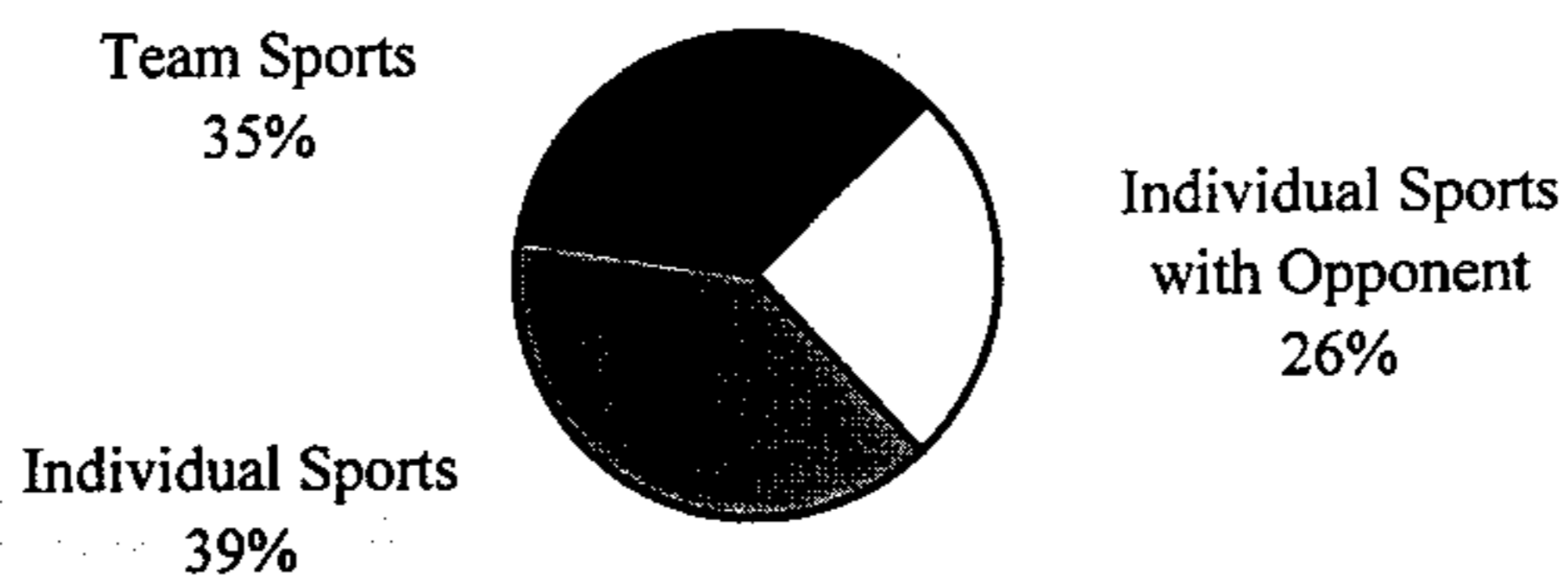
Figure 8. Nature of Injuries (n=309)



INJURY PATTERN - WITH THE CLASSIFICATION OF ATHLETES IN RELATION TO TYPES OF SPORTS

In this part of data analysis, subjects were classified into three main categories. They were: (1) Individual sports athletes (39%), (2) Individual sports athletes with opponent (26%), and (3) Team sports athletes (35%) (Figure 9). The distribution of various sports in each category was as illustrated in Table 1.

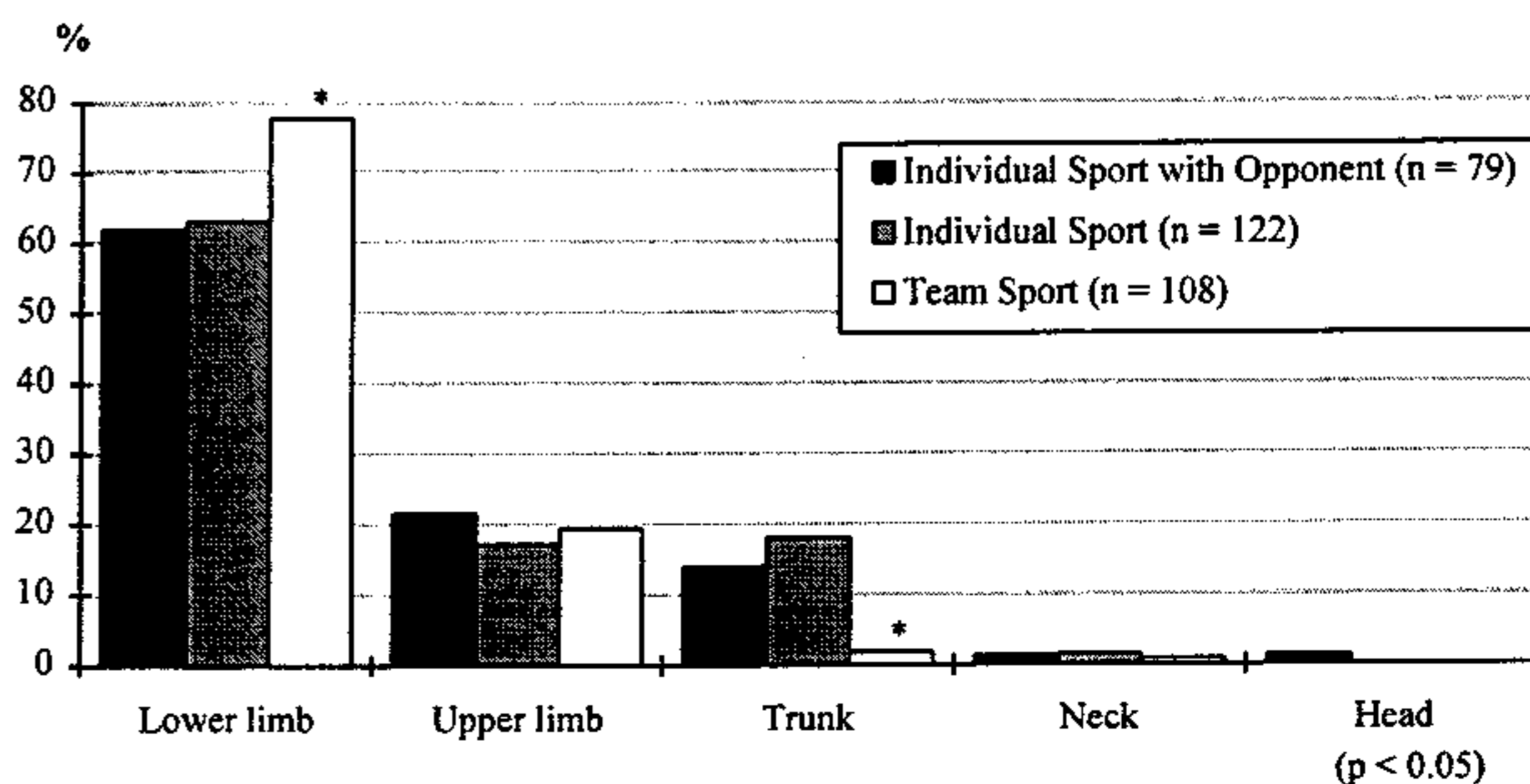
Figure 9. Classification of Athletes According to Types of Sports (n = 309)



