South African Journal for Research in Sport, Physical Education and Recreation, 2021, 43(2): 1 - 12.
Suid-Afrikaanse Joernaal vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2021, 43(2): 1 - 12.
ISBN: 0379-9069

INCIDENCE OF INJURY IN SOUTH AFRICAN MALE YOUTH FOOTBALLERS FROM AN ELITE FOOTBALL ACADEMY

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ABSTRACT

The incidence and characteristics of injury within a population of South African male youth football players from an elite academy was determined. A cross-sectional epidemiological study design including 63 male youth footballers, aged 14-19 years, selected for the squad of an elite South African academy for the 2017 football season. A pre-season baseline demographic questionnaire was administered. All injuries were recorded throughout the 2017 competitive season using the FIFA F-MARC Injury Questionnaire. The total injury incidence was 36.4 injuries per 1000 exposure-hours. Match and training incidences were 39.6 and 34.7 injuries per 1000 exposure-hours respectively. The Under-17 team recorded the highest injury incidence, with the Under-19 team recording the lowest. Injuries most commonly occurred in the lower leg and ankle with contusions and muscle strains/ruptures being the most common. The majority of match injuries occurred due to contact with another player and most training injuries were overuse injuries. Age and previous football academy experience did not influence injury incidence in this population. Further research on larger study populations is required to determine if these results are representative of the South African elite male youth football population.

***Keywords*:** Cross-sectional study; Football injuries; Youth football; South Africa.

INTRODUCTION

Football, also referred to as soccer or 'Diski' in South Africa, boasts between 220 and 270 million participants worldwide (Nuhu & Kutz, 2017). Football is the largest sport in South Africa, with over 2.2 million participants (Nuhu & Kutz, 2017). Football is a high-intensity contact sport requiring speed, fitness, agility and technique (Ergen & Ulkar, 2008). As a result, the sport is associated with a relatively high injury rate. Injury incidence at the academy level is almost half that of the adult professional level, but differs according to age (Price *et al*., 2004; Le Gall *et al*., 2007; Read *et al*., 2015; Nilsson *et al*., 2016).

Most injuries sustained in elite youth football outside of Africa occur in the lower limbs, including the ankle, knee and thigh, with injuries recorded in the upper body being significantly lower in these populations (Hawkins & Fuller, 1999; Junge *et al*., 2000; Price *et al*., 2004; Venturelli *et al*., 2011; Fousekis *et al*., 2012; Read *et al*., 2015; Bianco *et al*., 2016; Lee *et al*., 2020). Injury incidence in youth football has been recorded as between 1 to 66 injuries per 1000 exposure-hours, but usually higher during matches than during training (Junge *et al*.,

2000; Le Gall *et al*., 2006; Aoki *et al*., 2010; Rumpf & Cronin, 2012; Faude *et al*., 2013; Bianco *et al*., 2016; Nilsson *et al*., 2016).

Fewer than 10 studies have investigated football injury in African youth football (Goga & Gongal, 2003; Mtshali *et al*., 2009; Jacobs & Van den Berg, 2012; Sentsomedi & Puckree, 2016), with no studies describing injury incidence in South African male youth football. South African adult male football players are known to sustain different types and incidences of injuries compared to European football players (Calligeris *et al*., 2015). These South African adult, male football players, sustained a lower percentage of pre-season injuries, recorded a shorter average time off due to injury, and experienced a different set of injury mechanisms than what was recorded in European studies.

These study results indicate that South African adult football has its own unique injury incidence profiles. In order to identify the similarities and differences in injury data between youth football in South Africa and outside Africa, further empirical investigation was required. The majority of the available South African football research either investigated female amateur youth players or adult elite players. In addition, the limited body of available research, studies on elite male youth footballer injury incidence had retrospective study designs. The incidence of injuries in South African elite youth football players warranted prospective investigation to better guide injury prevention and rehabilitation services. This study is therefore unique in terms of prospective data collection and its male youth study population.

PURPOSE OF RESEARCH

The purpose of this study was to investigate the injury incidence and the relationships between age, previous academy football experience, and injury within a population of South African male youth football players from an elite academy. It was hypothesised that the injury incidence in this population would fall within the previously recorded range of 1 to 66 injuries per 1000 exposure-hours and that the incidence of injury would decrease as age and previous academy football experience increases.

