

Surfaces on Sprint Performance

Subjects: Others

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The main function of a sport surface is to ensure safety and adequate player performance during physical exercise practice.

Keywords: Speed ; Fatigue ; Artificial Turf ; Natural Turf ; Sand ; Performance Analysis

1. Introduction

One of the most important goals in sport surface construction is to improve sport performance ^[2]. The constant improvement of sport surfaces like artificial turf is motivated by the demands of the sport sector, as the quality of sport surfaces is considered a determining factor for achieving results ^[3]. It has been suggested that changes in sport surfaces can have effects on performance patterns and athlete injury ^[4]. Various studies have proven a relation between the elasticity of a sport surface and athletes' performance ^[5].

Research on injury risk has shown contradictory results, although in general, the risk of injury appears to be equivalent on artificial turf and natural grass ^{[6][7]}. On the other hand, Plaza-Carmona et al. ^[8] have shown that bone mass is not affected by practicing football on natural or on artificial turf. Other studies have focused on biomechanical aspects. Alcaraz et al. ^[9] analyzed running speed kinetics on sand and on an athletic track, finding significant differences in players' biomechanics. Previous researches have provided information on the influence of the structural components of artificial turf on its mechanical properties, like the study by Sánchez-Sánchez et al. ^[10], in which it was observed that a compact gravel sub-base extended surface durability, with adequate security parameters.

Likewise, exercise on soft surfaces, like sand, is associated with higher energy expenditure and lower stimulus in impact training than on hard surfaces ^{[11][12][13]}. Brito et al. ^[14] measured higher levels of lactate and increased heart rate in football players during a simulated match on sand compared to artificial turf and hard surfaces. Other studies recommend sand as a training surface for improving neuromuscular adaptations ^{[12][15]}. In volleyball players, vertical jump was higher on a hard surface than on a soft surface ^{[16][17]}.

Another common sport activity analyzed on different sport surfaces is sprint. It has been proven that the high absorption that occurs on sand surfaces limits the maximum speed ^{[11][18]}. Therefore, physical performance in sprint and jumping actions is influenced by traction, rigidity, and force reduction of the surface ^[19]. Studies like the one by Brechue et al. ^[20] analyzed the differences in speed during sprints on sand and on the track, showing a significant speed reduction on sand. However, no significant differences have been demonstrated in speed on artificial and natural turf, except when the sprinting action includes changes in direction, in which case, speed is higher on artificial turf ^[21]. Despite this, controversy exists, as the physiological demands of sprint on artificial and natural turf were found to be similar in some studies ^[22] or higher on natural surfaces in other works ^[23].

2. The Effect of Different Surfaces on Sprint Speed in Athletes

This study was completed in accordance to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines ^[24]. A search strategy was developed to identify all relevant studies assessing the effect of different surfaces on sprint speed in athletes. The search was registered in PROSPERO. Our systematic search was conducted in different online databases: PubMed (whole database), SPORTDiscus, and Web of Science (whole database), since their inceptions until 17 March 2020. The terms used in the search of the databases were: ('soccer' OR 'football' OR 'rugby' OR 'hockey' OR 'netball') AND (performance OR assessment OR sprint OR speed) AND ('artificial turf' OR 'synthetic' OR 'natural' OR 'grass' OR 'sand' OR 'playing surface' OR field).

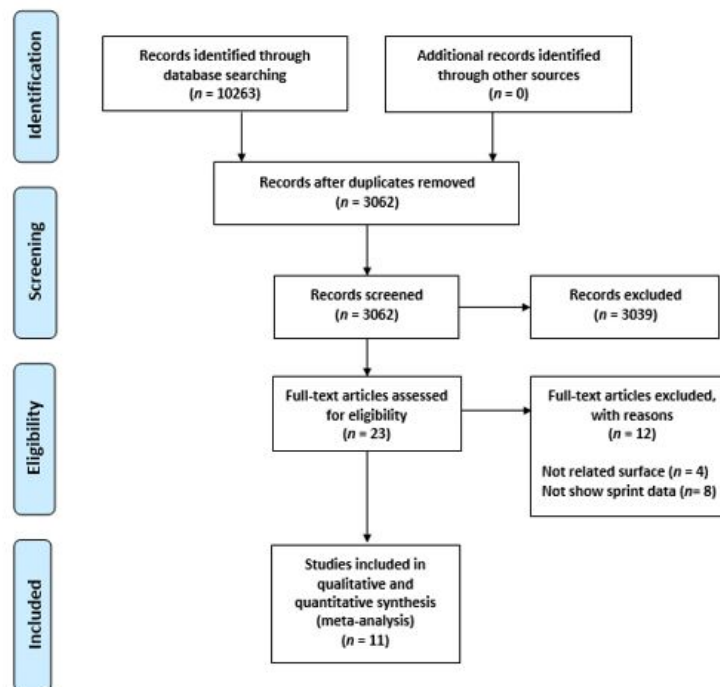
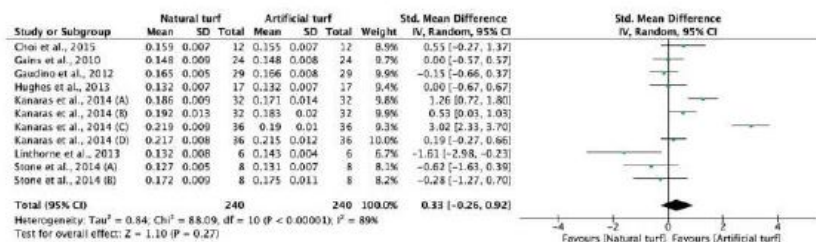
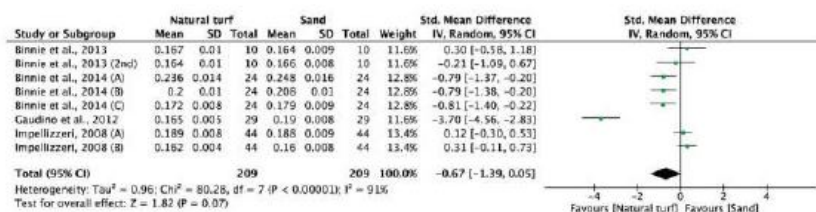


