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Comparing the Incidence of Anterior Cruciate Ligament Injury in Collegiate male Soccer, Taekwondo and Basketball Players

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ABSTRACT: The anterior cruciate ligament (ACL) is one of the most commonly disrupted ligaments in the knee. Male college basketball, taekwondo and soccer athletes have higher rates of anterior cruciate ligament injury. Rates of anterior cruciate ligament injuries for men in collegiate in this three sport activity have not been examined. Understanding anterior cruciate ligament injury incidence in basketball, taekwondo and soccer, a contact and non-contact sport for men, could further injury prevention efforts. Data were collected from Sports Cultural Olympiad male students 2010-2014 and analyzed to compare anterior cruciate ligament injuries in male college basketball, taekwondo and soccer athletes from the questionnaire (n = 372) and through interviews with injured players (n = 138). Our results indicate collegiate male basketball is a high-risk sport for anterior cruciate ligament injury. In fact, anterior cruciate ligament injury incidence in basketball, soccer and taekwondo in our study indicated that basketball has the greatest number of ACL injuries (α = 1%) and after basketball, Football had the highest injury in ACL and finally taekwondo with 46.8% has a minimum rate of ACL injury. Our finding may be explained by the fact that basketball involves more contact than soccer. Factors such as age, sex, chronicity of injury, associated pathology, activity level, attitude, range of motion and motivation must all be considered to compare of ACL injury. It was suggested that these data would be helpful for the reduction of injury risks and the costs besides with proper onsite precautions.

Keywords: Anterior cruciate ligament, collegiate, injury

INTRODUCTION

The anterior cruciate ligament (ACL) is the primary passive restraint against anterior tibial translation and hyperextension of the knee. As a secondary stabilizer, it restrains the varus and valgus as well as internal and external stresses on the knee [1]. It acts like a guide rope during knee extension from flexion (roll-and-glide mechanism of the knee). It averages 31-38 mm in length and 8-11 mm in width [2] and is not a single cord but a collection of fascicles that fan out over a broad flattened area, with a wider and stronger tibial than femoral attachment [3]. The injury of the ACL is a typical injury of the knee joint that occurs during sports activities [4, 5, and 6]. It has been well recognized that multiple factors, whether individually or in combination, contribute to non-contact ACL injury. The ongoing mission of the ACL research retreat is to bring clinicians and researchers together to present and discuss the most recent advances in ACL injury epidemiology, risk factor identification, and injury-risk screening and prevention strategies and to identify future research directives [7]. Researchers have utilized a range of measurement techniques focused on different at risk groups, evaluated many sports, identified an array of injury mechanisms, and utilized different study designs. Current investigations concerning ACL injury risk focus on a range of potential factors, and the majority of these studies are based on small sample sizes and, as a result, are underpowered. Nowadays, most athletes return to competition following reconstructive surgery, but the time loss from sport and the financial cost of suffering an ACL injury are high [8]. ACL tear in soccer is quite frequent and they seriously affect players' career with short-term and long-term consequences. It has also been seen that ACL injuries are very invalidating events that require surgical treatments and keeps majority of soccer players out of competition at least four months every season. In professional soccer it has significant economic consequences. Soccer is particularly known as a sport with a reasonably high risk for ACL injuries [4, 5, 9, and 10]. Injury rates as high as 2.8 and 3.2 injuries per 10,000 athlete exposures have been reported in women's collegiate basketball and soccer [11]. As in many other combat sports, there is high potential for injury associated with elite athletic performance in taekwondo [12-18].

Defining injury as any circumstance for which the athlete sought the assistance of on-site medical personnel, the latest reviews on competition injuries in taekwondo concluded that total injury rates are 20.6–139.5 per 1000 athlete-exposure (A-E) for elite men and 25.3–105.5 per 1000 A-E for elite women. When only time-loss injuries are considered, rates are 6.9–33.6 per 1000 A-E for men and 2.4–23.0 per 1000 A-E for women [17]. ACL tears can also occur during rough play, mover vehicle collisions, falls, and work-related injuries. About 80% of sports-related ACL tears are "non-contact" injuries. This means that the injury occurs without the contact of another athlete, such as a tackle in soccer. Most often ACL tears occur when pivoting or landing from a jump. The knee gives-out from under the athlete when the ACL is torn. Our result showed an ACL injury occurred more often during a practice than during competition. The situations during a competition and a practice are different in many respects. Athletes usually spend a much longer time in practice than in competition. Non-contact ACL injuries typically occur during deceleration and change of direction with the foot fixed Knee torsion that results from making a sudden directional change on a planted foot has been implicated as a cause of ACL tears. Data such as contact versus non-contact, position of the knee and lower leg, direction of knee collapse, direction of body twisting, and other events were recorded. The number of variables an athlete must respond to in team sports may explain the higher incidence of injuries in sports such as soccer, basketball and taekwondo [19].The purpose of this study was (1) to update the rates of ACL injury in matched men's sports (soccer, taekwondo and basketball) and (2) to compare these ACL injury rates to those in men's among this sports activity. We hypothesized that a lower rate of ACL injuries in soccer, taekwondo and basketball athletes would be evident over the past 5 years if any of the excess ACL risk in men athletes was owing to shorter length of participation in organized sport and possibly lower fitness level. We also hypothesized that the risk of ACL injury would be lower in both men's taekwondo when compared with basketball and soccer. We were further motivated by the increasing popularity of soccer and a desire to better understand the differences and trends in injury patterns between soccer, taekwondo and basketball.