METHODOLOGY

Ethical considerations

The University of Pretoria, Faculty of Healthcare Sciences Research Ethics Committee (Reference No. 453/2016) approved of the study before data collection started. Written parental consent and personal assent from all included participants was obtained. The participants' rights were protected throughout the study.

Population and sampling

As this study aimed to investigate the incidence of injury within a specific population, the inclusion of the entire population was required. The inclusion criteria for the study were: (1) selection for an elite male youth football academy for the 2017 season; and (2) an age of between 14 and 19 years. The exclusion criterion was a pre-existing injury at the start of the study. A total of 63 players were eligible and subsequently included in the study. These players comprised the Under-15 (n=20), Under-17 (n=37) and Under-19 (n=6) academy teams. To ensure anonymity, participants were allocated a unique participant code prior to the start of data collection and all data was recorded under these participant codes.

Each team played in at least five different leagues and/or tournaments. Each league/tournament had different match durations, with an increase in match duration with an increase in player age. The Under-15 team played shorter matches (between 40 to 60 minutes) than the Under-17 team (60 to 80 minutes), with the Under-19 team playing the longest matches (70 to 90 minutes).

Data collection procedure

A pilot study was conducted prior to data collection with a group of 10 male youth footballers from the amateur division of the same youth football club. Assessors received training on the data collection tools and procedures prior to the pilot study. No challenges occurred during the pilot study. Data were collected in two phases: (1) a pre-season baseline assessment and (2) competitive season injury recording. The pre-season baseline assessment consisted of the application of a demographic questionnaire. The demographic questionnaire was administered at the end of the pre-season period and recorded the participant's age, weight, height, leg length, dominant leg, player position, previous injury history over the last two seasons (2015 and 2016), as well as the duration of the participant's academy football experience (prior to 2017, in years).

Pre-season baseline data was recorded by a team of five final-year physiotherapy students, trained in the methods of collecting the demographic data characteristics. Each assessor was allocated a specific station and was responsible for collecting the data for one demographic variable. The assessors recorded all participant data under the unique participant code and were blinded to the results recorded at the other stations.

Data collection tool

Injury recording for the 2017 competitive season (April to November 2017) was completed using the *Fédération Internationale de Football Association* Medical Assessment and Research Centre (FIFA F-MARC) Injury Questionnaire. The validity of the questionnaires was ensured as it was developed by experts in the field of football injury surveillance (Fuller *et al*., 2006). The simplified format of the questionnaire, as used by the International Olympic Committee (IOC), was administered (Fuller & Walker, 2006; Junge *et al*., 2008; Junge & Dvorak, 2013). The IOC has employed an injury surveillance system to monitor injuries at the Olympic Games since 2008 and has since used this questionnaire to collect athlete injury data.

The F-MARC Injury Questionnaire enabled the researcher to objectively record aspects of all injuries in a standardised manner. The location, type and cause of injury, as well as the duration of absence from play (severity of the injury) were recorded. The chief researcher, trained in the method of injury data collection, recorded all injury data throughout the 2017 competitive season. The exposure hours for the study population were recorded by each team coach and submitted to academy management, who supplied the report to the first author at the end of the competitive season. The total exposure hours consisted of time spent both in training and during matches.

Data analysis

Match, training and total injury incidence were calculated by dividing the number of injuries by the number of exposure hours, then multiplied by 1000 (Phillips, 2000). Descriptive statistics were used to summarise the demographic data. Inferential statistics were employed to analyse the correlations between age, previous academy football experience and injury.

Correlations were analysed using a Fisher's Exact Test, with a p-value of less than 0.05 considered significant.

RESULTS

Pre-season baseline assessment

Sixty-three participants made up the study population. The mean age of the population was 15±1.24 years, with the mean weight and height 57±8.89 kg and 166±7.09 cm respectively. The mean duration of previous academy football experience was 1.57± 1.94 years. Thirty-four participants (54%) had never played academy football before the 2017 season. Table 1 presents a summary of the demographic characteristics of the participants.

Table 1. **DEMOGRAPHIC PROFILE OF PARTICIPANTS** (N= 63)

Variable	Mean±SD
Age (yrs)	15.0±1.24
Weight (kg)	57.0±8.89
Height (cm)	166.0±7.09
Left leg length (cm)	92.8±4.98
Right leg length (cm)	92.6±5.01
Duration of academy football experience (prior to 2017) (yrs)	1.6±1.94

Injury incidence

A total of 18 injuries were recorded during the 2017 competitive season with 11 training injuries and 7 match injuries. Only three participants sustained more than one injury, with one participant sustaining a recurring injury (1.8%). The total injury incidence was 36.4 injuries per 1000 exposure-hours. Match injury incidence was 39.6 injuries per 1000 exposure-hours and training injury incidence was 34.7 injuries per 1000 exposure-hours.

