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Sprint and Change of Direction Performances on Three Different Futsal Playing Surfaces †

Shariman Ismadi Ismail [1,2,*], Hiroyuki Nunome [3], Yuji Tamura [3], Takahito Iga [3] and Shusei Sugi [2]

[1] Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Shah Alam 40450, Malaysia
[2] Graduate School of Sports and Health Science, Fukuoka University, Fukuoka 814-0180, Japan; ss1229_soccer@yahoo.co.jp
[3] Faculty of Sports and Health Science, Fukuoka University, Fukuoka 814-0180, Japan; nunome@fukuoka-u.ac.jp (H.N.); ytamura@fukuoka-u.ac.jp (Y.T.); iga@fukuoka-u.ac.jp (T.I.)
* Correspondence: shariman_2000@yahoo.com; Tel.: +60-17-531-5407
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Abstract: This study was conducted to clarify the differences in sprint and change of direction performances on different futsal flooring systems (area-elastic (AE) vs. combined-elastic (CE)). Eight recreational athletes were recruited to perform the 505-agility test on three different EN 14904-certified futsal playing surfaces (AE, CE1 and CE2). All participants wore an identical footwear during the test. Timing-gate systems were utilized to record the time of 5-m sprint run-up and the change of direction components from the agility test. Participants were also requested to evaluate the perceived shoe-surface overall traction performance after each trial. The differences of performance across all surfaces were analyzed by one-way ANOVA repeated measures ($p < 0.05$). Results revealed that there was significant difference in change of direction performance between CE1 and CE2 surfaces ($p = 0.04$). It was also found that the mean score of the perceived traction performance evaluated by the participants were significantly different across all surfaces ($p < 0.05$).

Keywords: futsal; traction; playing surfaces

1. Introduction

Futsal is one of the fastest-growing indoor sports in the world [1–3]. Like any other sports, the playing surface is crucial for injury prevention and successful performance. In general, there are four main systems for indoor sports surface: point elastic, mixed elastic, area elastic and combined elastic [4]. Futsal is commonly played on a rigid, non-abrasive indoor court. It could be argued that the fast-paced and many directional changes in the nature of the game are benefited from such playing surface systems. Since there is no specific standard for types of the playing surface materials, it is common for futsal to be played on several types of surfaces, namely wooden flooring or on various types of synthetic surfaces. To date, it is inconclusive if different flooring systems could influence the player's movements, namely sprinting and changing of direction performances.

This study was conducted to clarify the differences in (1) short-distance sprint and change of direction performances; (2) perceived shoe-surface overall traction performance, between an area-elastic (hardwood flooring) and combined-elastic (vinyl + hardwood flooring) systems.

2. Method

2.1. Participants

In this study, eight male recreational athletes were recruited (age 22.4 ± 3 years old, body mass 71.0 ± 8.0 kg, height 172 ± 1.4 cm). All participants are active in sports activity. The exclusion criteria are history of fracture of any parts of lower limb and lower limb ligament injury. All participants provided their written informed consent prior to the study, in accordance to the research ethical approval obtained from the institutional research ethics committee.

2.2. Instrumentation

The experiment test area set-up is shown in Figure 1. Three identical test areas were prepared according to the 505-agility test standard, each with different futsal playing surface material (1.5-m width and 20.5-m length). Timing-gate systems (Witty System, Microgate, Italy) with maximum precision (±0.4 thousandths of a second) were utilized to record the time of a 5-m sprint run-up and the change of direction components from the agility test. All participants wore identical futsal shoes during the test (Mizuno Monarcida Sala, model no. Q1GA1611).