MATERIALS AND METHODS

Data were collected from Sports Cultural Olympiad male students 2010-2014 in 2 different ways, from the questionnaire (n=372) and through interviews with injured players (n = 138). The sport activities that were considered for the study included: soccer, basketball and Taekwondo male athlete (Table1).

This study aimed to investigate the incidence of knee injuries among collegiate soccer, basketball and taekwondo player and also compared the injury in ACL among sport activities that mentioned. As a result, all acute injuries that occurred during training activities or during competition are reported and collected in the injury registry. All injured players were interviewed during the 2010-2014 to compare player recall with the questionnaire. The interview data were also used to check whether the questionnaire we obtained was a representative sample. The entire athletes were diagnosed as having an ACL injury confirmed by magnetic resonance imaging (MRI) and/or an arthroscopic procedure. Approximately seventy five percent of the subjects visited the clinic within one month, and 25 percent of the subjects visited the clinic within one week after an ACL injury incident. We classified the activity of the subject at the time of the ACL injury in two categories (A) competitions (B) practice.

RESULTS

The majority of soccer injuries are caused by trauma; the proportion of overuse injuries accounts for between 9% and 34% of all injuries [20, 21]. Soccer injuries affect predominately the ankle and knee as well as the muscles of the thigh and calf [22, 23]. The incidence of soccer injury has been investigated in several studies, and varies for male outdoor players (>16 years) from 12–35 injuries per 1000 match hours [23, 24]. For youth players, the reported incidences range from 0.5–13.7 injuries per 1000 hours exposure [25, 26]. Specific analysis of youth soccer players has shown that the incidence of injury increases with age [27, 28, 29, and 30]. Understanding the injury pattern of a particular sport and its inherent risk factors is a key area of current sports medicine [31]. The main injury mechanism in taekwondo is through direct contact, especially the exchange of accurate turning kicks and poorly performed or non-existent blocking skills [14, 17, 32, and 33]. The vast majority of all injuries are localized to the lower extremities, especially the instep of the foot, and these are contusions, sprains and muscle strains [14, 17, and 34]. The head and neck regions are the next most likely to receive taekwondo competition injuries [14, 17]. Basketball injuries are generally defined as either acute/traumatic or overuse injuries. Acute or traumatic injuries occur due to a sudden force, or impact, such as a fall or a stumble. Overuse injuries occur over time due to stress on the muscles, joints and soft tissues without proper time for healing. They begin as a small, nagging ache or pain, and can grow into a nasty debilitating injury if they aren't treated early.

Table 1: Sports activities participation (n = 510).

Sport	N	Rate(%)	Height(m)	Weight(kg)	Age(yrs)
Soccer	268	52.5	1.73	72.3	24.7
Basketball	96	18.9	1.88	86.9	21.8
Taekwondo	146	28.6	1.76	73.7	22.1

Both types of injuries may result from overuse, lack of proper rest, lack of proper warm ups or poor conditioning. Basketball continues to increase in popularity at all levels of play, from recreational to professional and remains immensely popular, not just in the United States, but throughout the world [35].

Overall incidence rate in basketball have been reported to be higher during competitive matches than training sessions [36, 37]. Results of the most commonly studied population of adolescent basketball players – American public high school players, revealed that injury incidence vary considerably, from 5.6 – 36.8 per 100 participants for boys and 7.8 – 49.0 per 100 participants for girls [37].