Table 2. **INJURY INCIDENCE OF PARTICIPANTS** (injuries per 1000 exposure-hours)

	Matches		Training		Total	
Age level	Formula	Injury incidence	Formula	Injury incidence	Formula	Injury incidence
Under-15	2/45.8* 1000	43.6	1/316.6* 1000	3.1	3/362.4* 1000	8.3
Under-17	5/63* 1000	79.3	10/316.6* 1000	31.5	15/379.6* 1000	39.5
Under-19	0/67.8* 1000	0	0/316.6* 1000	0	0/384.4* 1000	0
Total	7/176.6* 1000	39.6	11/316.6* 1000	34.7	18/493.2* 1000	36.4

The Under-15 team recorded 8.3 injuries per 1000 exposure-hours, sustaining most of their injuries during the first three months of the competitive season. The Under-17 team recorded 39.5 injuries per 1000 exposure-hours and the Under-19's recorded no injuries. See Table 2 for a summary of the injury incidence results for the participants.

Influence of age and previous academy football experience on injury

The relationship between age and injury (p=0.698) and the relationship between previous academy football experience and injury (p=0.642) was not statistically significant.

Injury characteristics

***Table 3*. INJURY CHARACTERISTICS BY BODY PART, TYPE AND CAUSE**

Injury characteristics (n= 63)	**Injuries (%)** **Matches**	**Training**	**Total**
By Body Part			
Pelvis/sacrum/buttocks	–	2 (11)	2
Ankle	1 (5.5)	2 (11)	3
Groin	1 (5.5)	1 (5.5)	2
Head	1 (5.5)	–	1
Foot	–	1 (5.5)	1
Face	1 (5.5)	–	1
Knee	1 (5.5)	1 (5.5)	2
Thigh	–	2 (11)	2
Lower leg	2 (11)	–	2
Abdomen	–	1 (5.5)	1
Hip	–	1 (5.5)	1
By Type			
Stress fracture	–	1 (5.5)	1
Tendon rupture	–	1 (5.5)	1
Other bone injuries	–	2 (11)	2
Sprain	–	1 (5.5)	1
Strain/muscle rupture/tear	1 (5.5)	2 (11)	3
Concussion	1 (5.5)	–	1
Ligamentous rupture without instability	1 (5.5)	–	1
Fracture (traumatic)	1 (5.5)	–	1
Contusion	2 (11)	1 (5.5)	3
Dislocation	1 (5.5)	–	1
Laceration	–	1 (5.5)	1
Other	–	2 (11)	2
By Cause			
Overuse (gradual onset)	–	4 (22)	4
Contact: stagnant object	1 (5.5)	2 (11)	3
Contact: another athlete	6 (33)	1 (5.5)	7
Non-contact trauma	–	2 (11)	2
Overuse (sudden onset)	–	1 (5.5)	1
Contact: moving object	–	1 (5.5)	1

Injuries most commonly occurred in the lower leg and ankle. The most common injuries sustained during training were muscle strains, ruptures and/or tears and other bone injuries. The most common injuries sustained during matches were contusions. The most common mechanism of training injury was due to overuse (of gradual onset) and the most common mechanism of match injury was contact with another athlete. Injuries ranged in severity from 1 to 120 days of absence from all forms of play. The mean injury severity was 32 days. Table 3 provides a summary of the injuries characteristics in this population by location, type and cause.

DISCUSSION

This study reports an investigation into injury incidence and injury characteristics in South African elite male youth football players. Youth football injury incidence in Europe and Asia varies from 1 to 66 injuries per 1000 hours of exposure. The results of the study reported in this article fall within this injury incidence range (36.4 injuries per 1000 exposure-hours) (Junge *et al*., 2000; Le Gall *et al*., 2006; Aoki *et al*., 2010; Rumpf & Cronin, 2012; Faude *et al*., 2013; Bianco *et al*., 2016; Nilsson *et al*., 2016). In the current study, match injury incidence (39.6 injuries per 1000 exposure-hours) was higher than training injury incidence (34.7 injuries per 1000 exposure-hours).

