

Natural and synthetic grass. A comparative study on the incidence of muscle injuries for senior athletes

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Abstract. The study was conducted, for six months, to verify the incidence of the type and quality of the surface of the soccer fields with reference to the performance of the athletes and the percentage of muscle injuries. Artificial grass and natural grass playing fields were chosen to test the reactions of a sample of fifty amateur soccer players, registered for two teams between 25 and 35 years old and the average age of the sample was 34.7 (SD +/- 4.26) with an average weight of 77.4 (range 68-89 Kg.) and an average height of 178.3 cm (range 168- 187 cm). The athletes underwent three months training and competitions on each surface and the results showed a greater percentage of injuries on artificial turf fields than on natural grass. The team that carried out the first three months (November-January) taking advantage of the synthetic grass, denoted, in the following three months (February-April), an improvement in the performances in terms of continuous attendance during official competitions. Monitoring was carried out by detecting the conditions that led a player to leave the field, then to interrupt the activity, which had consequences in participation, training and matches. Injuries were classified according to the time of absence from sporting activity. Data collection, carried out through observational methods with computerized transcription in relation to the number of lower limb muscle injuries, showed that, in total, the sample of athletes suffered 36 muscle injuries (of which 5 relapses) equal to about 72 % These events occurred mostly during training (around 68%) compared to races (around 32%). There were 10 minor injuries (contractures - 27.8%), moderate ones 18 (sprains - 50%) and severe ones 8 (tears - 22.2%). The affected muscle areas were mainly located on the femoral quadriceps, the biceps femoris and the calf (soleus and gastrocnemius). Research has shown that synthetic grass has caused more injuries than natural grass

Key word: *soccer, natural grass, synthetic grass, injuries.*

Introduction

Football is one of the most widespread team sports in the world practiced by millions of people, both male and female. The soccer fields have different surfaces that allow everyone to practice the favorite sport. For the passion and interest that the game of football arouses we find surfaces in natural grass, synthetic grass and, in some cases, still fields without grass.

For decades the use of artificial turf fields has been spreading, which for its quality and appearance is similar to a real natural lawn. The choice of synthetic grass (1) compared to natural grass occurs for several reasons, above all of for practical and economic ones, and among these reasons a better maintenance and different deterioration more hours to use it all over the year, sustainability in terms of pollution and resistance to climate change. It is important to point out that synthetic grass can offer more regular soils, without holes, less rigid, (2) therefore, less harmful to the health of the athletes even if some studies show, for synthetic fields, an incidence of injuries similar or even greater than the other fields (3). The game of football, both at a competitive and recreational level, is characterized by various high intensity, intermittent and continuous activities (4, 5) (accelerations, decelerations, leaps and landings, changes of direction) so that the surface of race fields, natural grass and / or synthetic grass, is one of the significant factors affecting the service quality and the number and type of accidents. Athletes, both in competitive and amateur competitions, perform complex actions during training that are seldom repeated in the race due to variables, often uncontrolled, among which the surface of the competition fields is decisive (6). Furthermore the efficiency of the motor gesture is subject not only to the intensity of the performance, but also to the age, physical and mental health of the athlete, also in terms of health costs and lost working hours, as well as meteorological conditions (7), we understand the importance of using a playground with a balanced and well-maintained surface. The risk factors of inadequate performance and injuries are therefore not only related to the incorrect execution of technical gestures (landings, leaps, sprints, changes of direction, torsions) but to the combination of various factors, intrinsic and extrinsic, such as inappropriate surfaces or unsuitable shoes (8, 9, 10), which determine specific injury patterns (11).

In fact it is found that more injuries occur due to overloading in players with a higher average age, while injuries that characterize younger players are often due to trauma or contact, and some kinds of injuries, such as muscle injuries, mainly concern certain age groups compared to others (12).