In this study injury was defined as any physical complaint caused by soccer, basketball or taekwondo during inter collegiate training and matches. The duration of absence due to an injury was categorized according to the severity grading up to one week, 8–21 days, or more than 21 days. An injury was categorized as overuse if it was caused by repetitive micro trauma with no identifiable traumatic event. Non-contact injuries included overuse injuries. The classification of an injury as caused without or by contact with another player was based on information about the circumstances of the injury given by the player. The main injury to the ACL being torn is usually non-contact involvement. When it happens though, it is most often in contact sports. These sports are soccer, basketball and Taekwondo. The reason for this difference in the type of sport and how it happens involves the activities done in each sport. With these sports, there is usually a rapid change of direction or landing form a jump involved. The most frequent way that the ACL is torn is the athlete has a planted foot with the knee in an almost extended position (sometimes hyper-extended). The most participants in the three sports activities were soccer with 268 athletes and less one was basketball. The sport activities and demographic Characteristics that were considered for the study included: soccer, basketball and Taekwondo male athlete (Table 1).Our results also indicate most time of injury were in during practice (Table 2). Comparison of ACL injury among sport activities in our study indicated that basketball has the greatest number of ACL injuries (α = 1%) and after basketball, Football had the highest injury in ACL and finally taekwondo with 46.8% has a minimum rate of ACL injury (Fig. 1).

Table 2. Activity at the time of the injury.

Time of injury	Total(510)	Rate (%)
Practice	314	61.4
Competition	196	38.6

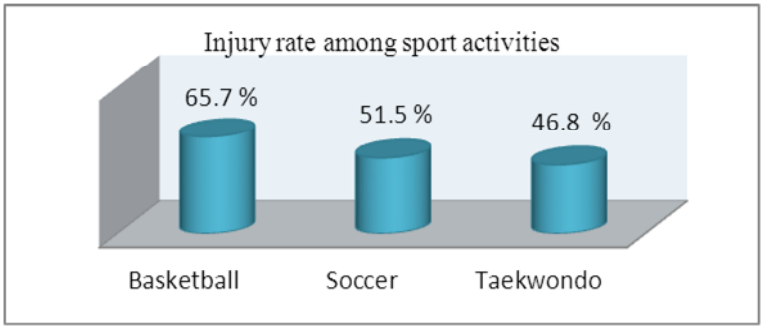

Fig. 1. Comparison ACL injury among basketball, soccer and taekwondo.

DISCUSSION

The function of the ACL is to stabilize the knee joint, prevent abnormal movements, and steer the movement of the knee [38]. The ACL prevents forward translation of the tibia relative to the femur, and cadaver studies have shown that at 30° of knee flexion the ACL represents 85% of the total capsular and ligamentous resistance [1]. An ACL tear is most often a sports-related injury. ACL tears can also occur during rough play, mover vehicle collisions, falls, and work-related injuries. About 80% of sports-related ACL tears are "non-contact" injuries. This means that the injury occurs without the contact of another athlete, such as a tackle in soccer. Most often ACL tears occur when pivoting or landing from a jump.

The knee gives-out from under the athlete when the ACL is torn. Our result showed an ACL injury occurred more often during a practice than during competition. The situations during a competition and a practice are different in many respects. Athletes usually spend a much longer time in practice than in competition. Along with longer commitment, athletes usually challenge new team formation and technique during a practice rather than during a competition, which might increase the risk of injury. However, a more stressful situation might be imposed on the athletes during a competition than during a practice both physically and mentally. The present study is a prospective investigation of the incidence of ACL injury in soccer, basketball and taekwondo players. Although the teams were selected to be of a similar age and skill level, the soccer, basketball and taekwondo players differed substantially in almost all baseline characteristics as well as in the amount of time spent in matches. The proportion of high and low skill level teams did not vary significantly between the groups. Before the results of the comparison of soccer and basketball injuries are discussed, the incidence of injury for each sport will be compared with the incidences reported in other studies of injury, for the given sport. One of the main problems encountered in attempting to compare incidences of sports injuries reported in the literature is that different evaluation methods and definitions of injury have been used [39, 40, and 41]. Another important aspect in comparing the incidence of sports injuries is the influence of the ratio of time spent in practice relative to time spent playing competitions. Usually, more injuries occurred during practice than during competition sessions and, as such, differences in the ratio of practice and competition hours may bias calculations of the overall incidence of injury. For this reason, it is recommended that the incidence of competition injuries in relation to the time spent in matches, and of practice injuries in relation to the time spent in training, are reported and compared separately.