Injury in Relation to Body Parts

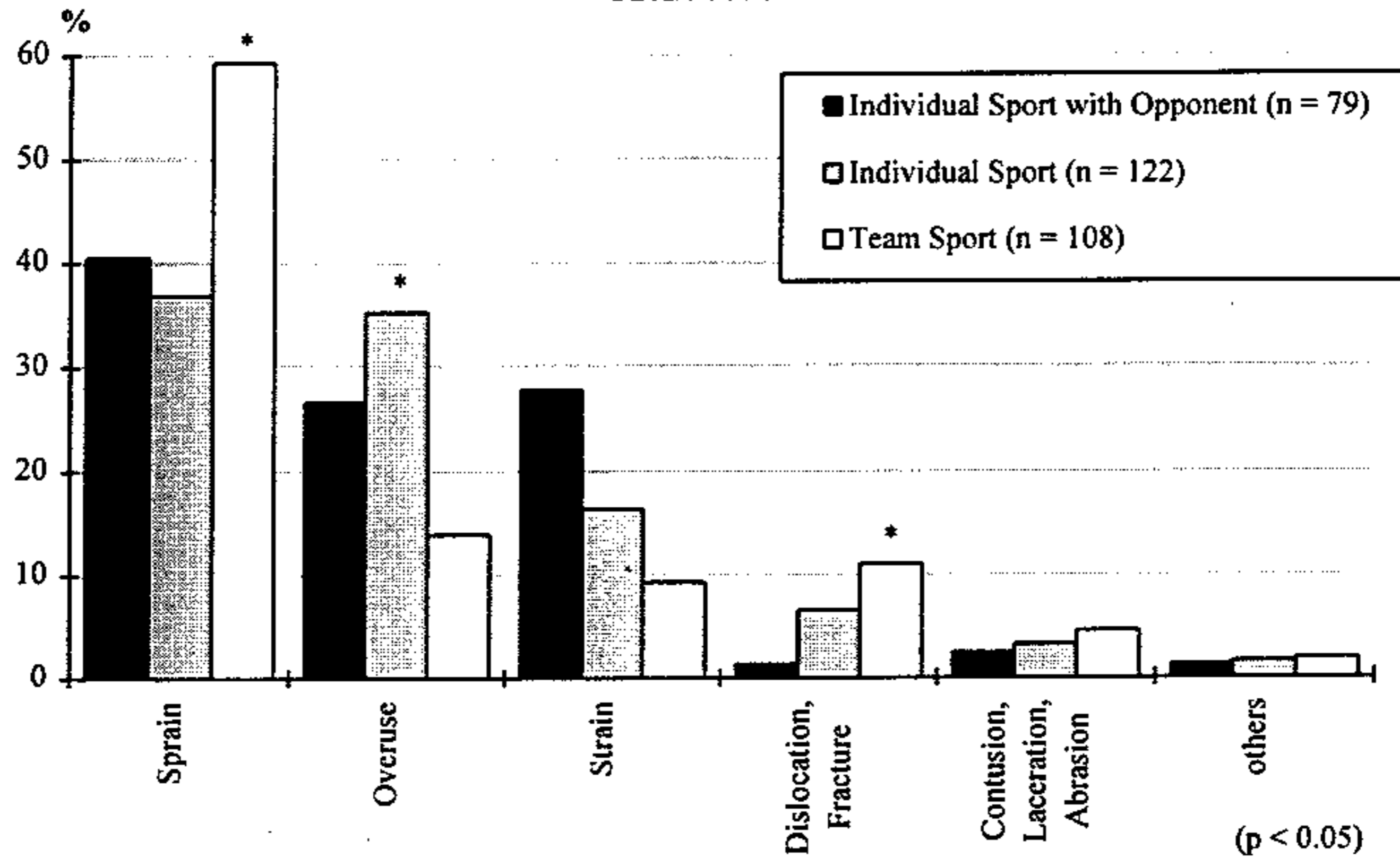
Among the three groups of athletes, there was no significant difference in the incidence of injuries in different body parts, except for team sports athletes. Athletes in team sports had a significantly higher incidence of lower limb injuries than athletes in individual sports with opponents and athletes in individual sports ($p=0.025$). Besides, athletes in team sports had a significantly lower incidence of trunk injuries than athletes in the other two groups ($p=0.0004$). (Figure 10)

Figure 10. Injuries in Various Body Part in the Three Categories of Athletes



When comparing types of injury sustained within the three groups of athletes, it was found that athletes in team sports group had a significantly higher incidence of sprain ($p=0.005$) and dislocation/fracture ($p=0.03$) than athletes in individual sports with opponent group and individual sports group. However, athletes in individual sports with opponent group had a higher incidence of strain than athletes in team sports group and individual sports group. Athletes in team sports had a comparatively lower incidence of overuse injuries than the other two groups. (Figure 11)

Figure 11. Types of Injury in the 3 Categories of Athletes



Review of Injury Data in the Three Categories of Athletes by Sports

In order to have a more detailed analysis of sports injuries among the three categories of athletes, two of the sports in each category with the highest number of injury cases were reviewed.

Individual Sports

In this category, gymnastic and track events were the two sports with the highest number of injury cases recorded.

In gymnastic, a total of 22 injury cases were recorded. Fifty percent (11 cases) of the injuries occurred in lower limbs, 27.3% (6 cases) of the injuries occurred in upper limbs, 18.2% (4 cases) were back injuries, and there was one case of neck injury (Figure 12). Among these injuries, 50% (11 cases) of the cases were ligamentous sprain which included three cases of ankle sprain, two cases of wrist sprain; and 31.8% (7 cases) of the cases were overuse injuries which included back, elbow, knee and ankle with no specific pattern. There was one case of elbow dislocation (Figure 13).

In track event, a total of 21 injury cases were recorded. 95.2% (20 cases) of injuries occurred in lower limb. Among the lower limb injuries, lower leg was the most commonly injury site. It comprised of 30.0% (6 cases) of all lower limb injuries in track athletes. Most of the injuries in track athletes were overuse injuries (38.1%) which occurred mainly in the knee and lower leg. Followed by muscle strain (33.3%) which

occurred mainly in the thigh; and ligamentous sprain (28.6%) which occurred mainly in ankle region. There were no major injury like fracture or dislocation recorded in the track athletes.

Figure 12. Injury to Various Body Parts in Six of the Sports with the Highest Number of Injury Cases

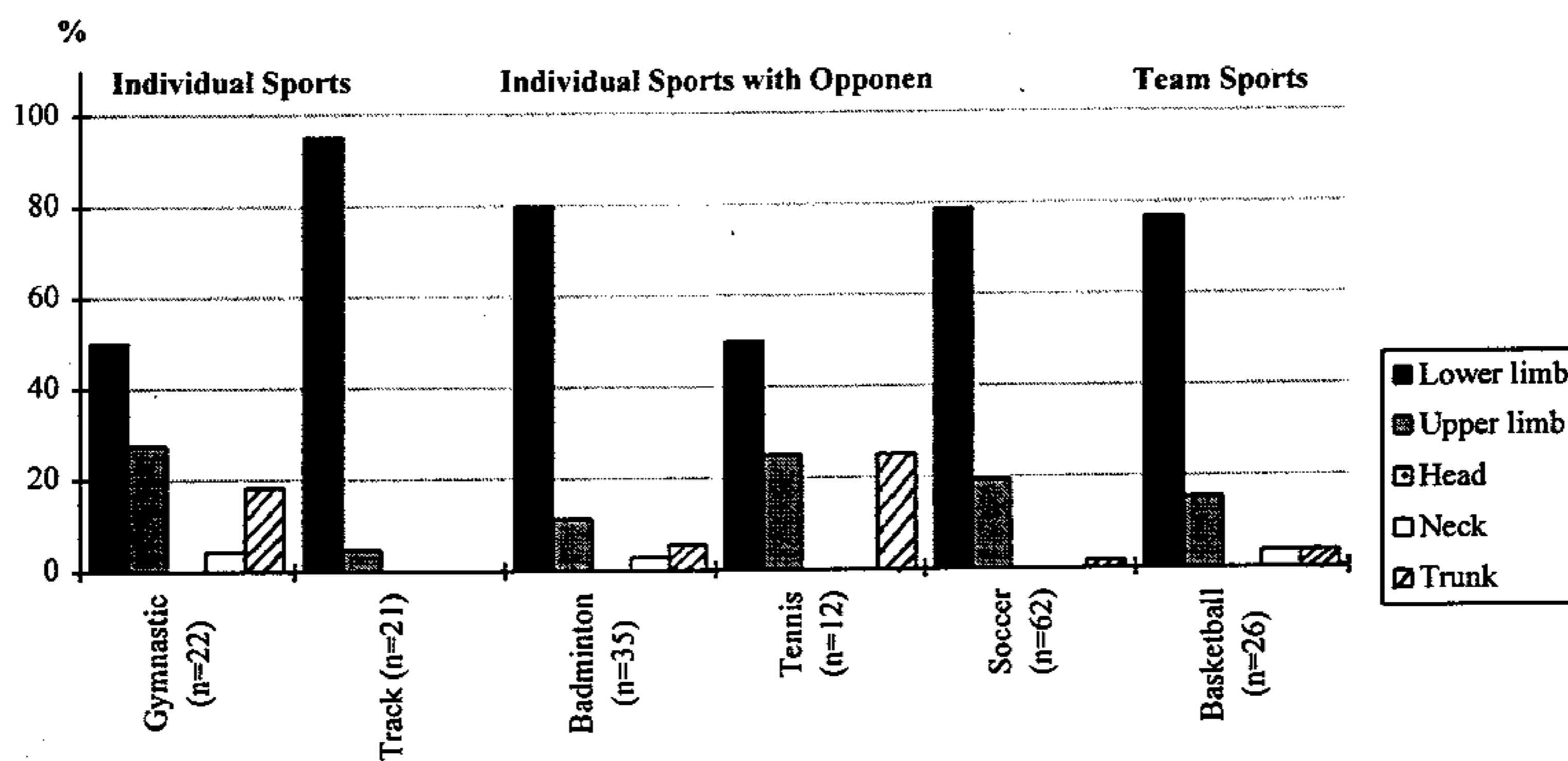
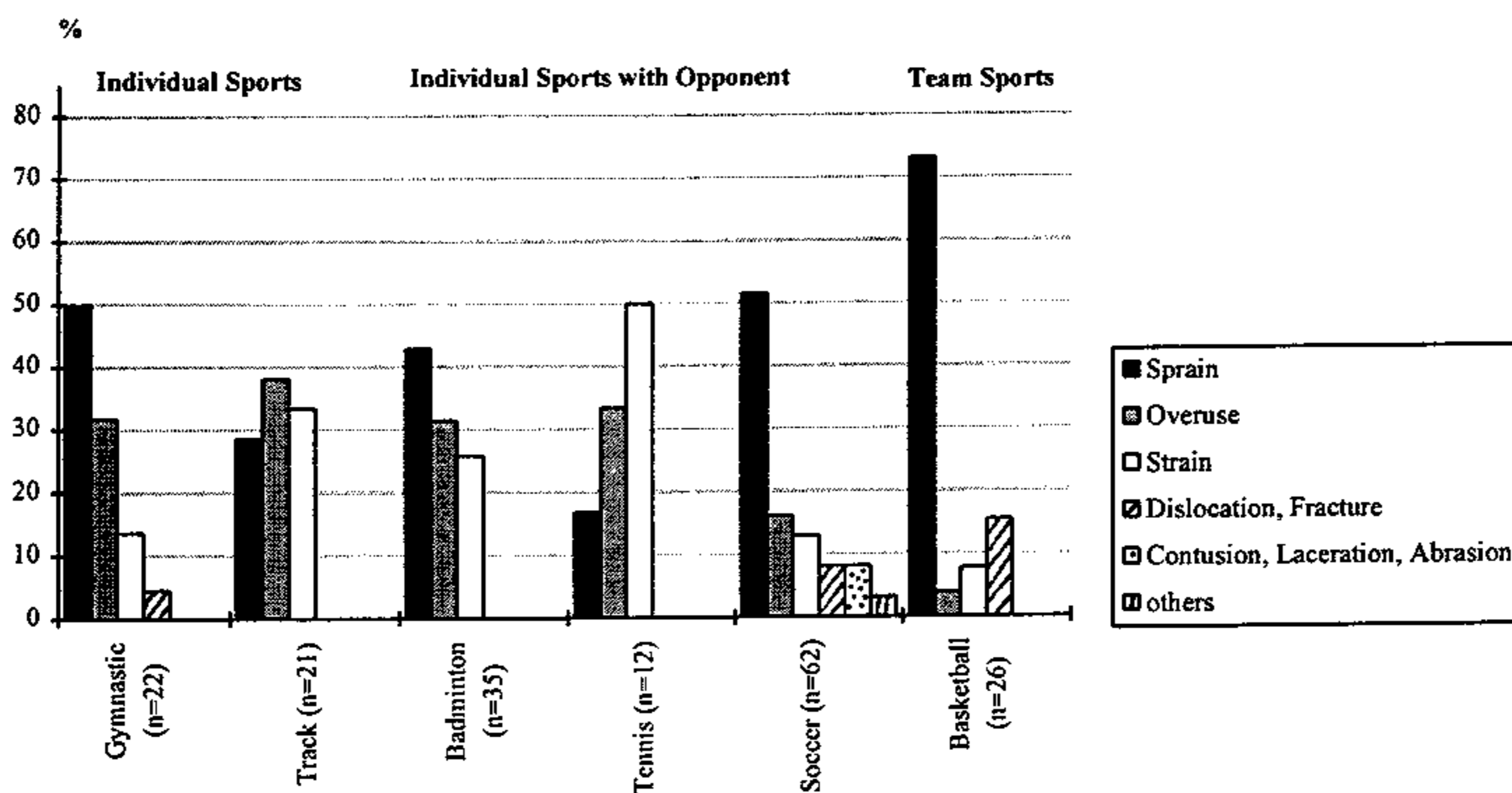