Table 1. Intrinsic and extrinsic factors

Intrinsic factors	Extrinsic factors
Age	Type of shoes used
Muscle strength	Shin Guards
Joint instability	Activity level
Asymmetry of muscle strength between the limbs	Tape and PC
Previous injuries	Exercise load
Ligamentous laxity	Positions and game roles
Proprioceptive abilities	Game Fouls
Ability to adapt to different surfaces	
Inappropriate fatigue and cures / treatments	

Considering what we have showed up to this point, a six-month study was carried out (November 2017 - April 2018), on a sample of fifty athletes divided into two teams, participating in an amateur football league at 11. Each team carried out training and competitions for three months on artificial turf fields and three months on natural grass fields to check any differences in performance, in terms of attendance at races, the number and type of accidents, paying more attention to the injuries concerning the lower limb muscle type, DOMS (Delayed Onset Muscular Soreness).

Material and Method

Participants. The participants were fifty (13) senior male athletes, aged between 25 and 35 (14) who had to play a number of races between 20-24. The players were members of clubs registered for amateur football championships and had passed the medical examination to be suitable to perform competitive activities. The research team, coordinated by the author, led the study with two companies, called yellow and green for the color of the uniforms, each consisting of twenty-five players. The average age of the sample was 34.7(SD \pm 4.26) with an average weight of 77.4 (range 68-89Kg) and an average height of 178.3cm (range 168-187 cm)

Target. The research target was to verify the number and type of injuries, and the consequent number of presences in official competitions, considering the performance on different playing surfaces consisting of natural grass and / or synthetic grass. Monitoring was carried out by detecting the conditions that led a player to leave the field, then to interrupt the activity, which had consequences in participation, training and matches (15). Injuries (Table 2) were classified according to the time of absence from sporting activity.

Table 2. Injuries classification

< 15gg	Mild injury
between > 15gg , < di 45gg	Moderate injury
> 45gg	Serious injury

The research was conducted through an observational method and computerized data surveys, from November 2017 to April 2018. The two companies followed the same training program (16), drawn up jointly by the technical staff, consisting of two training sessions a week, characterized by athletic, technical and tactical exercises. The quality of the training is certainly an important factor that can affect on the onset of problems during a season and indicates how the absence of muscle injuries is directly linked to specific programs of pre-activity heating and correct use of stretching technique. The training was carried out both on natural grass pitches and artificial turf fields for about three months for each type of surface.

From November to January the yellow group trained on artificial turf field while from February to April the natural grass field was used. The green group, on the contrary, carried out training on natural grass field from November to January, and on synthetic grass the remaining three months.

The analysis also considered that the execution of technical gestures was subordinated not only to the surface but also to the physical conditions of the athletes and to the climatic conditions. It is clear that a technical

gesture carried out on a natural grass field in constant sunshine and temperature is comparable to the one on a synthetic grass field. The situation is different if the weather conditions are disadvantageous (wind, rain, etc.). The ball bounce is different, the ground slipperiness is significantly different, the difficulty coefficient to make a stop or a passage is variable. *Materials and resources:* Soccer ball n.5, stadium, cones, small tools, PC, grid.

Results

The data collected through a computerized survey showed that, in total, the sample of senior athletes suffered 36 muscle injuries (of which 5 relapses) to the lower limb equal to about 72%. These events occurred mostly during training (around 68%) compared to races (around 32%). With reference to the classification (Table 2) there were 10 minor injuries (contractures - 27.8%), 18 moderate (sprains - 50%) and 8 serious (tears - 22.2%) mainly located on the femoral quadriceps, biceps femoral and calf (soleus and gastrocnemius). Of the twenty-five players in the yellow group, eighteen suffered a total of twenty two muscle injuries (Table 3, Figure 1), with three relapses while the twenty-five players in the green group suffered a total of fourteen muscle injuries (Table 3, Figure 2), with two relapses. The final survey showed a numerical increase in injuries occurring during training period (November-January) for the yellow group, compared to that monitored in the field on natural grass (about 40%).