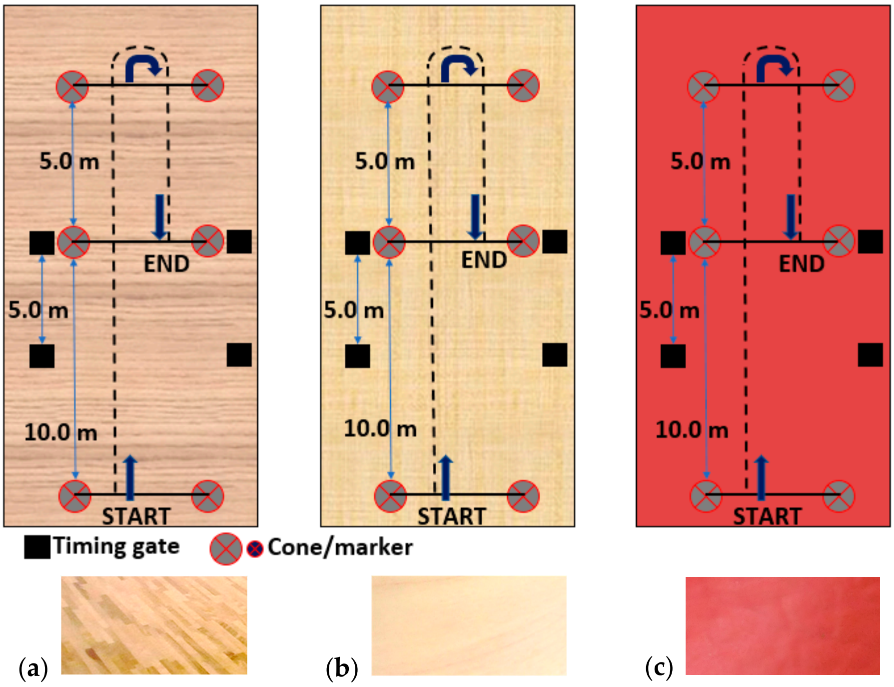


Figure 1. The 505-agility test set-up with different playing surfaces; (**a**) AE: Hardwood surface with shock absorption between 40–55% (A3) (**b**) CE1: Vinyl surface with shock absorption between 25–35% (P1), Impact Protection Index* (IPI) value of 52 (**c**) CE2: Vinyl surface with shock absorption between 25–35% (P1), Impact Protection Index* (IPI) value of 73. * The Impact Protection Index (IPI) measures the property of the vinyl surface that reduces the risk of immediate injury for all users when falling, diving, or sliding (Sources: ETH Zurich study Poitiers University biomechanical study AFNOR recommendation letter AC P 90-205). A higher IPI measurement provides more protection from shock on the body.

2.3. Procedure

Each participant performed four maximal randomized trials (no two consecutive trials on the same surface) of the 505-agility test [5] on each futsal playing surface as shown in Figure 1 (changing direction using right and left leg, twice each). The 5-m sprint performance component was measured as the time when participants ran between timing gate 1 and timing gate 2. The change of direction performance component was measured as the time when participants ran past the timing gate 2, turned back at 5m ahead, and then went back to pass the timing gate 2 again.

All participants were also requested to evaluate their perceived shoe-playing surface overall traction performance after each trial using 5-point Likert scale (1 = poor, 2 = fair, 3 = average, 4 = good, 5 = excellent).

2.4. Data and Statistical Analysis

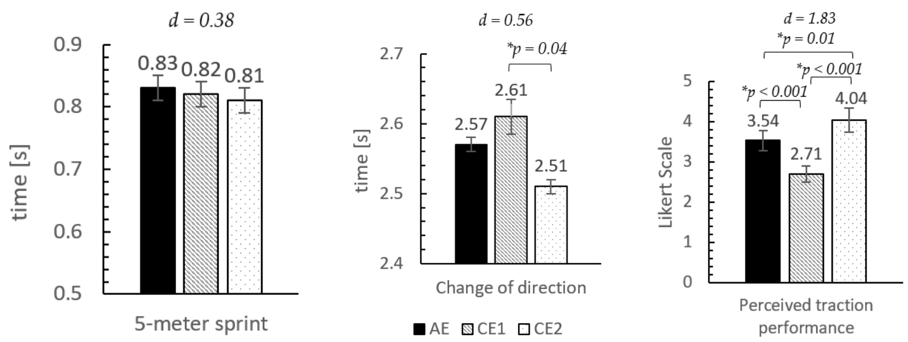
The overall results of 505-agility test using right and left leg for each participant were compared using paired-sample *t*-test ($p < 0.05$). When there was no statistical significance between right and left leg performance, all data were used for further analysis.