Figure 13. Types of Sport Injury in Six of the Sports with the Highest Number of Injury Cases



Individual Sports with Opponent

In this category, badminton and tennis were the two sports with the highest incidence of sports injury recorded.

In badminton, 35 injured cases were recorded. Eighty percent (28 cases) of the injuries occurred in the lower limb, 11.4% (4 cases) in the upper limb (Figure 12). Injuries around ankle joint was the most common site of injury (31.4% of all badminton injuries), followed by injuries around the knee (22.9% of all badminton injuries). Ligamentous sprain was the most common type of injury and occurred mostly in knee, ankle and wrist, it comprised of 42.9% of all badminton injuries. Overuse injury (31.4% of all badminton injuries) which occurred mainly in the ankle and knee (Figure 13). In ligamentous sprain, there was a case of complete anterior cruciate ligament torn in the knee and one case of meniscus injury. There was also a case of complete rupture of the achilles tendon.

In tennis, there were 12 cases of injuries recorded. Fifty percent of the injuries occurred in the lower limb. Twenty-five percent of the injuries occurred in upper limbs and 25% were back injuries (Figure 12). Most injuries were muscle strain (50.0%), and followed by overuse injury (33.3%) which mainly occurred in the knee. (Figure 13)

Team Sports

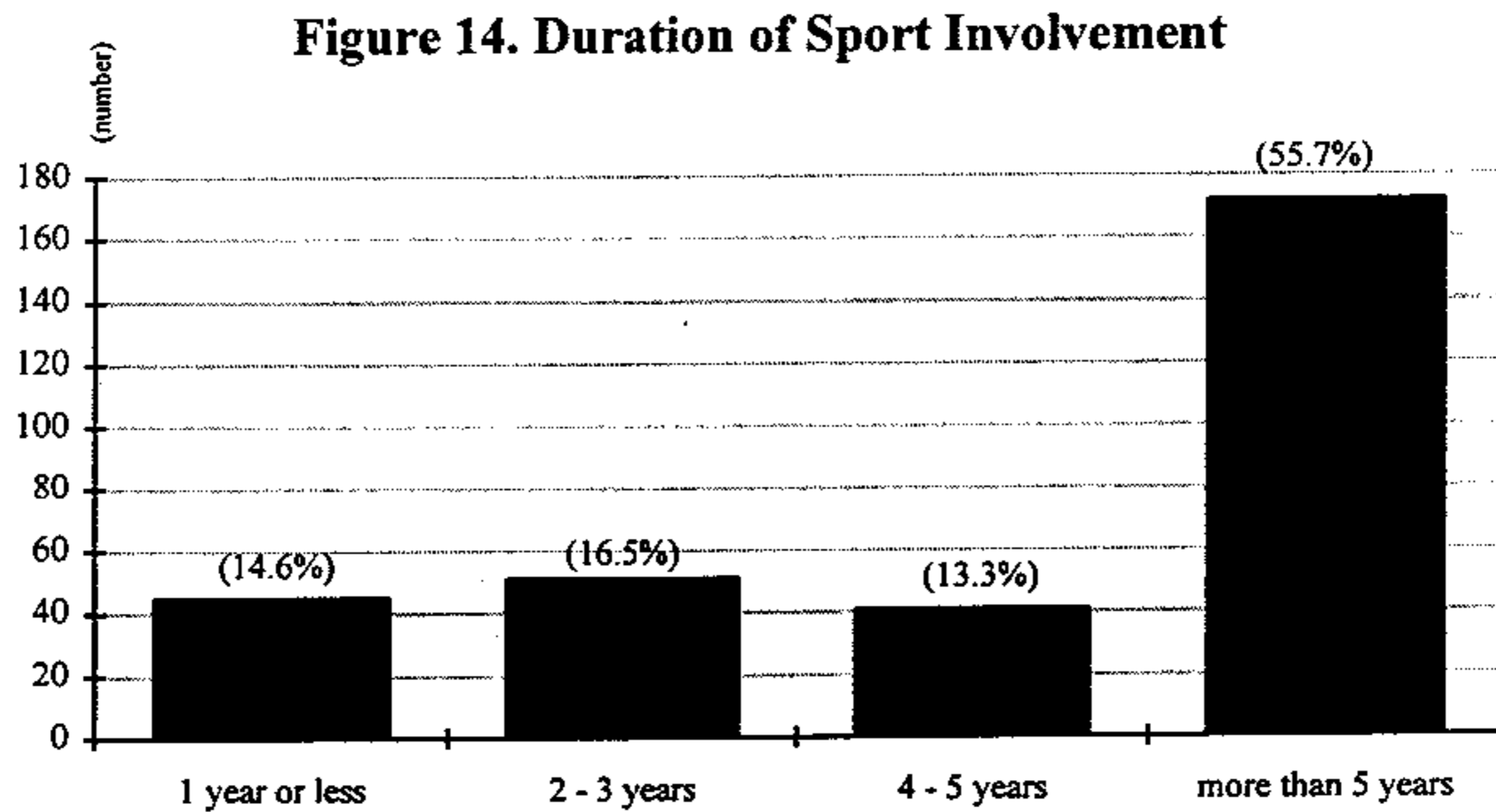
In team sports, soccer and basketball were the two sports with the highest incidence of injury recorded.