Table 3. Injuries lower limb yellow and green group

Injuries number yellow group	Severity	Injuries number green group
7	Mild injury	3
10	Moderate injury	8
5 (including three recurrences)	Serious injury	3 (including two recurrences)

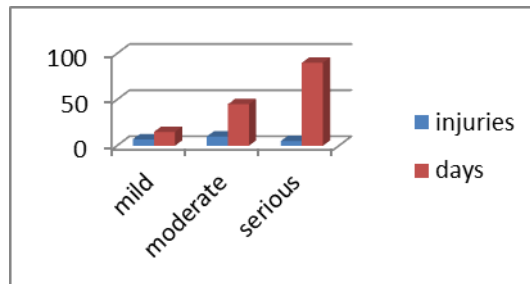


Figure 1. Yellow group injury trend

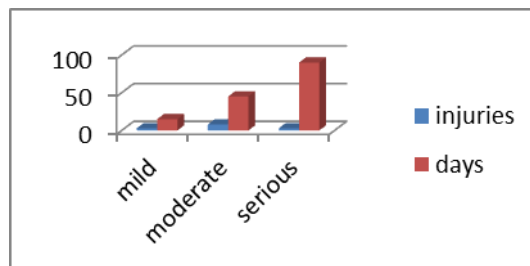


Figure 2. Green group injury trend

Discussion and Conclusion

The research target was to verify the occurrence of lower limb muscle injuries (17) on 2 types of surfaces: natural and synthetic. The final data showed that, although with a gap of about 20%, the accidents occurred mainly on artificial turf fields. Statistical references show that muscle injuries occupy a large part of the rehabilitation procedures and being a study related to amateur football, the social fallout in terms of lost working hours (18) and the time duration of disability must not be neglected (19). The interesting fact which comes out is the correlation between some types of injuries, in particular of a muscular nature, and the synthetic surface (15).

The limited number of sample, fifty amateur athletes, and the literature references that state that muscle injuries are more frequent in middle age, should be considered variable in lower average age (7).

In literature, few studies have been found concerning the comparison between the game surfaces proposed by this research. However, the study methodology adopted made it possible to make a comparison between two teams that carried out both training and competitions on both surfaces, albeit in different periods of the year.

The critical factors, in addition to the atmospheric variability, can be identified in the poor adaptation of the athletes to different surfaces and the difficulty in developing certain abilities in the presence of surface changes.

The sample, even if of only fifty athletes, showed a greater adaptability to the natural grass field compared to the synthetic grass one, so it is clear that the playing surface is a significant variable that determines fluctuating performances and that affects the type of injuries. The athletes performed the same type of training and controlled the diet (20-24).

Our research has pursued the objective of detecting lower limb muscle problems and the data confirmed that synthetic grass significantly increases injuries to the back of the thigh. It is hoped the intensification of other studies on these topics considering that the purpose is always referred to the protection of the individual health, who through sport can live gratifying experiences and improving self-esteem and the development of collaborative abilities and relationships.