The rate of basketball ACL injuries over this 4 years period is almost 20% higher in taekwondo and almost 15% higher in soccer (Fig. 1). This finding may be explained by the fact that basketball involves more contact than soccer. Incidental trauma or minimal trauma, which may lead to an awkward landing position or a disturbance in the neuromuscular patterns that protect the knee, may be key factors in ACL injuries [42, 43]. However, without information on the mechanism of how the injuries occurred, this remains a hypothesis [44]. Another possibility for injury differences between this three sport activities can be related to surface that activity done on it. Because, soccer field turf grasses let to athlete to glide and reduced risk of injury but in basketball and taekwondo glide is less likely and in pivoting and landing from a jump more injury is likely.

Finally, direct comparisons between basketball, soccer and taekwondo are problematic because the rules of play are fundamentally different and further study of ACL injury patterns and prospective identification of specific risk factors are warranted and essential to the goal of decreasing injury among an ever-growing group of athletes.

REFERENCES

Butler DL, Noyes FR, Grood ES. (1980). Ligamentous restraints to anterior-posterior drawer in the human knee. A biomechanical study. The Journal of Bone & Joint Surgery 62(2), 259-270.

Girgis FG, Marshall JL, Monajem A. (1975). The cruciate ligaments of the knee joint. Anatomical, functional and experimental analysis. Clinical Orthopaedics and Related Research Journal 106: 216-231.

Furman W, Marshall JL, Girgis FG. (1976). The anterior cruciate ligament. A functional analysis based on postmortem studies. *The Journal of Bone & Joint Surgery* **58**(2), 179-185.

Arendt E, Dick R. (1995). Knee injury patterns among men and women in collegiate basketball and soccer NCAA date and review of literature. *American Journal of Sports Medicine* **23**(6), 694-701.

Bjordal JM, Arnoy F, Hannestad B, Strand T. (1997). Epidemiology of anterior cruciate ligament injuries in soccer. *American Journal of Sports Medicine* **25**(3), 341-345.

Gray J, Taunton JE, McKenzie DC, Clement DB, Mc Conkey JP, Davidson RG. (1986). A survey of injuries to the anterior cruciate ligament of the knee in female basketball players. *International Journal of Sports Medicine* **6**(6), 314-316.

Shultz J, Randy J, Schmitz, Benjaminse, Ajit M, Chaudhari MC, Darin A. (2012). ACL Research Retreat VI: An Update on ACL Injury Risk and Prevention. *Journal of Athletic Training.* **47**(5), 591–603.

Gillquist J, Messner K. (1999). Anterior cruciate ligament reconstruction and the long-term incidence of gonarthrosis. *Sports Medicine* **27**(3), 143-156.

Gwinn DE, Wilckens JH, McDevitt ER. (2000). The relative incidence of anterior cruciate ligament injury in men and women at the United States Naval Academy. *American Journal of Sports Medicine*. **28**(1), 98-102.

Powell JW, Barber-Foss KD. (2000). Sex-related injury patterns among selected high school sports. *American Journal of Sports Medicine* **28**(3), 385-391.

Mihata LCS, Beutler AI, Boden BP. (2006). Comparing the incidence of anterior cruciate ligament injury in collegiate lacrosse, soccer, and basketball players: implications for anterior cruciate ligament mechanism and prevention. *American Journal of Sports Medicine* **34**(6), 899-904.

Feehan M,Waller AE. (1995). Precompetition injury and subsequent tournament performance in full-contact taekwondo. *British Journal of Sport Medicine* **29**(4), 258–262.

Beis K, Tsaklis P, Pieter W, Abatzides G. (2001). Taekwondo competition injuries in Greek young and adult athletes. *European Journal of Sports Traumatology Related Research* **23**(3), 130–136.

Lystad RP, Pollard H, Graham PL. (2009). Epidemiology of injuries in competition taekwondo: a meta-analysis of observational studies. *Journal of Science and Medicine in Sport* **12**(6), 614–621.

Schluter-Brust K, Leistenschneider P, Dargel J, Springorum HP, Eysel P, Michael JW. (2011). Acute injuries in taekwondo. International Journal of Sports Medicine 32(8), 629–34.

Kazemi M. (2012). Relationships between injury and success in elite taekwondo athletes. Journal of Sports Science 30(3), 277–283.

Pieter W, Fife GP, O'Sullivan DM. (2012). Competition injuries in taekwondo: A literature review and suggestions for prevention and surveillance. *British Journal of Sports Medicine* **46**(7), 485–491.

Engebretsen L, Soligard T, Steffen K, Alonso M, Aubry M, Budgett R, Dvorak J, Jegathesan M, Meeuwisse W, Mountjoy M, Plmer D, Vanhegan I, Renstrom P. (2013). Sports injuries and illnesses during the London Summer Olympic Games 2012. *British Journal of Sports Medicine* **47**(7), 407–414.