Injury incidence is also reported to be higher during matches than during training for both elite youth and adult professional football players outside Africa (Le Gall *et al*., 2006; Brink *et al*., 2010; Faude *et al*., 2013; Bianco *et al*., 2016; Nilsson *et al*., 2016; Pfirrmann *et al*., 2016; Renshaw & Goodwin, 2016). This higher injury incidence during matches may be due to the higher intensity at which players perform during match play (Bengtsson *et al*., 2013). Matches may also have a higher incidence of foul play, which is a known risk factor for injury (Ryynänen *et al*., 2013). Training injury incidence in this study was higher than what has been recorded outside South Africa.

The degree of difference between match injury incidence and training injury incidence in South African youth footballers was smaller than what has been recorded in the past in Europe and Asia (Junge *et al*., 2000; Le Gall *et al*., 2006; Aoki *et al*., 2010; Rumpf & Cronin, 2012; Faude *et al*., 2013; Bianco *et al*., 2016; Nilsson *et al*., 2016). South African youth player injuries are more equally distributed across matches and training, compared to Europe and Asia. When compared to South African adult professional football players, South African elite youth football players had similar patterns of injury incidences and also recorded a higher incidence of injuries during matches when compared to training. This is consistent with the fact that match play is at a higher intensity than training (Bengtsson *et al*., 2013). However, the degree of difference between training and match injury incidence was larger in the adult player population (Calligeris *et al*., 2015).

The injury incidence in the Under-15 team was 8.3 injuries per 1000 exposure-hours, with the majority of injuries occurring within the first three months of the competitive season. At this point, the participants had only been exposed to pre-season training and it is possible that a lack of match exposure could have influenced this increased incidence at the start of the competitive season. Previous research reported that youth footballers appear to have a higher risk for injury particularly during and immediately after pre-season training (Woods *et al*., 2002). The lack of match exposure and possible deficits in their technical ability at this point in the season, coupled with the effects of accelerated physical growth and maturation experienced during this age range could account for a high incidence of injury (Malina *et al*., 1991; Malina, 1994; Reyes *et al*., 1994; Malina *et al*., 2000; Malina *et al*., 2004). A lack of data regarding technical ability, physical growth and maturation in this study means that it cannot be confirmed if this is true for South African elite male youth footballers.

A large difference exists between match versus training injury incidence in this youth football age group (43.6 injuries per 1000 exposure-hours versus 3.1 injuries per 1000 exposure-hours). These injury incidence results are quite different to a study conducted with a population of Korean youth footballers in the Under-15 age group. Lee *et al*. (2020) reported a more evenly distributed injury rate between matches and training and that the injury rate was higher during training. The Under-15 team in the current study played the second-highest

number of games of the three teams but had the lowest number of match hours (45.8 hours). This South African academy aims to ensure that younger players are not overloaded in terms of exposure to training and matches, which could possibly increase their risk for either injury or burnout (Bergeron *et al*., 2015).

The Under-17 team recorded the highest injury incidence (39.5 per 1000 exposure-hours). These players represented a combination of novice and experienced academy football players. Match injury incidence was the highest in this age group at 79.3 injuries per 1000 exposure-hours. Although the Under-17 team did not have the highest total match-hours during the competitive season (63 hours), they played the most matches. This busy match schedule could have influenced their high match injury incidence, but further research would be needed to confirm this.

The Under-19 team recorded no injuries. The Under-19 team played the fewest matches but had the highest total match hours (67.8 hours) and played the longest matches. Due to the small number of participants in the Under-19 team and the absence of an objective evaluation for physical growth and maturation at the point of data collection, it is not possible to state whether physical growth and phase of physical maturation had an influence on the number of injuries recorded in each of the teams.

In the study population, previous academy football experience ranged from 0 to 10 years. The majority of players with previous experience fell into the older age groups (Under-17 and Under-19 teams), and although the majority of injuries recorded occurred in the younger participants (ages 14 to 16) no statistically significant relationship was found between injury and age, and previous academy football experience and injury. Over half the participants reported a history of previous injury (n=33). The previous injury history data was collected retrospectively and were possibly not accurate because of recall bias. Therefore, it was not included in the data analysis.