There were 62 cases of soccer injuries recorded in this study. Lower limb comprised of 79% of all soccer injuries. 51.6% (32 cases) were ligamentous sprains which mainly occurred in the knee. These included five cases of complete knee ligament torn, five cases of knee ligament torn together with meniscus injury, and five cases of meniscus injury alone. Overuse injuries accounted for 16.1% (10 cases) of all soccer injuries. It occurred mainly in the knee. Muscle strain accounted for 12.9% (8 cases) of all soccer injuries, which mainly occurred in the thigh. There were five cases of dislocation/fracture. They included a case of fracture around knee, a case of elbow dislocation, a case of shoulder dislocation and two cases of wrist fracture (Figure 13).

Another team sport is basketball. There were 26 injury cases recorded. 76.9% (20 cases) were lower limb injuries. Injury around the knee was the most common site, it accounted for 57.7% of all basketball injuries, followed by ankle injury (19.2%). There were 19 cases (73.1%) of ligament sprain, which include three cases of complete knee ligament torn, five cases of knee ligament torn together with meniscus injury. Besides knee sprains, ankle sprains were also common. There were 5 (26.3%) cases of ankle sprain recorded. There were also four cases (15.4%) dislocation/fracture cases which included one case of wrist fracture, one case of knee dislocation and two cases of shoulder dislocation.

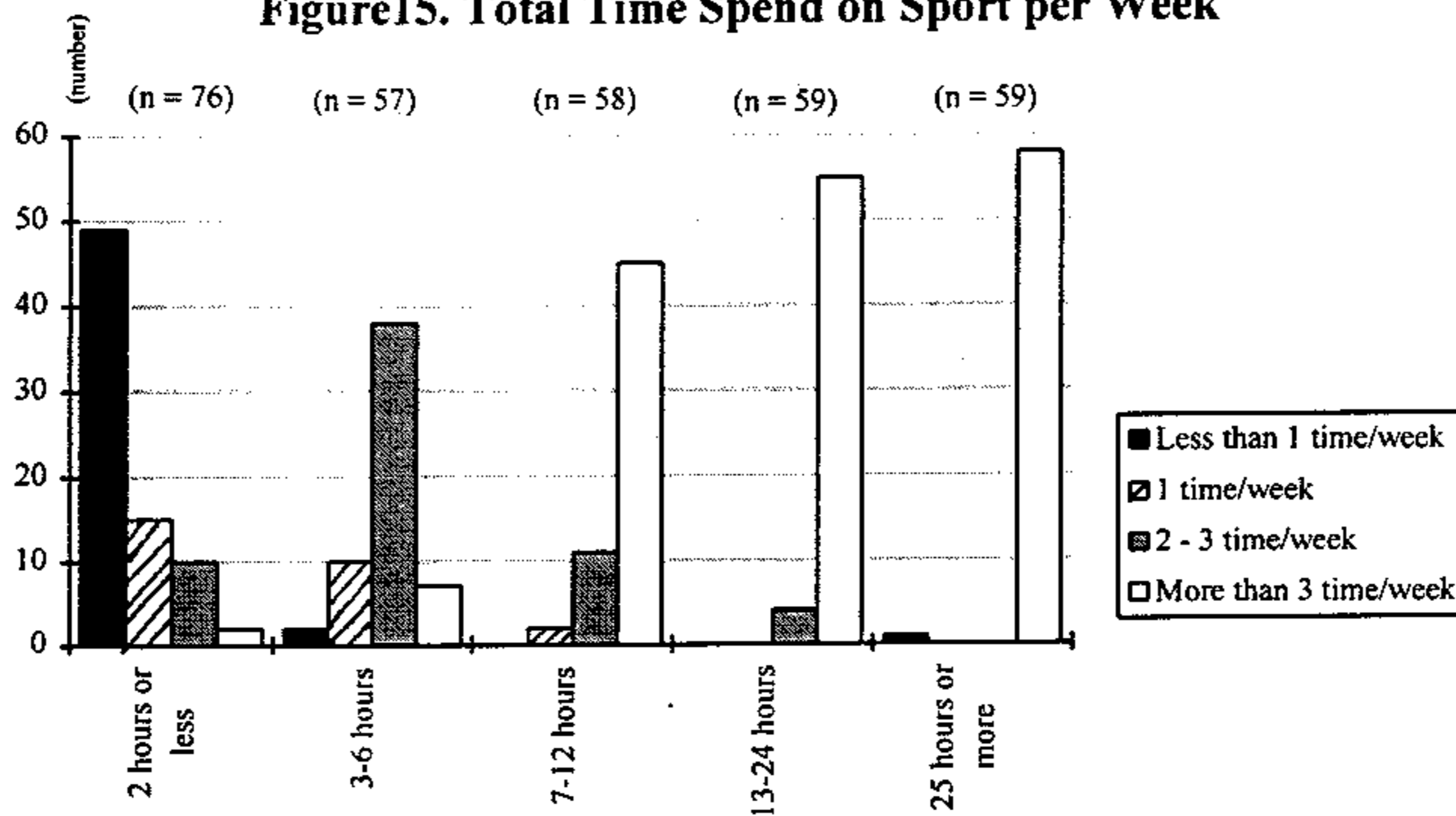
DATA RELATED TO SPORTS ACTIVITY

In this study, 55.7% of the subjects had involved in the sport activity which caused this injury for at least five years. Only 14.6% of athletes had taken up the sport for one year or less. (Figure 14)



More than half of the athletes (54.0%) are used to participate in sport activity for at least three times per week. Only 16.8% of the athletes are used to participate in sport activity for less than once per week. 25.6% of the athletes are used to participate in sport activity for less than once a week or for less than or equal to two hours per week. (Figure 15)

Figure15. Total Time Spend on Sport per Week



THE PRACTICE OF WARM-UP EXERCISE

A “proper” warm-up exercise should consist of three main components: (1) general warm-up exercise, e.g. light jogging, this helps to increase the general body temperature, (2) stretching exercise, to improve muscle, tendon and joint’s flexibility, and (3) sports specific warm-up, i.e. technique simulation at a lower intensity, to prepare the body and mind for the coming event.

In this study, athlete’s practice of warm-up was recorded. These included the practice of each of the three components of warm-up and the time used in each component. The data was analyzed.

Results showed that 79.3% of the athletes claimed that they practised regular warm-up exercise and only 20.7% said they did not practise regular warm-up. However, if the data was analyzed according to the definition of a “proper” warm-up, only 34% of athletes practised a “proper” warm-up exercise. The data reviewed that only 45.0% of athletes are used to perform general warm-up regularly, and 57.3% are used to doing sports specific warm-up, while 76.4% are used to doing stretches before sports.

In order to assess whether a well-trained athlete has a better knowledge or habit in the practice of warm-up, athletes were classified into four categories according to their competitive level: (1) Professional athletes (n = 13), i.e. athletes who earn their living through sports participation, (2) Hong Kong Team athletes (n = 100), i.e. athletes who represent Hong Kong for major international events, (3) Amateur athletes (n = 109) includes those sport team/club athletes, and (4) Recreational athletes (n = 87).

Results showed that 12 athletes (92.3%) in the professional group, 94 athletes (94.0%) in the Hong Kong Team, 96 athletes (88.1%) in the amateur group and 43 athletes (49.4%) in the recreational group reported that they practise regular warm-up exercise. Although athletes claimed that they performed warm-up, some athletes might just do a very brief warm-up (e.g. less than 5 minutes). The purpose of warm-up actually had not been achieved. Therefore, a break down that athletes who did not or performed warm-up less than or equal to 5 minutes were also analyzed. The result showed that there was a significant high percentage of recreational athletes who did not perform warm-up or practise warm-up exercise with a total of 5 minutes or less (Table 2). However, when the data was analyzed according to the definition of a "proper" warm-up, only 10 athletes (76.9%) in the professional group, 36 athletes (36.0%) in Hong Kong Team, 43 athletes (39.4%) in amateur group and 16 athletes (18.4%) in recreational group reported that they had performed a "proper warm-up". It was statistically significant that fewer recreational players performed regular warm-up than the other three groups ($p < 0.05$)