References

1. Cheng H., Hu Y., Reinhard M. (2014). Environmental and health impacts of artificial turf: a review. *Environ Sci Technol*; 18;48(4):2114-29
2. Ekstrand J., Tropp H. (1990). The incidence of ankle sprains in soccer. *Foot Ankle*; 11(1):41-4.
3. McGhie D., Ettema G. (2013). Biomechanical analysis of surface-athlete impacts on third-generation artificial turf. *The American Journal of Sports Medicine*; vol. 41, no. 1, pp. 177-185
4. Høy K., Lindblad BE., Terkelsen CJ, Helleland HE., Terkelsen CJ. (1992), European soccer injuries. A prospective epidemiologic and socioeconomic study. *Am J Sports Med*; 20(3):318-22.
5. Inklaar H. (1994). Soccer injuries. I: Incidence and severity. *Sports Med Auckl NZ*; 18(1):55-73.
6. Montesano Pietro, Tafuri Domenico, Mazzeo Filomena (2016). The dropouts in young players. *Journal of Physical Education and Sport*; Vol. 16, Issue 4, Art 197, pp. 1242 - 1246
7. Taimela S., Kujala UM., Osterman K. (1990). Intrinsic risk factors and athletic injuries. *Sports Med Auckl NZ*; 9(4):205-15.
8. Hawkins RD., Hulse MA., Wilkinson C., Hodson A., Gibson M. (2001). The association football medical research programme: an audit of injuries in professional football. *Br J Sports Med*; 35(1):43-7.
9. Hawkins RD., Fuller CW. (1999). A prospective epidemiological study of injuries in four English professional football clubs, *Br J Sports Med*. 33(3):196-203.
10. Yde J., Nielsen AB. (1990). Sports injuries in adolescents' ball games: soccer, handball and basketball. *Br J Sports Med*; 24(1):51-4.
11. Ford KR., Manson NA., Evans BJ., Myer GD., Gwin RC., Heidt RS., et al. (2006). Comparison of in-shoe foot loading patterns on natural grass and synthetic turf. *J Sci Sports Med Aust*; 9(6):433-40
12. Hägglund M., Waldén M., Ekstrand J. (2006). Previous injury as a risk factor for injury in elite football: a prospective study over two consecutive seasons. *Br J Sports Med*; 40(9):767-72.
13. Heidt RS, Dormer SG, Cawley PW, Scranton PE, Losse G., Howard M. (1996). Differences in friction and torsional resistance in athletic shoe-turf surface interfaces. *Am J Sports Med*; 24(6):834-42.
14. Platonov V. (2004). *Fondamenti dell'allenamento e dell'attività di gara*, Calzetti&Mariucci, Perugia.
15. Meyers MC, Barnhill BS. (2004). Incidence, causes, and severity of high school football injuries on FieldTurf versus natural grass: a 5-year prospective study. *Am J Sports Med*; 32(7):1626-38.
16. Hocking J., Cordy J., Mendez-Villanueva A., Coutts AJ. (2013). Monitoring fitness, fatigue and running performance during a pre-season training camp in elite football players. *J. Sci. Med. Sport*; (12):S1440-2440
17. Montesano Pietro, Tafuri Domenico, Mazzeo Filomena (2016). The dropouts in young players. *Journal of Physical Education and Sport*; Vol. 16, Issue 4, Art 197, pp. 1242 - 1246
18. Junge A., Lamprecht M., Stamm H., Hasler H., Bizzini M., Tschopp M., et al. (2011). Countrywide campaign to prevent soccer injuries in Swiss amateur players. *Am J Sports Med*; 39(1):57-63.
19. Mazzeo, F., Motti, M.L., Messina, G., Monda, V., Ascione, A., Tafuri, D., Palmieri, F., Messina, A., Monda, M. (2013). Use of nutritional supplements among south Italian students of physical training and sport university. *Current Topics in Toxicology*; 9, pp. 2126

20. Montesano P. (2018). Monitoring and upgrading of coordinative and conditional capacities of young athletes practicing handball. *Journal of Physical Education and Sport @ (JPES)*; Vol. 18, Suppl 1: 465 – 468.
21. Nica AS, A Caramoci, M Vasilescu, AM Ionescu, D Paduraru, V Mazilu (2015). Magnesium supplementation in top athletes-effects and recommendations. *Medicina Sportiva*; vol. XI, no 1, 2482-2494.
22. Mazzeo F., Santamaria, S., Monda, V., Tafuri, D., Dalia, C., Varriale, L., & Monda, M. (2016). Dietary supplements use in competitive and non-competitive boxer: An exploratory study. *Biology and Medicine*; 8(4) doi:10.4172/0974-8369.1000294
23. Munteanu AM, D Manuc, A Caramoci, M Vasilescu, A Ionescu (2014). Nutrition timing in top athletes. *Medicina Sportiva*; X(3): 2357-2363
24. Ionescu AM, MM Vasilescu, A Carmoci, AS Nica, S Ionescu (2014). Long-term glutamine supplementation in elite gymnasts. *Farmacia*, 62 (4), 761-766

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