The injury characteristics in this population were reported in terms of location, type and cause. Injuries most commonly occurred in the lower leg and ankle. The most common injuries sustained during matches were contusions, joint subluxations and dislocations. These results are consistent with what has been reported in other youth football injury research (Hawkins & Fuller, 1999; Junge *et al*., 2000; Price *et al*., 2004; Venturelli *et al*., 2011; Fousekis *et al*., 2012; Read *et al*., 2015; Bianco *et al*., 2016; Lee *et al*., 2020). Training injuries were most commonly muscle strains, ruptures and/ or tears, as well as other bone injuries. These results are also similar to previous research (Hawkins & Fuller, 1999; Junge *et al*., 2000; Price *et al*., 2004; Venturelli *et al*., 2011; Fousekis *et al*., 2012; Read *et al*., 2015; Bianco *et al*., 2016). Football is played at a higher intensity during matches and the increase in intensity and force with which players run and come into contact with each other, can account for the more traumatic nature of match injuries (Ergen & Ulkar, 2008).

The most common mechanism of match injury was contact with another athlete. Contact with another athlete accounted for 6 out of the 7 match injuries, and were associated with injuries of a higher severity (more time away from all forms of play). These types of injuries included a concussion, an ankle ligament rupture with instability, a traumatic fracture of the face and a knee dislocation. The high intensity of match play and the presence of foul play during matches are known risks for injury in youth football (Bengtsson *et al*., 2013; Ryynänen *et al*., 2013). These factors could have contributed to the traumatic nature of match injuries, but further research into the influence of foul play on injury in South African youth football is required to identify if it is a risk factor for match injury. The most common causes of training injuries were due to overuse (of gradual onset), contact with a stagnant object (net, goal post)

and non-contact trauma. The high number of injuries due to overuse may be related to the players' lack of exposure to the pre-season and competitive season training load prior to the 2017 (Bergeron *et al*., 2015). To confirm this speculation, further research is required to investigate the relationship between training load and injury in South African youth football.

The strengths of this study lie in the study design, the diversity of participants and the novelty of its results. This study was designed and executed according to the guidelines for sports injury epidemiology research (Phillips, 2000). A cross-sectional study design and the prospective method of data collection contributed to accurate results (Phillips, 2000). Pre-season baseline data was recorded by a team of assessors trained in the methods of collecting the demographic characteristics. Each assessor collected a single demographic data component, which improved the consistency of the data. This procedure ensured that each assessor was blinded to other data recorded. Only one assessor, trained on the F-MARC Injury Questionnaire, documented injuries throughout the competitive season. Both training and match injury data was recorded to calculate injury incidence. More than one team was included in the study population, improving the generalisability of the results (Phillips, 2000).

The use of the FIFA F-MARC Injury Questionnaire meant that the injury recording procedure is valid and reliable and can be compared to other studies using the same design and instrument (Phillips, 2000; Fuller *et al*., 2006; Junge *et al*., 2008; Lee *et al*., 2020). Through calculating the injury incidence rates for each team, the study populations' exposure hours were standardised, taking into account the participant distribution by team and therefore, different total match-hours played between these three teams. This study provides baseline data for South African and African elite youth football in terms of injury incidence, injury characteristics and the influence of age and previous academy football experience on injury.

LIMITATIONS

Although a total sampling technique was applied, the current study was limited by sample size as the study was conducted at one academy. Due to a shuffle in the team lists before the season, participants who were selected to move over to the adult professional sides at the start of the pre-season period were excluded, which further reduced the available sample size. Consistent accessibility to participants and financial limitations also dictated the use of only one academy. A small number of injuries and the uneven distribution of participants between the three age groups imposed limitations.

Information regarding playing surface, number of foul-play incidents during matches, coaching tactics and game plans were also not included in this study. Therefore, the results cannot be generalised for the South African elite male youth football population as a whole. Injury history data was collected retrospectively. The accuracy of this data may have been compromised by its self-reported nature (Tofthagen, 2012). It was thus not possible to accurately investigate the relationship between injury history and injuries sustained in the 2017 competitive season.

PRACTICAL IMPLICATIONS

In terms of clinical significance, the study results indicate that the first three months of the competitive season are important for injury prevention. The high number of match injuries and their traumatic nature (fractures and dislocations) implied that more vigilant enforcement of the rules by referees may be required. The cause of training injuries (overuse injuries) may be

prevented through effective training programmes. The results provide a guide for coaches and team physiotherapists regarding which players to be more attentive to for injury management and prevention.