Figure 1. Flow diagram of the study.

3. Potential Bias



(a)



(b)

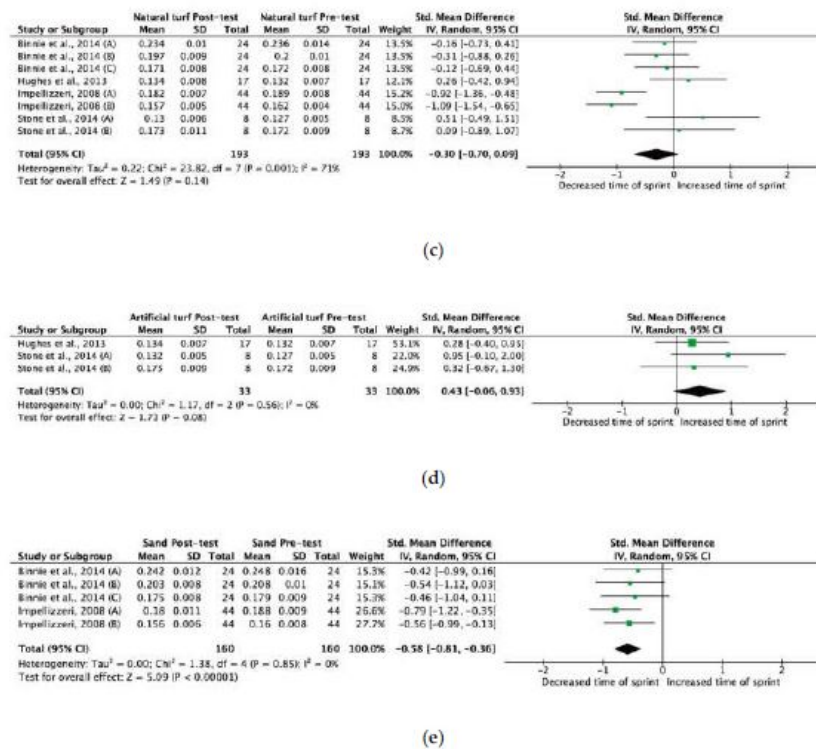


Figure 4. Standardized mean difference (SMD) between sprint time in: a) natural vs. artificial turf; b) natural turf vs. sand; c) natural turf pre- and post- sprint time assessment with different training methods; d) artificial turf pre- and post- sprint time assessment with different training methods; e) sand turf pre- and post- sprint time assessment with different training methods. Square represent the SMD for each trial. Diamonds represent the pooled SMD across trials.

4. Conclusion

In conclusion, the playing surface is a determining variable affecting the performance of sprint. Thanks to their qualitative improvement, artificial-turf pitches are similar to those in natural turf as regards their effect on sprint speed. The high impact absorption of sand represents the main factor deteriorating sprint performance. Despite this, sand surfaces do not prevent improvements.

As for the limitations, of this study the high heterogeneity of the results observed when comparing different surfaces may be due to the limited time available to produce force during sprint on each surface. Other meta-analyses have shown high heterogeneity of results when different methods were compared [25].

Future research must include control variables to determine the effects of the structural characteristics of artificial- and natural-turf pitches, as well as their mechanical properties. However, the results of this meta-analysis do not show performance differences, in the case of sprint speed. In fact, the results show a better performance on artificial turf in some sub-groups. Previous studies showed that artificial turf also does not cause more injuries and can even reduce them [26]. Therefore, even though the effect of artificial turf on speed could in principle affect a game result, until now, scientific investigation suggests that it is an ideal surface to substitute natural turf in unfavorable economic situations or adverse climates, without negative repercussions on sprint performances

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