INTRODUCTION

Musculoskeletal injuries are common in sports practice and correspond to 80% of lesions in sports. Joint injuries, especially on the knee, have significantly increased due to increase of the number of people who practice physical activities, both professionally and recreationally. In addition, starting sports activities has happened at early ages, with training request and increasing levels of competitiveness, sometimes devoid of appropriate technical supervision.

Sports injuries can be defined in numerous ways: injuries that lead to stopping practice or competition, decreased activity, and need for medical care. The National Athletic Injury Reporting System (NAIRS) from U.S.A. divides lesions into the following categories: non-reportable, the athlete does not interrupt activities; minor, losing of 1-7 days; moderate, 8 to 21 days; major, over 21 days loss and severe injury, resulting in permanent disability. Some other factors may determine the severity of the injury, its nature, duration of treatment, absence from school and costs involved. This number of musculoskeletal injuries comprise the majority of bruises, light sprains, and muscle injuries (about 54%) which compromises sports practice for a brief period of time. These correspond to non-reportable injuries, lighter, smaller and in a smaller proportion, moderate ones. The lower limb is most commonly affected, due to the overhead imposed in sports that involve running and jumping, in which the force on the knees can reach up to 10 times the body weight; other important factors would be the change of direction, as in football, and physical contact between participants. Approximately 90% of sports injuries are located in the hip, thigh, knee, leg, ankle and foot.

There are few Brazilian studies that assess the epidemiology of knee injuries in practice of various sports, inversely to what is observed in the international literature. The aim of this study is to conduct a cross-sectional analysis of the most common orthopedic injuries in the knee found in athletes of different sports categories, who were seen in an outpatient’s ward of a specialized center. Since it is a referral center, the majority of patients seen have moderate, severe and even serious injuries, according to the NAIRS classification, which prevent athletes from physical activity for a prolonged period. This information may assist in the prevention, diagnosis and treatment of knee injuries in sports practice, professional or recreational, and in order to establish a profile of that patient, and the specialized service driven to sportsmen.
MATERIALS AND METHODS

After approval by the Institution’s Ethics Research Committee, the records of patients seen at the outpatient clinic specialized in knee surgery a Specialized Center for Sports Traumatology from January 2008 to September 2009 were analyzed. Inclusion criteria were patients diagnosed with knee injury, caused or symptomatic during sports practice, which prevented the athlete/patient from training for a variable period of time. Exclusion criteria were: patients who were not athletes, who had not confirmed and signed diagnosis (either clinical or by imaging) and finally, those who had some injury not related to sports, for example, patients with tibial plateau fractures caused by traffic accidents.

We obtained a total of 440 patients included in the study, that were analyzed according to: age, gender, sport practiced, and diagnosis (knee injury), as a unique injury or associated with others. The diagnosis was made by clinical examination and imaging by an experienced examiner, specialized in knee surgery; analysis of medical records were performed by a single orthopedic surgeon.

From this data collection a statistical analysis was performed, with patients being divided by sports category and subsequent percentage division of the lesions, mean age of practitioners and division by gender. We obtained a total of 33 sports categories and lesions consisted mostly of chronic injuries that slowed or made impossible sports practice. The mean age was 28.25 years old (range 18-47) and the division by gender for the whole sample was 28% female and 72% male.

On statistical analysis, categories with less than 10 practitioners (without statistical importance) were excluded and the remaining categories (nine sports categories) were analyzed, comparing mean age, gender and most prevalent injuries, trying to establish correlations between them. For this analysis, the chi-square test and Fisher exact test were used.

RESULTS

After cross-examination, we reached a total of 440 patients divided into 33 sports categories. We can observe the distribution of athlete categories in Figure 1.

After division by category, patients were analyzed regarding gender, mean age and diagnosed injury. The main lesions found are shown in Table 1.

As for all patients, mean age and gender data obtained are reported in Table 2.

The least common diagnoses were: osteoarthritis, Osgood-Schlatter osteochondritis, chondral injury, medial collateral ligament injury, lateral collateral ligament injury, and posterior cruciate ligament injury.

We can still cite as findings: ischiobibial tendinopathy, popliteal tendinopathy, iliotibial tract syndrome, goose foot tendinopathy, avulsion fracture of the tibial-tuberosity (patient aged 15 years old), contusion, muscle injury, synovial plica, tibial plateau fracture, quadriceps tendinopathy, and finally, stress fracture of the patella.

Among combined lesions, we observed that 34.7% of ACL injuries were associated to meniscal injury, 6.2% were associated with MCL injury, 2.4% association with PCL injury and 3.7% associated with chondral injury. Regarding meniscal injuries,
After this initial observational analysis, categories with less than 10 practitioners were excluded because they have no statistical relevance and compared the remaining nine categories by age, gender and most prevalent injuries. The compared categories were: athletics, ballet/dance, basketball, street run, football, handball, jiu-jitsu, judo and volleyball.