By employing the methods outlined in this article, youth football academies can establish their own objective and affordable injury database. This continuous monitoring of injuries would equip coaching staff and physiotherapists to respond to changes in injury patterns during a competitive season through the adjustment of training and recovery programmes. An injury database would also supply youth footballers with a reliably documented injury history to inform their prospective professional clubs as part of their medical examinations. This strategy could ensure better, player-specific management from the beginning of their adult professional careers.

RECOMMENDATIONS

Recording injuries is vital to assist in managing current and planning future seasons. Comparing results between studies is often complicated by the difference in units of measurement for injury incidence ('injuries per 1000 player-hours', taking into account each individual players hours of play, or 'injuries per 1000 exposure-hours', in which the total number of exposure hours for the group are considered). Different studies also report different population sample sizes. It is recommended that this study's methodology be used as a guide for future research on larger elite male and female youth football populations to obtain results that are more representative of South African youth football. This would aid in performing research that maintains a high level of validity and reliability and make them internationally comparable.

It is also recommended that future studies include an objective evaluation for physical growth and maturation (Tanner scale) in participants in order to evaluate the influence of age and physical maturation on injury incidence in male youth football players (Marshall & Tanner, 1970; Maliki *et al*., 2018). Playing surface, number of foul-play incidents during matches, coaching tactics and game plans need to be investigated in future studies to gain a better understanding of whether they are risk factors for injury in youth football.

CONCLUSION

The injury incidence in South African elite male youth football players falls within the previously reported range of injury incidence in youth football outside Africa (1 to 66 injuries per 1000 exposure-hours). As expected, match injury incidence in South African male youth football was higher than training injury incidence, but more evenly distributed between matches and training than other youth football populations. The incidence of training injuries in South African male youth footballers is higher than among youth football populations outside South Africa. The Under-17 team recorded the highest injury incidence, with the Under-19 team recording the lowest. Age and previous academy football experience did not influence injury in this elite male youth football population.

The first prospective injury incidence study in South African male youth football has been reported. The study results provide valuable baseline data from which to guide future research. Future studies should use this study design to conduct further research into injury incidence and injury risk factors in African youth football. This strategy may also ease the transition for youth footballers to adult professional teams and ensure player-specific management. Such

monitoring may assist medical teams in managing injuries and implementing injury prevention protocols in youth football teams.

Acknowledgements

The authors thank the participants and the University of Pretoria High Performance Centre for their contribution to this study's success.

Conflict of interest

The authors report no conflict of interest.

REFERENCES

AOKI, H.; KOHNO, T.; FUJIYA, H.; KATO, H.; YATABE, K.; MORIKAWA, T. & SEKI, J. (2010). Incidence of injury among adolescent soccer players: A comparative study of artificial and natural grass turfs. *Clinical Journal of Sport Medicine,* 20(1): 1-7.

BENGTSSON, H.; EKSTRAND, J.; WALDEN, M. & HAGGLUND, M. (2013). Match injury rates in professional soccer vary with match result, match venue, and type of competition. *American Journal of Sports Medicine,* 41(7): 1505-1510.

BERGERON, M.F.; MOUNTJOY, M.; ARMSTRONG, N.; CHIA, M.; COTE, J.; EMERY, C.A.; FAIGENBAUM, A.; HALL, G., jr.; KRIEMLER, S.; LEGLISE, M.; MALINA, R.M.; PENSGAARD, A.M.; SANCHEZ, A.; SOLIGARD, T.; SUNDGOT-BORGEN, J.; VAN MECHELEN, W.; WEISSENSTEINER, J.R. & ENGEBRETSEN, L. (2015). International Olympic Committee consensus statement on youth athletic development. *British Journal of Sports Medicine,* 49(July): 843-851.

BIANCO, A.; SPEDICATO, M.; PETRUCCI, M.; MESSINA, G.; THOMAS, E.; NESE SAHIN, F.; PAOLI, A. & PALMA, A. (2016). A Prospective analysis of the injury incidence of young male professional football players on artificial turf. *Asian Journal of Sports Medicine,* 7: e28425.

BRINK, M.S.; VISSCHER, C.; ARENDS, S.; ZWERVER, J.; POST, W.J. & LEMMINK, K.A. (2010). Monitoring stress and recovery: new insights for the prevention of injuries and illnesses in elite youth soccer players. *British Journal of Sports Medicine,* 44(11): 809-815.