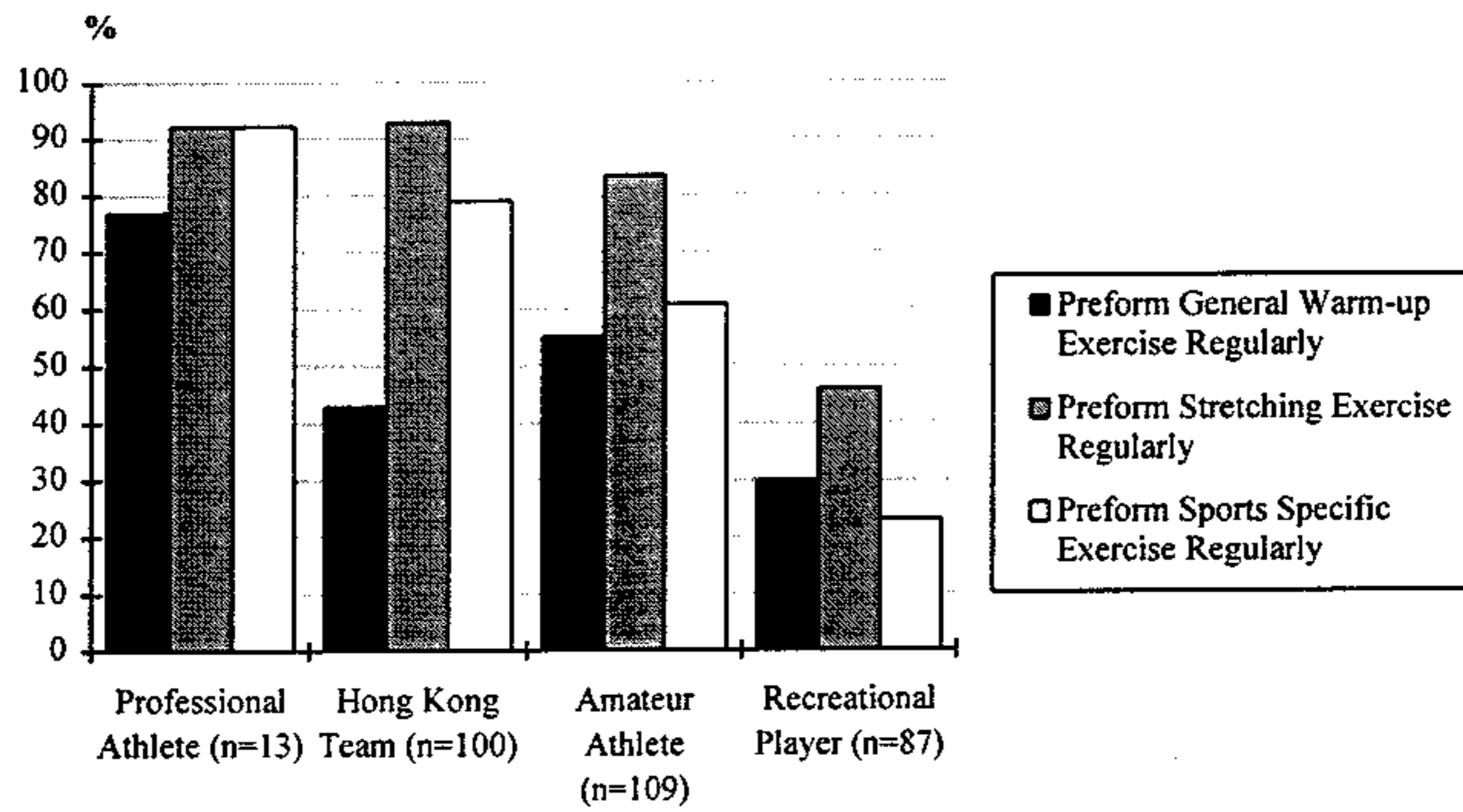
Table 2. Number of athletes who did not perform regular/"proper" warm-up or performed regular warm-up but with a total warm-up time less than or equal to 5 minutes.

	no. of athletes did not perform warm-up	no. of athletes with warm-up (but total time \leq 5 min.)	no. of athletes did not perform "proper" warm-up
Professional (n = 13)	1 (7.7%)	0	3 (23.1%)
Hong Kong Team (n = 100)	6 (6.0%)	2 (2.0%)	64 (64.0%)
Amateur (n = 109)	13 (11.9%)	14 (12.8%)	66 (60.6%)
Recreational (n = 87)	44 (50.6%)	11 (12.6%)	71 (81.6%)

The Practice of General Warm-up

Forty-five percent of athletes reported that they used to perform general warm-up as part of their routine warm-up. This included 10 athletes (76.9%) in the professional group, 43 athletes (43.0%) in the Hong Kong Team, 60 athletes (55.0%) in the amateur group and 26 athletes (29.9%) in the recreational group claimed that they performed general warm-up exercise. (Figure 16)

Figure 16. Distribution of the Three Components of Warm Up Exercise for Different Types of Athletes



The Practice of Stretching Exercise

A total of 76.4% of athletes claimed that they performed stretching exercise as part of their routine warm-up. This included 12 athletes (92.3%) in the professional group, 93 athletes (93.0%) in the Hong Kong Team, 91 athletes (83.5%) in amateur group and 40 athletes (46.0%) in recreational group. (Figure 16)

The Practice of Sports Specific Warm-up

57.3% of athletes are used to perform sports specific exercise as part of their routine warm-up. There were 12 professional athletes (92.3%), 79 Hong Kong Team athletes (79.0%), 66 amateur athletes (60.6%) and 20 recreational athletes (23.0%) respectively. (Figure 16)

Time Spent in Warm-up Exercise

The result showed that the mean time that athletes spent in warm-up was: professional: 30.5 min. \pm 12.9 min., Hong Kong Team: 29.1 min. \pm 14.4 min., amateur: 24.5 min. \pm 15.9 min., and recreational: 12.8 min. \pm 10.3 min. It was significant that the recreational group spent less time in warm-up exercise than the other three groups ($p < 0.05$).

Table 3 showed those athletes who did not perform warm-up exercise and performed warm-up but with a total time less than or equal to 15 minutes (or each part of warm-up less than or equal to 5 minutes).

Table 3. Athletes among the four groups who did not practised/practised warm-up but with a total time less than or equal to 15 minutes (or each part of warm-up less than or equal to 5 minutes).

	<u>General warm-up</u>	<u>Stretching</u>	<u>Sports specific</u>	<u>Total</u>
Professional (n = 13)	7 (53.8%)	4 (30.8%)	4 (30.8%)	4 (30.8%)
Hong Kong Team (n = 100)	79 (79.0%)	22 (22.0%)	39 (39.0%)	30 (30.0%)
Amateur (n = 109)	80 (73.4%)	53 (48.6%)	54 (49.5%)	41 (37.6%)
Recreational (n = 87)	79 (90.8%)	74 (85.1%)	78 (89.7%)	78 (89.7%)

The result showed that less than 50% of athletes performed general warm-up for more than 5 minutes. However, more than half of the athletes performed stretching for more than 5 minutes, except the recreational group. It was found that the recreational athletes, who spent less than or equal to 15 minutes in performing warm-up, was significant higher than the other 3 groups.

THE RELATIONSHIP BETWEEN NATURE OF SPORTS PARTICIPATION AND INJURY

In order to identify whether difference in the intensity in sports participation would result in different types of sports injuries, the nature of sports participation when injury occurred were recorded and analyzed.

The nature of sports participation is defined as whether the athlete is practising, or competing in a tournament when the injury occurred, or it occurred when the athlete is performing recreational sports activity, or in a training competition.

The result showed that the percentage of ligamentous sprain was significant higher during tournament and recreational activities than during practice or training competition ($p=0.004$). The occurrence of overuse injury was significantly higher during practice ($p=0.000$). The occurrence of muscle strain was significantly higher during training competition ($p=0.006$) than in other times. Dislocation/fracture had a significantly higher occurrence rate during recreational activity ($p=0.002$).

THE RELATIONSHIP BETWEEN NATURE OF SPORTS PARTICIPATION AND KNEE SPRAIN

In this studying sample, 45.6% (141 cases) of injuries were ligamentous sprain. Knee sprain comprises of 46.8% (66 cases) of all sprains. Knee is a complex joint. Injury to the knee joint especially when ligaments and meniscus are involved often results in significant disabilities which affects sports participation.

In these 66 cases of knee sprain, 29 cases (43.9%) were partial knee ligamentous sprain while the other 37 cases involved complete knee ligament torn (all ACL torn), or together with meniscus injury, or meniscus injury alone.

It was found that more serious knee injuries, which involved complete ligament torn \pm meniscus injury occurred more during tournament, and accounted for 31.8% (21 cases) of all knee sprain. Partial knee ligament injury occurred more during recreational activities and accounted for 22.7% (15 cases) of all knee sprains.

When the time spent in practising, recreation and competing was considered, it seemed that vigorous sports participating would result in more serious knee injuries. It was because more hours were usually spent in practising than competing.

USE OF PROTECTIVE AIDS

It was shown that 88% of subjects did not use any protective aid which related to their injured area. Only 9.4% of them claimed that they used protective aids in their injured area regularly.