In Table 3 we can see the analysis in the categories studied regarding to age.

Through variance analysis with one factor we observed that the groups differ with respect to age (p <0.001). According to Bonferroni test, we observed that the street run group differs from the other groups, except the athletic group (p <0.05). The street run group’s mean age is significantly higher than other age groups, except for the athletic group.

The results of comparison of groups regarding to gender are shown in Table 4. Using the chi-square test, we conclude that groups differ regarding gender. The ballet group has the highest percentage of female cases, followed by athletics, handball and volleyball groups.

In football, the most prevalent sport category, we obtained the distribution of lesions observed in Figure 2.

| Sports category       | Total number of patients | Fem/male % | Mean age |
|-----------------------|--------------------------|------------|----------|
| Athletics             | 25                       | 52/48      | 36       |
| Ballet/dance          | 11                       | 81/19      | 28,9     |
| Baseball              | 4                        | 0/100      | 21,7     |
| Basketball            | 22                       | 32/68      | 25,8     |
| Boxing                | 3                        | 0/100      | 33       |
| Capoeira              | 9                        | 23/77      | 29,3     |
| Karate                | 8                        | 25/75      | 33,5     |
| Biking                | 4                        | 25/75      | 29,7     |
| Street run            | 38                       | 31/69      | 42,8     |
| Climbing              | 3                        | 0/100      | 31       |
| Football              | 167                      | 17/83      | 28,7     |
| Gymnastics            | 4                        | 75/25      | 13,75    |
| Handball              | 17                       | 47/53      | 23,7     |
| Hapkido               | 1                        | 0/100      | 23       |
| Jiu-jitsu             | 21                       | 9,5/90,5   | 27,6     |
| Judo                  | 17                       | 35/65      | 21,5     |
| Kickboxing            | 3                        | 33/66      | 31       |
| Kung-fu               | 4                        | 50/50      | 28,2     |
| Greco-roman wrestling | 4                        | 50/50      | 18,5     |
| Motobiking            | 1                        | 100/0      | 27       |
| Bodybuilding          | 4                        | 50/50      | 29,75    |
| Synchronized swimming | 1                        | 100/0      | 23       |
| Swimming              | 8                        | 25/75      | 34,5     |
| Skating               | 1                        | 100/0      | 18       |
| Rowing                | 1                        | 100/0      | 26       |
| Rodeio                | 1                        | 0/100      | 32       |
| Skate                 | 9                        | 0/100      | 29       |
| Surf                  | 6                        | 17/83      | 30,1     |
| Taekwondo             | 6                        | 50/50      | 32       |
| Tennis                | 5                        | 60/40      | 47,4     |
| Table tennis          | 1                        | 0/100      | 22       |
| Triathlon             | 5                        | 20/80      | 26,8     |
| Volleyball            | 26                       | 54/46      | 27,1     |

6.2% were associated with chondral injury and 3.7% associated with patellar tendinopathy. We still observed a case of association of patellar tendinopathy and patellofemoral syndrome, and one case of posterior cruciate ligament injury associated with posterolateral corner injury (16%).

In football, the most prevalent sport category, we obtained the distribution of lesions observed in Figure 2.
The most prevalent ones were sports with impact and burden. Another data analyzed was distribution of sports categories: training centers, ambulatory and emergency rooms. Injuries and tendinopathy eventually appear most frequently in studies in trauma centers specialized in the sports/knee and anterior cruciate ligament injury. These findings corroborate other studies.

In our study, the most frequent injuries were meniscal and anterior cruciate ligament. These findings corroborate other studies in trauma centers specialized in the sports/knee and injuries most commonly found in sports such as bruises, muscle injuries, and tendinopathy eventually appear most frequently in training centers ambulatory and emergency rooms. Another data analyzed was distribution of sports categories: the most prevalent ones were sports with impact and burden of the lower limbs in agreement with other works. Football was the most commonly found sport, reflecting Brazilian’s profile, in which this sports’ culture is prevailing, that besides the intense burden and change towards lower limbs, it is often practiced without technical/medical supervision and in inappropriate floor. The most common found injuries among football practitioners is complete rupture of the anterior cruciate ligament, with 54% of injuries. The most commonly described injury mechanism is a combination of valgus force on the knee associated with femoral internal rotation/external tibia rotation, which is usually used during a football match. Of this total, 34% are associated to meniscus injury, similar to data from other services. The second most frequent injury among football practitioners is meniscal injury. The second most popular sport among the patients analyzed is street run, which is becoming increasingly popular in our midst. As in football, running is most often practiced without technical and/or medical supervision. Unlike football, where torsional mechanisms are common, they rarely occur during running, which explains the low prevalence of ligament injuries. The most common injuries are meniscal lesions, often degenerative (mean age is notoriously higher in this group).