Kasbparast Jr Mehdi, Kohandel Mehdi, Keshavarzi Hamidreza, Rezaei Mehdi. (2014). Some risk factors influencing of non-contact ACL injury in Soccer, Basketball and Taekwondo players. *International Journal of Biosciences* **5**(4), 278-286.

Arnason A, Gudmundsson A, Dahl HA, Johannsson E . (1996). Soccer injuries in Iceland. *Scandinavian Journal of Medicine and Science in Sports* **6**(1), 40–45.

Nielsen AB, Yde J. (1989). Epidemiology and traumatology of injuries in soccer. *American Journal of Sports* Medicine **17**(6), 803–807.

Fried T, Lloyd GJ. (1992). An overview of common soccer injuries. Management and prevention. *Sports Medicine* **14**(4), 269–75.

Inklaar H. (1994). Soccer injuries. I: Incidence and severity. *Sports Medicine* **18**(1), 55–73.

Dvorak J, Junge A. (2000).Football injuries and physical symptoms–Review of the literature. *American Journal of Sports Medicine* **28**(Suppl 5), S3–9.

Sullivan JA, Gross RH, Grana WA, Garcia-Moral CA. (1980). Evaluation of injuries in youth soccer. *American Journal of Sports Medicine* **8**(5), 325–7.

Peterson L, Junge A, Chomiak J, Baumann T, Dvorak J. (2000). Incidence of injuries and symptoms due to football in different age and skill level groups. *American Journal of Sports Medicine* **28**(Suppl 5), S51–7.

De Loes M, Goldie I.(1988). Incidence rate of injuries during sport activity and physical exercise in a rural Swedish municipality: incidence rates in 17 sports. *International Journal of Sports Medicine* **9**(6), 461–467.

Inklaar H, Bol E, Schmikli SL, Mosterd WL. (1996).Injuries in male soccer players: team risk analysis. *International Journal of Sport Medicine* **17**(3), 229–234.

Schmidt S, Bunemann LK, Lade V, Brassoe J.O. (1985). Soccer injuries of youth. *British Journal of Sports Medicine* **19**(3), 161–164.

Schmidt S., Jorgensen U, Kaalund S , Sorensen J. (1991). Injuries among young soccer players. *American Journal of Sports Medicine* **19**(3), 273-275.

Junge A, Engebretsen L, Alonso JM, Renstrom P, Mountjoy M, Aubry M, Dvork J. (2008). Injury surveillance in multi-sport events: The international olympic committee approach. *British Journal of Sports Medicine* **42**(6), 413–21.

Pieter W, Zemper ED. (1999). Head and neck injuries in young taekwondo athletes. *The Journal of Sports Medicine and Physical Fitness* **39**(2), 147–53.

Zetou E. (2013).Injuries in taekwondo athletes. Physical Training. http://ejmas.com/pt/2006pt/ptart_Zetou_0906.html (accessed 30 May).

Kazemi M, Shearer H, Choung YS. (2005). Pre-competition habits and injuries in taekwondo athletes. *BMC Musculoskelet Disorders* **6**: 26.

Cantwell JD. (2004). The physician who invented basketball. The *American Journal of Cardiology* 93(8),1075-1077.

Zvijac K, Thompson W. (1996). Epidemiology of sport injuries. *American Journal of Sports Medicine* **53**: 86-97.

Harmer PA. (2005). Basketball injuries. *Medicine and Sports Science* **49**: 31-61.

Nordin M, Frankel VH. (2001). Basic Biomechanics of the Musculoskeletal System.3rd ed. Philadelphia, Pa: Lippincott Williams & Wilkins.

Finch CF. (1997). An overview of some definitional issues for sports injury surveillance. S*ports Medicine* **24**(3), 157–63.

Junge A, Dvorak J. (2000). Influence of definition and data collection on the incidence of injuries in football. *American Journal of Sport Medicine* **228**(Suppl 5), S40–46.

Van mechelen W, Hlobil H, Kemper HCG. (1992). Incidence, severity, etiology and prevention of sports injuries. Review of concepts. *Sports Medicine* **14**(2), 82–99.

Boden BP, Dean GS, Feagin JA Jr, Garrett WE Jr. (2000). Mechanisms of injury in the anterior cruciate ligament. *Orthopedics* **23**(6), 573-578.

Feagin J, Lambert K. (1985). Mechanism of injury and pathology of anterior cruciate ligament injuries. *Orthopedic Clinics of North America* **16**(1), 41-45.

Nisell R. (1985). Mechanics of the knee. A study of joint and muscle load with clinical applications. *Acta Orthopaedica Scandinavica* **216**(suppl 56), 1-42.