The differences of 5-m sprint and change of direction performance and the perceived traction performance across all surfaces were analyzed by one-way ANOVA repeated measures ($p < 0.05$). Post-hoc Bonferroni analysis was then performed if necessary, at significance level of $p < 0.05$.

The effect size was measured using Cohen's *d*, converted from the eta-squared value calculated using the ANOVA results according to Cohen (1988) [6].

3. Results

The results obtained from this study are presented in Figure 2.



(**a**) (**b**) (**c**)

Figure 2. (**a**) 5-m sprint performance (**b**) change of direction performance (**c**) perceived overall traction performance. (*One-way ANOVA repeated measures with Bonferroni test: $p < 0.05$). Effect sizes are shown as Cohen's *d*.

4. Discussion

There are three main findings in this study. The first one is related to the 5-m sprint and change of direction performance. Across all types of playing surfaces, no significant differences were found during 5-m straightforward sprint performance (Figure 2a). This finding is in line with the results reported in the previous studies where, on certain sport surfaces, short-distance sprint performance may not be influenced by the shoe and the playing surfaces' interaction [7,8].

However, it was found that change of direction performance in futsal can be influenced by different shoe-surface interaction (Figure 2b). Again, this finding is in line with previously reported studies across several sports such as soccer and basketball [9,10]. Inconsistency of findings between straightforward running and cutting might be explained by high-traction demand during change of movement direction in futsal [11,12]. In addition, the role of shoe outsole tread geometry and sliding orientation during change of direction on different playing surfaces may also account for it [9,13].

The second finding is related to the perceived overall traction performance on each playing surfaces. This study revealed that with respect to the traction performance, participants felt each playing surfaces performed differently (Figure 2c), even though all the surfaces have similar traction property approved by EN 14904-certified criteria. This highlights the low-sensitivity aspect of the sport surface slip resistance standard, where all three playing surfaces were identified as similar (there is only one criteria for slip resistance property: 80–110 based on pendulum/skid resistance test value; according to EN standard), yet it performed or was felt differently by human participants.

The third finding is related to the performance between different types of flooring systems. As shown, with respect to the traction performance (cutting), neither AE nor CE flooring systems proved better performance against one another because the resultant performance of AE was ranked 2nd in between CEs (Figure 2b). This suggested there is another main factor that could influence traction performance. One of the possibilities is the different value of the Impact Protection Index (IPI) possessed by CE1 and CE2 which could influence the impact mechanism during shoe-floor interaction. Previous study has identified that the grip performance of sports footwear was highly correlated with the initial impact phase of the shoe-floor interaction [14]. Another possibility is the tribological aspect of the playing surface. Previous study highlighted that surface roughness aspects influenced the frictional properties in sports footwear-floor interaction [15]. Future studies should be warranted to observe the impact dynamics and tribological properties of futsal court material.

Finally, it is worth mentioning that even with small numbers of participants, the effect sizes measured in this study for the change of direction during the 505-agility test (d = 0.56) and the perceived traction performance (d = 1.83) have indicated a moderate to large statistical power. Therefore, this finding emphasizes the feasibility of change of the direction-functional test to evaluate shoe-playing surface interactions [16].

5. Conclusions

Within the limitation of this study, it was concluded that different playing surfaces could potentially influence the playing performance in futsal, in particular during change of direction movements. It was also found that although all playing surfaces meet the same slip resistance performance criteria, the perceived overall traction performance evaluated by human participants were significantly different across all surfaces. Additionally, it was found that with respect to the traction performance, neither AE nor CE flooring systems proved to be better against one another. The tribological aspects might influence the shoe-playing surface interaction more rather than the flooring system itself.

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