SURFACE GROUND AND INJURY

There were 214 out of 309 cases of sports injuries of which their injuries may be associated with the surface ground which the athletes played on. It was found that a significantly higher percentage of athletes sustained injury while playing on hard surface than those on synthetic surface and grass. There was also a significantly higher percentage of athletes who sustained injury while playing on synthetic surface than those on grass field. ($p \leq 0.005$)

TREATMENT FOLLOWING INJURY

Treatment(s) which subjects had received after injuries was recorded. It was found that most of the subjects had received more than one source of treatment/examination after their medical consultation, e.g. splint, physiotherapy and X-ray examination. 292 athletes (94.5%) stated that they had received physiotherapy after injuries, 135 cases (43.7%) reported that they needed medication and 120 cases (38.8%) needed to have X-ray examination. There were 41 cases (13.3%) with operation done. Among 309 cases, only 21 cases (6.8%) and one case (0.3%) needed splint/sling and stitches respectively.

Consultancy

In this study, the types of medical assistance athletes usually looked for when they were injured were identified. Since the injury data collected in this study was from the Sports Injury Clinics in the Prince of Wales Hospital and Sports Medicine Clinic in the Hong Kong Sports Institute, most athletes had sought consultation from the orthopedic

specialists after injury. In this study, 222 cases (71.8%) out of 309 cases had sought orthopedic consultancy at one stage or the other. However, only 145 cases (46.9%) had sought orthopedic consultancy alone.

32.7% of athletes had sought more than one source for injury management. These included a combination of general physician, massage, bone setter, or others (acupuncture, physiotherapy, chiropractor, etc.). 18.1% of athletes had sought consultations from two sources, 5.2% of athletes had sought consultations from three sources and 2.6% of athletes had sought consultations from four sources. (Figure 17 & Figure 18)

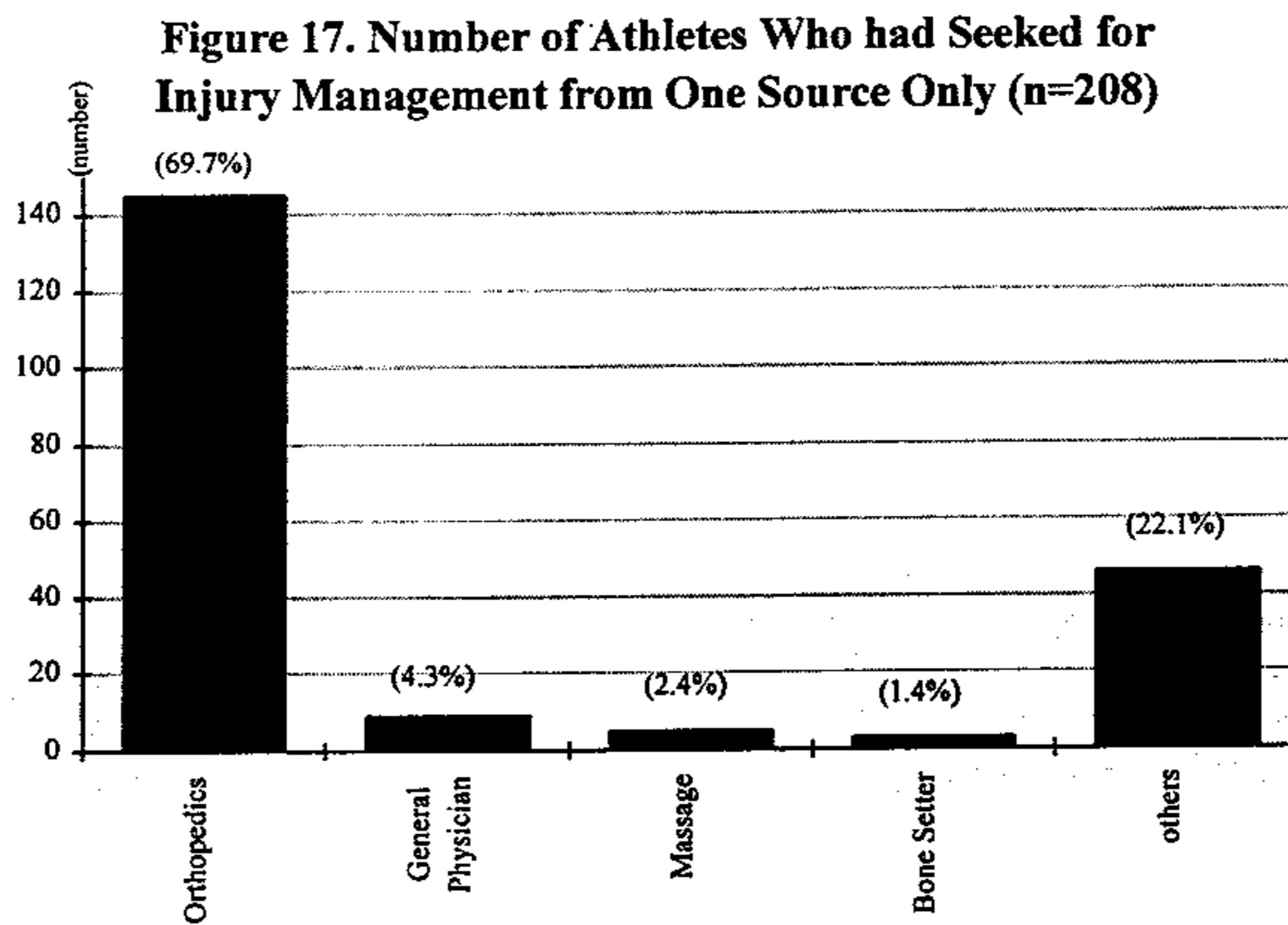
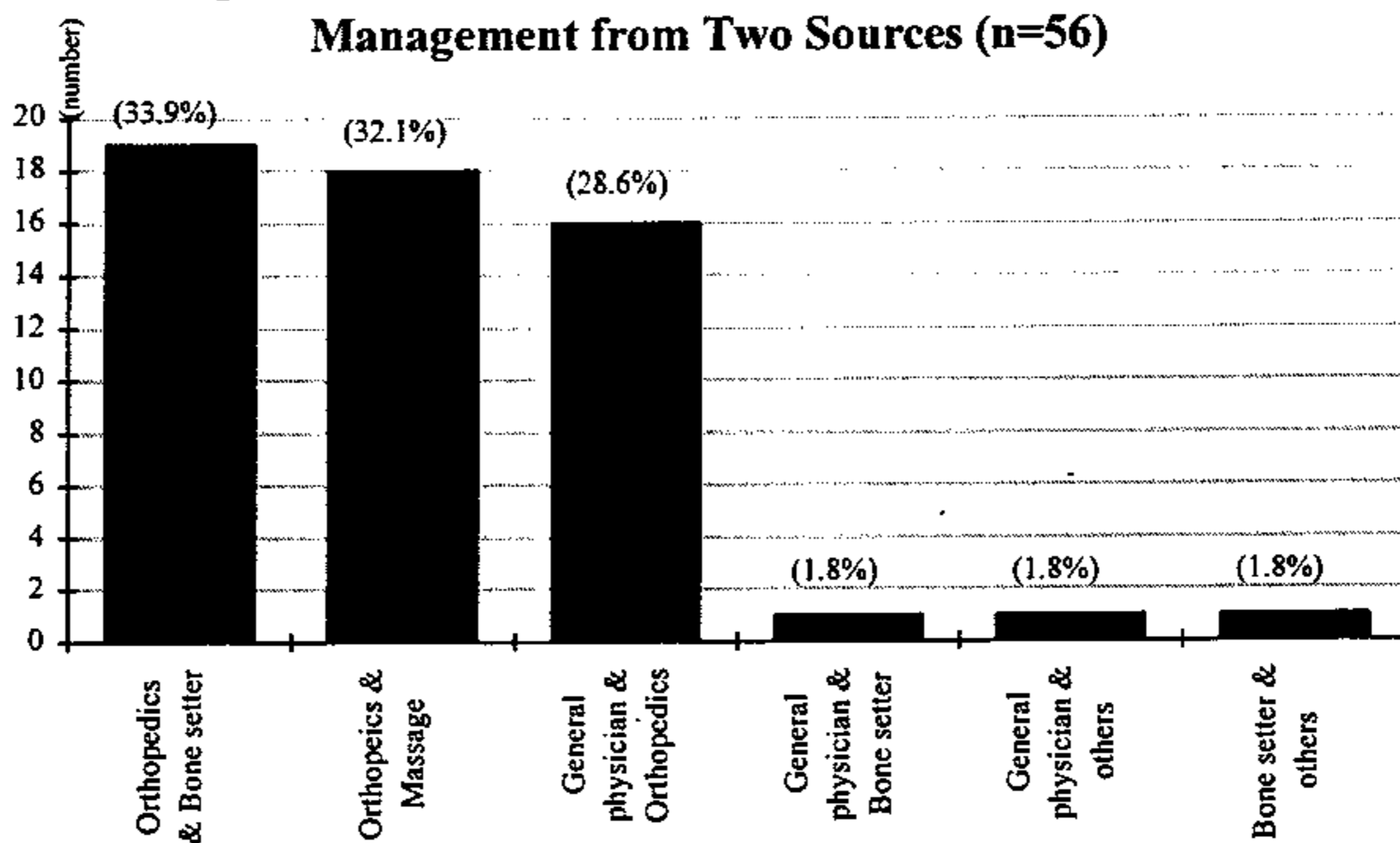