CALLIGERIS, T.; BURGESS, T. & LAMBERT, M. (2015). The incidence of injuries and exposure time of professional football club players in the Premier Soccer League during football season. *South African Journal of Sports Medicine,* 27(1)**:** 16-19.

ERGEN, E. & ULKAR, B. (2008). Proprioception and ankle injuries in soccer. *Clinical Sports Medicine,* 27(1)**:** 195-217.

FAUDE, O.; RÖßLER, R. & JUNGE, A. (2013). Football injuries in children and adolescent players: are there clues for prevention? *Sports Medicine (Auckland, N.Z.),* 43(9): 819-837.

FOUSEKIS, K.; TSEPIS, E. & VAGENAS, G. (2012). Intrinsic risk factors of noncontact ankle sprains in soccer: a prospective study on 100 professional players. *American Journal of Sports Medicine,* 40(8): 1842-1850.

FULLER, C.W.; EKSTRAND, J.; JUNGE, A.; ANDERSEN, T.E.; BAHR, R.; DVORAK, J., HÄGGLUND, M.; MCCRORY, P. & MEEUWISSE, W.H. (2006). Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *British Journal of Sports Medicine,* 40(3): 193-201.

FULLER, C.W. & WALKER, J. (2006). Quantifying the functional rehabilitation of injured football players. *British Journal of Sports Medicine,* 40(2): 151-157.

GOGA, I. & GONGAL, P. (2003). Severe soccer injuries in amateurs. *British Journal of Sports Medicine,* 37(6): 498-501.

HAWKINS, R.D. & FULLER, C.W. (1999). A prospective epidemiological study of injuries in four English professional football clubs. *British Journal of Sports Medicine,* 33(3): 196-203.

JACOBS, S. & VAN DEN BERG, L. (2012). An investigation of identified factors and their influence on the number of injuries sustained by elite male African youth soccer players: sport science. *African Journal for Physical Health Education, Recreation and Dance,* 18(2)**:** 515-533.

JUNGE, A.; CHOMIAK, J. & DVORAK, J. (2000). Incidence of football injuries in youth players. Comparison of players from two European regions. *American Journal of Sports Medicine,* 28(5 Suppl): S47-S50.

JUNGE, A. & DVORAK, J. (2013). Injury surveillance in the World Football Tournaments 1998-2012. *British Journal of Sports Medicine,* 47(12): 782-788.

JUNGE, A.; ENGEBRETSEN, L.; ALONSO, J.M.; RENSTROM, P.; MOUNTJOY, M.; AUBRY, M. & DVORAK, J. (2008). Injury surveillance in multi-sport events: the International Olympic Committee approach. *British Journal of Sports Medicine,* 42(6): 413-421.

LEE, I.; JEONG H.S. & LEE, S.Y. (2020) Injury profiles in Korean soccer. *International Journal of Environmental Research and Public Health,* 17(14): Article 5125. https://doi.org/10.3390/ijerph 17145125

LE GALL, F.; CARLING, C. & REILLY, T. (2007). Biological maturity and injury in elite youth football. *Scandinavian Journal of Medicine & Science in Sports,* 17(5): 564-572.

LE GALL, F.; CARLING, C.; REILLY, T.; VANDEWALLE, H.; CHURCH, J. & ROCHCONGAR, P. (2006). Incidence of injuries in elite French youth soccer players. *American Journal of Sports Medicine,* 34(6): 928-938.

MALIKI, A.B.H.M.; ABDULLAH, M.R.; JUHAIR, H.; MUHAMAD, W.S.A.W.; NASIR, N.A.M.; MAT-RASID, S.M.; ADNAN, A.; KOSNI, N.A.; ABDULLAH, F. & ABDULLAH, N.A.S. (2018). The role of anthropometric, growth and maturity index (AGaMI) influencing youth soccer relative performance. *IOP Conference Series: Materials Science and Engineering,* 342(April): Article no. 012057.

MALINA, R.M.; PENA REYES, M.E.; EISENMANN, J.C.; HORTA, L.; RODRIGUES, J. & MILLER, R. (2000). Height, mass and skeletal maturity of elite Portuguese soccer players aged 11-16 years. *Journal of Sports Sciences,* 18(9): 685-693.