Some lesions found practically independent of the sports category practiced, and are epidemiologically determined by patient’s age group. As found in this study, osteochondritis of the tibial tuberosity (Osgood-Schlatter), in which all patients who presented with symptoms and clinical and radiographic signs consistent with the disease, were aged between 10 and 15 years old, as reported in the literature. Another example would the occurrence of osteoarthritis in patients aged over 55 years old. Among the categories, martial arts showed a high prevalence of ACL injury among those with body contact involving key engines (crashes) such as judo, jiu-jitsu, and those with kicking motion as tae kwon do, kickboxing, and karate in which hyperextension of the knee occurs. It is noted that the importance of patellar tendinopathy in jumping sports: volleyball (30%), athletics (20%), ballet/dance (36%), handball (23%), and patellofemoral syndrome (chondral lesion) in sports with overload on this joint, usually with sports great knee flexion: cycling (50%), bodybuilding (50%), and triathlon (50%). Regarding gender, a higher rate of female patients was found with a diagnosis of patellofemoral instability. This difference between genders was not significant due to the small number of patients with this condition.

Despite some categories are underrepresented in our analysis, it was not possible to establish which injuries may be related to them; others, such as football, street run, volleyball, basketball, athletics, handball, jiu-jitsu, judo and dance (these from the most popular sports in our midst) showed a significant amount of athletes and enables us to establish the epidemiology of knee injuries in these modalities.

The high prevalence of ACL injury in football, handball and jujitsu was statistically significant, as it was patellofemoral instability in dance/ballet and judo (perhaps the highest percentage of female athletes), and patellar tendinopathy in volleyball and ballet. Still regarding the statistical analysis, we found that athletics practitioners were older than and street run and a greater participation of female athletes in ballet/dance, athletics, handball and dance.

As a weak point of our study, we can mention the small sample

| Table 4. Sports category versus gender. |
|----------------------------------------|
| Sports category | % fem | % male |
|-----------------|-------|--------|
| Athletics       | 52    | 48     |
| Ballet/dance    | 81,82 | 18,18  |
| Basketball      | 31,82 | 68,18  |
| Street run      | 31,58 | 68,42  |
| Football        | 16,17 | 83,83  |
| Handball        | 47,06 | 52,94  |
| Jiu-jitsu       | 9,52  | 90,48  |
| Judo            | 35,29 | 64,71  |
| Volleyball      | 46,15 | 53,85  |

Table 5. Sports category versus diagnoses.

| Sports category | Meniscal injury | ACL | Patellar tendinopathy | Patellar instability |
|-----------------|-----------------|-----|-----------------------|----------------------|
| Athletics       | 36%             | 12% | 20%                   | 4%                   |
| Ballet/dance    | 18,18%          | 9,09%| 36,36%                | 27,27%               |
| Basketball      | 27,27%          | 36,36%| 13,64%                | 0%                   |
| Street run      | 23,68%          | 10,53%| 10,53%                | 2,63%                |
| Football        | 15,38%          | 54,49%| 4,79%                 | 4,19%                |
| Handball        | 5,88%           | 47,06%| 23,53%                | 5,88%                |
| Jiu-jitsu       | 23,81%          | 47,62%| 14,29%                | 0%                   |
| Judo            | 23,53%          | 35,29%| 0%                    | 17,65%               |
| Volleyball      | 15,38%          | 26,92%| 30,77%                | 7,69%                |

DISCUSSION

In our study the most frequent injuries were meniscal and anterior cruciate ligament injury. These findings corroborate other studies in trauma centers specialized in the sports/knee and injuries most commonly found in sports such as bruises, muscle injuries and tendinopathy eventually appear most frequently in training centers ambulatory and emergency rooms. Another data analyzed was distribution of sports categories: the most prevalent ones were sports with impact and burden of the lower limbs in agreement with other works. Football was the most commonly found sport, reflecting Brazilian’s profile, in which this sports’ culture is prevailing, that besides the intense burden and change towards lower limbs, it is often practiced without technical/medical supervision and in inappropriate floor. The most common found injuries among football practitioners is complete rupture of the anterior cruciate ligament, with 54% of injuries. The most commonly described injury mechanism is a combination of valgus force on the knee associated with femoral internal rotation/external tibia rotation, which is usually used during a football match. Of this total, 34% are associated to meniscus injury, similar to data from other services. The second most frequent injury among football practitioners is meniscal injury. The second most popular sport among the patients analyzed is street run, which is becoming increasingly popular in our midst. As in football, running is most often practiced without technical and/or medical supervision. Unlike football, where torsional mechanisms are common, they rarely occur during running, which explains the low prevalence of ligament injuries. The most common injuries are meniscal lesions, often degenerative (mean age is notoriously higher in this group).

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size in some categories; determining different training conditions for the same category; time of injury until the visit to a specialized center and clarify the mechanism of injury in some categories. In order to overcome this limitation, we suggest multicenter studies with a larger number of patients and longer follow-up.

CONCLUSION
Our study was relevant to observe large number of patients in sports categories such as football and street run with, respectively, higher rate of injuries to the anterior cruciate ligament and meniscus.

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