Figure 18. Number of Athletes had Sought for Injury Management from Two Sources (n=56)

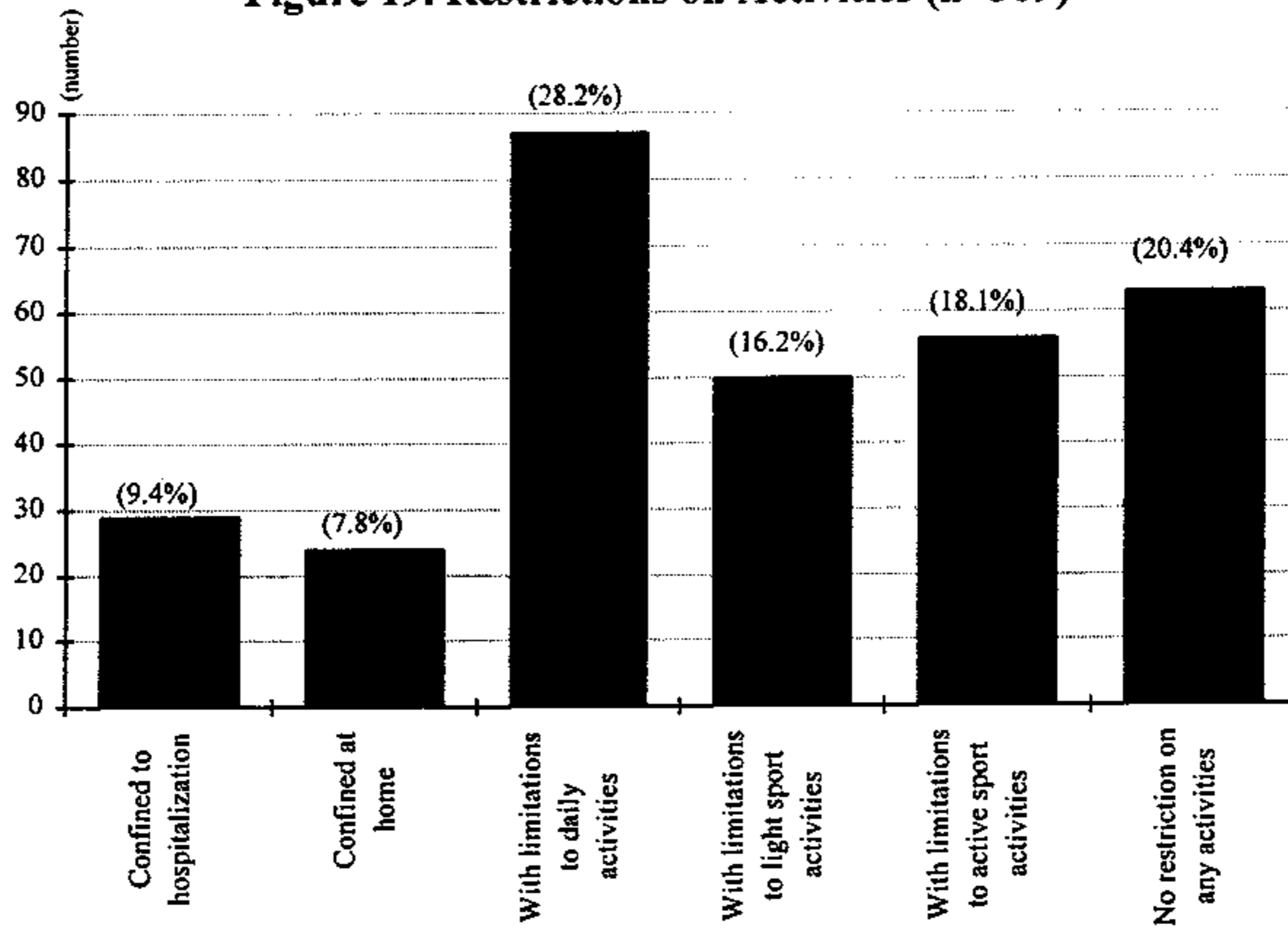


In this study, 14.9% of athletes had consulted bone setters at one stage or another for their sport injuries.

Restriction to Activities

In this study, 9.4% of cases needed hospitalization, these were mainly cases of complete ligament torn, complete tendon rupture and dislocation/fracture. Most of the athletes can still continue sports activities at a lower level. (Figure 19)

Figure 19. Restrictions on Activities (n=309)



IV. DISCUSSION

In this study, sports injury data was mainly collected through two sources, i.e. the Sports Injury Clinic in the Prince of Wales Hospital and the Sports Medicine Department in the Hong Kong Sports Institute. Both of these clinics are specialized for the sports injuries management. Referrals from general clinic are often required, especially in the hospital setting, before athletes could attend the Sports Injury Clinic. Therefore, some cases especially those minor injuries like abrasion, laceration or minor sprains, would be missed out. It is because most of these cases, after consultation in the emergency unit or the general out-patient clinic, will be discharged without the need to follow-up in the Sports Injury Clinic. Despite the fact that there might be some incompleteness in the sampling of sport injury data, the data that was collected provide valuable information. In most epidemiological studies, sports injuries data usually involved specific sports^{2,10,13,17,18,21} or the data was collected in general clinic or hospital^{6,8,12,25}, thus the data usually was either sports specific or too general. This study provided an even distribution of elite athletes, amateur athletes and recreational athletes which provides more information concerning the relationship between the level or the intensity of sports participation and the occurrence of sports injuries. The relationship between different types of sports activities and their injuries was also analyzed.

Overall Injury Pattern

Areas of Injury

Most sports activities involve lower limb movements, the loading force to lower limb joints is usually very high especially during sports activities. Knee joint however is not a true hinge joint, there are also translation and rotation components. During sports activities, muscles around the knee have to produce a very high force in order to cope with the required movements of the activity. Injuries will occur if the muscle control was insufficient.

Nature of Injury

In this study, one-fifth of the cases (21%) were recurrent injury. It is recommended that a proper rehabilitation following injury is essential to prevent recurrent injury. After initial injury, there is usually pain and swelling which limits activity. This limitation will lead to secondary muscle atrophy, a decrease in range of motion and muscle balance in the affected area. There would also be a decrease in joint sense if the injury affected the joint. All of these defects will lead to a deficient in movement control. A proper rehabilitation program to correct this deficiency and incidents of recurrent injury will decrease. Therefore, a proper rehabilitation program following injury is essential not only to decrease pain and swelling but to prevent recurrent injury.

Injury Related to Three Categories of Athletes

In this study, athletes were grouped into three categories according to the characteristics of each sport. The three categories were: (1) Individual sports, (2) Individual sports with opponent(s), and (3) Team sports. It is grouped in such a way that in "individual" sports, the athlete is mainly competing against his/herself. The influence of "another athlete" will be of minimal. The actions or movements are more of a control type. In "individual sports with opponent", the athlete's response will be directly affected by his/her competitor but basically, there is less direct body contact. In team sports, the athlete's response is directly related to teammates and his/her opponents, more rapid changes are required. There are usually more body contact in team events.

The result showed that athletes in team sports had a higher incidence of sprains and dislocation/fracture than athletes in individual events or athletes in individual sports with opponents. This can be explained by the fact that there is usually more direct body contact in team sports, the force of sudden impact may lead to dislocation/fracture. Besides, in team sports like soccer and basketball, it involves more sudden twisting, cutting and turning during sport activities than some other sports like running and swimming, and there are more direct attack during sports, thus more ligamentous sprains would occur.

Secondly, there were significantly more overuse injuries for those athletes in individual events. In individual events, there is usually no direct body contact, movement is more controlled, injuries would therefore be related more to the intrinsic factors of the athlete, such as a lack of strength, flexibility, etc., and repetitive actions may result in higher incidence of overuse injuries.

In this study, gymnastic and track events had a relatively high percentage of overuse injuries than the other two categories, i.e. team sports and individual sport with opponent. There was only one case of elbow dislocation in gymnastic, otherwise, there was no major injury that required hospitalization. This can be explained by the characteristics of sports would result in different patterns of sports injuries.