MALINA, R.M. (1994). Physical growth and biological maturation of young athletes. *Exercise and Sport Sciences Reviews,* 22(1): 280-284.

MALINA, R.M.; BOUCHARD, C. & BAR-OR, O. (1991). Physical activity as a factor in growth, maturation and performance. In R.M. Malina, C. Bouchard, O. Bar-Or (Eds.), *Growth, Maturation and Physical Activity* (pp. 371-390). Champaign, IL: Human Kinetics.

MALINA, R.M.; EISENMANN, J.C.; CUMMING, S.P.; RIBEIRO, B. & AROSO, J. (2004). Maturity-associated variation in the growth and functional capacities of youth football (soccer) players 13-15 years. *European Journal of Applied Physiology,* 91(5-6): 555-562.

MARSHALL, W.A. & TANNER, J.M. (1970). Variations in the pattern of pubertal changes in boys. *Archives of Disease in Childhood,* 45(239): 13-23

MTSHALI, P.T.; MBAMBO-KEKANA, N.P.; STEWART, A.V. & MUSENGE, E. (2009). Common lower extremity injuries in female high school soccer players in Johannesburg east district. *South African Journal of Sports Medicine,* 21(4): 163-166.

NILSSON, T.; ÖSTENBERG, A.H. & ALRICSSON, M. (2016). Injury profile among elite male youth soccer players in a Swedish first league. *Journal of Exercise Rehabilitation,* 12(2): 83-89.

NUHU, A. & KUTZ, M. (2017). Descriptive Epidemiology of Soccer Injury During Elite International Competition in Africa. *International Journal of Athletic Therapy and Training,* 22(2)**:** 21-28.

PFIRRMANN, D.; HERBST, M.; INGELFINGER, P.; SIMON, P. & TUG, S. (2016). Analysis of injury incidences in male professional adult and elite youth soccer players: A systematic review. *Journal of Athletic Training,* 51(5): 410-424.

PHILLIPS, L.H. (2000). Sports injury incidence. *British Journal of Sports Medicine,* 34(2): 133-136.

PRICE, R.J.; HAWKINS, R.D.; HULSE, M.A. & HODSON, A. (2004). The Football Association medical research programme: An audit of injuries in academy youth football. *British Journal of Sports Medicine,* 38(4): 466-471.

READ, P.; OLIVER, J.L.; LLOYD, R.S.; DE STE CROIX, M.B.A. & MYER, G. D. (2015). Injury risk factors in male youth soccer players. *Strength and Conditioning Journal,* 37(5): 1-7.

RENSHAW, A. & GOODWIN, P.C. (2016). Injury incidence in a Premier League youth soccer academy using the consensus statement: A prospective cohort study. *British Medical Journal Open Sport and Exercise Medicine,* 2(1): e000132.

REYES, M.E.P.; CARDENAS-BARAHONA, E. & MALINA, R.M. (1994). Growth, physique, and skeletal maturation of soccer players 7-17 years of age. *Humanbiologia Budapestinensis,* 5: 453-458.

RUMPF, M.C. & CRONIN, J. (2012). Injury incidence, body site, and severity in soccer players aged 6-18 years: Implications for injury prevention. *Strength and Conditioning Journal,* 34(1): 20-31.

RYYNÄNEN, J.; JUNGE, A.; DVORAK, J.; PETERSON, L.; KAUTIAINEN, H.; KARLSSON, J. & BORJESSON, M. (2013). Foul play is associated with injury incidence: an epidemiological study of three FIFA World Cups (2002-2010). *British Journal of Sports Medicine,* 47(15): 986-991.

SENTSOMEDI, K.R. & PUCKREE, T. (2016). Epidemiology of injuries in female high school soccer players. *African Health Sciences,* 16(1): 298-305.

TOFTHAGEN, C. (2012). Threats to validity in retrospective studies. *Journal of the Advanced Practitioner in Oncology,* 3(3): 181-183.

VENTURELLI, M.; SCHENA, F.; ZANOLLA, L. & BISHOP, D. (2011). Injury risk factors in young soccer players detected by a multivariate survival model. *Journal of Science and Medicine in Sport,* 14(4): 293-298.

WOODS, C.; HAWKINS, R.; HULSE, M. & HODSON, A. (2002). The Football Association Medical Research Programme: An audit of injuries in professional football - analysis of pre-season injuries. *British Journal of Sports Medicine,* 36(6): 436-441.

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