For athletes in individual sports with opponents, e.g. badminton and tennis, there were more cases involving ligamentous sprain. It is due to the nature of the sports activities that movements cannot be predetermined or preset thus athletes need to react accordingly. More sudden twisting, jumping or turning would be required in these sports. There is higher loading to the joints and ligament especially in the lower limbs, therefore, joint sprain is more likely to occur. More serious sports injuries like ligament rupture, meniscus injury were recorded in this category.

For team sports like soccer and basketball, athletes will have more direct body contact. Sudden changes in direction to avoid attack or collision is often unavoidable, especially if there was foul play. More serious injuries like dislocation/fracture, complete ligament

torn, etc., which required hospitalization, occurred in a higher frequency in team sports than in the other two categories. In contact sports, a straight observation to rules and regulation is important in order to avoid foul play or unnecessary body contact which might result in serious sports injuries.

Data Related to Sports Activity

In this study, most of the injured athletes belonged to a relatively active group. Most athletes in this studying population participated sports activity regularly or had regular training. When an injury occurred, it is more difficult for the athletes, especially the elite and the professional athletes to stop and rest completely. It is because this will alter his/her training schedule and/or that will affect their performance. Sometimes, athletes do not want to stop because they enjoy sports and do not wish to stop even though they had an injury. A modified training program which basically "rests" the injured part, but at the same time maintains the uninvolved parts active, is an alternative. This modified way helps maintain basic skill level, as well as, cardiovascular fitness of the athletes. Besides, it also helps in their psychological well-being. The concept and practice of modified training program is well accepted by athletes and coaches because it diminishes the adverse effect of detraining to the lowest.

The Practice of Warm-up

A proper warm-up before sports activity is essential to prevent sports injuries. Warm-up can increase blood flow to muscles, preparing the body for action. The increase in body temperature, would result in a decreased body fluid's viscosity (e.g. joint fluid) and soft tissue's elasticity, and flexibility will also increase. This helps improving co-ordination in body movements. Warm-up can also prepare the mind for the coming activities¹⁹. A "proper" warm-up should therefore begin with a general warm-up which mainly works on large muscle groups to increase general body temperature, and then followed by stretching exercise to improve the elasticity of joint capsule, ligaments, muscles and tendons. After that, athletes should then perform the sports specific warm-up. Sports specific warm-up helps to prepare the body and mind with specific skill that is required for that particular sport activity.

In this study, details regarding athletes' practice of warm-up are recorded. This includes whether the athlete is used to perform warm-up or not. The procedure and time spent in warming-up were also recorded. From the data analysis, it seems that the procedure of a "proper" warm-up has not been fully understood by most athletes. This study showed that only 34% of athletes had performed a "proper" warm-up. This includes 76.9% of professional athletes, 26% athletes in the Hong Kong Team and 34% of amateur athletes who claimed that they are used to practise a "proper" warm-up. There were only 18.4% of athletes in the recreational group who are used to do so.

The low percentage of recreational athletes who perform regular warm-up could be due to these athletes participating in sports mainly for fun, they may or may not have a proper training program and they had not been taught about the importance of warm-up exercise before exercise. It is recommended that educating the general sports population on the importance of warm-up and the proper way of warming up before any sport activities is essential to prevent sport injuries.

Relationship Between Nature of Sports Participation and Injury

In most cases, athletes would spend more time in training than in competing. Overuse injuries occurred more often during training when the same movements had to be practised repeatedly until it is perfect. Repeated movements often cause microtrauma to the joint, tendon, ligament, etc., overusing the structures and resulted in pain and inflammation. However, during tournament, athletes are used to exert their maximum potential in order to win. They may play so hard that exceed their body limit thus injuries may be resulted, thus the injuries are usually of a more traumatic type.

Use of Protective Aids

Not many athletes in Hong Kong are used to wear protective aids, for example, preventive taping. Most of the time athletes may find it unnecessary. However, the use of protective aids really depends on the purpose of the aids, for example, helmet for cyclists will reduce the seriousness of head injury when they fall or have a traffic accident. Rules should be imposed on some high risk sports to prevent unnecessary sport injury.

Surface Ground and Injury

Comparing three different types of ground surfaces, hard surface ground had the least ability to absorb high impact forces and followed by synthetic surface. Reaction force from ground surface can transmit to various parts of the body especially to the lower limbs. Since the reaction force is high for hard ground, it can lead to repeated microtrauma to tissue structures which then results in overuse injuries. Softer surface gives a better yield, thus loading force to bones or soft tissues will be lowered. In softer ground, even if the athletes fell on the ground, injuries will be less serious in most cases because of the nature of the ground.

Treatment Following Injury

According to the findings of this study, most sports injuries require non-operative or conservative treatment after the consulting the sports medicine specialist. Most of them just required medication, X-ray checked or physiotherapy. There was only one-tenth (13.3%) of cases that required operation on their injured area. Most of these cases were dislocation/fracture and complete ligament torn \pm meniscus injury. Since most Hong

Kong people like to participate in those sports that do not need violent body contact, e.g. badminton, swimming, therefore serious injuries due to direct blow, twisting which causes fracture, etc. were fewer. Unsurprisingly, in the data analysis, it was found that team sports had more serious injuries than individual sports with/without opponent.

Consultancy

It is not uncommon in Hong Kong that athletes go to various personnel for the management of their injury. In Hong Kong, because of the medical system, it usually takes months before they could consult an orthopedic specialist or sports medicine doctor in hospital, therefore athletes will often look for other sources like bone-setters, herbalists and acupuncturists to help them to recover faster. According to the data of this study, around one-third of athletes had consulted more than one medical sources for their treatment. A better appointment system to arrange the injured athletes to consult the sports medicine specialist should be established. This would help athletes to return to sports more rapidly especially for those who are at an elite or professional level, since a long rest because of an injury will affect their sports performance, and their career as a sportsman.

V. CONCLUSION

This epidemiological study reported on the sports injury pattern among the Hong Kong sport population. It also provided information about the types of injury commonly occurred in various sports. The usual management for the injuries and the limitations caused by the injury were discussed.

The result of this study showed that most sports injuries occurred in the lower limbs. Knee and ankle were the two most vulnerable sites. Among all injuries, ligamentous sprain and overuse were the two common causes of sports injury in this study group. More major injuries such as complete ligament torn, dislocation/fracture occurred in team sports than individual sports.

This study provides information about athletes' practice and knowledge in "proper" warm-up before sports. Their practice and their level of sports participation is inter-related. Even though the concept of warm-up is somewhat better in elite and professional athletes, it is still inadequate. Hence, better education on proper warm-up should be delivered to the coaches, as well as the general public. Sports is enjoyable and is good for general health only if one can participate in it safely.

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Appendix I

No. (1,2,3) _____

Date: _____

SPORTS INJURIES REPORTING SYSTEM FORM (SIRS)II
SPORTS INJURY CLINIC
PRINCE OF WALES HOSPITAL / HONG KONG SPORTS INSTITUTE

PART I

1. Name: _____

2. Sex₍₄₎: M(1) / F(2)

3. Age_(5,6): _____

4. Tel: _____

5. Occupation₍₇₎: _____

6. Date of Accident: _____ / _____

MM_(8,9) YY_(10,11)

Day₍₁₂₎

first 1/3 / middle / last 1/3 / afterwards(1-4)

Injury Time of Activity₍₁₃₎

7. Sport in the Injury_(14,15): _____

PART II

8. Diagnosis:

Body Part_(16,17)

Lower limb(1)

Neck(4)

Upper limb(2)

Trunk(5)

Head(3)

Area of Injury_(18,19)

Head(01)

U.Arm(06)

Thorax(11)

Knee(16)

Others(20): _____

Face(02)

Elbow(07)

U.Spine(12)

Leg(17)

T.M.Joint(03)

Forearm(08)

L.Spine(13)

Ankle(18)

Neck(04)

Wrist(09)

Hip(14)

Foot/Toe(19)

Shoulder(05)

Hand/Finger(10)

Thigh(15)

Condition_(20,21)

Abrasion(01)

Sprain(partial)(04)

Meniscus Torn(08)

Burn(12)

Ligament & meniscus tear(16)

Laceration(02)

Sprain(complete)(05)

Fracture(09)

Heat Stroke(13)

Contusion(03)

Strain(partial)(06)

Cramp(10)

Overuse(14)

Others(17): _____

Strain(complete)(07)

Concussion(11)

Dislocation(15)

Extremity₍₂₂₎

Not Applicable(0)

Right(1)

Left(2)

Both(3)

PART III

9. Type of Athlete:₍₂₃₎

Professional(1)

Recreational(3)

Amateur (League/University/School/Others) (2)

National (HK team) (4)

10. Duration of Involvement in THIS Sport:₍₂₄₎

1 year or less (1)

4 to 5 years (3)

2 to 3 years (2)

More than 5 years (4)

