121 - THE RELATIONSHIP BETWEEN THE PERFORMANCE IN THE VELOCITY TEST OF YOUNG SOCCER PLAYERS IN DIFFERENT SURFACES

PEDRO ROGÉRIO VITORETTI AMARAL;
DAVIDSON ALVES DA SILVA;
SÍLVIA RIBEIRO SANTOS ARAÚJO.
Universidade Federal de Minas Gerais
Escola de Educação Física, Fisioterapia e Terapia Ocupacional.
Belo Horizonte, MG. Brasil
pedroamaral@msn.com

Introduction

Soccer is one of the most complex collective sports and it demands periods of high intensity that characterize a variety of sprints (HELGERUD, 2001). Sprints are extremely important for many sports (YOUNG, JAMES, MONTGOMERY, 2002). In a soccer game, although only 11% of the running distance is characterized by high velocity actions, sprints are decisive in a match because they directly affect the success of actions such as reaching a ball during the pass or scoring a goal (REILLY, BANGSBO, AND FRANS, 2000). Little and Williams (2005) also defend the idea that acceleration is an important aspect for professional players. During the game, this capacity can be identified when running after the ball, starting off a movement, or rapidly dribbling someone. Therefore, a variety of methods should be proposed to enhance the speed of an athlete.

Practices in sand have been frequently used because it leads to a lower chance of muscular injures when compared to rigid areas (MIYAMA, NOSAKA, 2004), and because it lowers the stress over the muscular system. However, the training methods have been planned without considering the specific characteristics of the surface in which the exercises are performed.

Some studies have researched about the influence of different surfaces in the performance of physical capacities (MOREIRA, 2001; PINNINGTON and DAWSON, 2001; SWMUCHROWSKI, DIAS and CARVALHO, 2004; FORD et al., 2006; IMPELLIZZERI et al., 2007).

Impellizzeri et al., (2007) compared the chronic effects of the plyometric training in grass and in sand and its effects on muscular pain, vertical jump heights, and sprint capacity of soccer players. The results show that both training methods produce positive effects in sprint capacity and in vertical jumps, independently of the surface. However, the plyometric training caused less muscular pain in sand than in grass. While in grass it was observed improvements of the CMJ performance, in sand it was observed improvements in the SJ performance. From that, we imply that sand training requires a more intense concentric phase probably to compensate for the degradation or reutilization of the elastic energy by sand, and also to compensate for the ankle joint difficult to move the body in the vertical axis (GIATSIS, KOLLIAS and PANOUTSAKOPOULOS, 2004). Many aspects influence the neuromuscular system related to the stretch-shortening cycle depending on the surface and on the training method.

Lejeune, Willems and Heglund (1998) found that 1.6 to 2.5 higher mechanical work is needed during a walk in sand when compared to a walk in a rigid surface at the same velocity. A run in sand, under the same conditions, requires 1.15 times more mechanical work than a run in a rigid surface. With regard to the energy expenditure, a walk in sand demands 2.1 2.7 times more energy than a walk in rigid surface at the same velocity. Running in sand requires 1.6 times more energy than running in a rigid surface. The energy expenditure increases mainly because of two facts: the mechanical work realized in sand and the reduction in concentric work efficiency of muscle and joints.

Pinnington and Dawson (2001) also analyzed the energy expenditure of non- professional runners during their work out both in sand and in a rigid surface with and without shoes under velocities of 8Km/h and 14km/h. In sand, independently of the conditions, the energy expenditure was 1.5 1.6 times higher than in grass. It was not found significant differences (P>0,05) when comparing activities in sand with or without shoes. Similar results were found by Zamparo et al. (1992).

Muramatsu et al (2006) compared the energy consumption during a maximum vertical jump in sand and in a firm surface, both at the same height.

They found that jumps in sand require 1.2 times more energy than jumps in a firm surface. The reasons for raising the energy expenditure in sand can be related to the degradation of elastic potential energy, the higher production of work to maintain body balance at an unstable surface, and the reduction of exercise efficiency to coordinate many body segments.

Therefore, the purpose of this study was to compare the performance of young soccer athletes during 15-meter-velocity tests (V 15m) in a straight line and different surfaces.

Materials and Methods

The subjects of the study were 22 athletes from a Belo Horizonte soccer team: 18 of a younger category (14 to 15 years old) and 4 of an older category (16 to 17 years old).

According to information given from the coaches and staff, none of the athletes presented medical impediments to participate in the tests. The children guardians signed a free informed consent term allowing the kids to participate in the study.

Before the beginning of the tests, the volunteers were submitted to characterization in which they were asked age, body mass (BM), and Stature (TAB. 1).

15-meter Velocity Test

The velocity test was performed in grass and sand using appropriate footwear (cleats), and without shoes to avoid influence of any footwear type in the results.

Table 1 Characterization of the Sample- Age (years), Body Mass (Kg), and stature (cm).

Values	Age (years)	BM (Kg)	Stature (cm)
Average	14,81	63,29	174,6
Standard Deviation	0,85	8,75	5,62

According to Mohr, Krustrup, and Bansbo (2003), the average sprint length in a soccer game is 15meters to 17meters. For Cometti et al. (2001) soccer players are faster for 10meter to 15meter distances. So that, after adaptations, MENZEL´s velocity test (1995) was used. This one consists of a 15meter long straight line with 2 photocells, one located at the 0m mark and one at the 15m mark, respectively. In order to verify the performance in this velocity test, it was used 2 pairs of MultiSprint EQ-34, Sunx, photocells that are triggered by the interruption of infrared rays when the players cross them, registering the time spent by

the volunteers to go through the 15meters.

In order to avoid the chronometer to be activated, the volunteers positioned themselves behind a line that was 30cm far away from the first photocell barrier. They started from a stationary position and the right moment to begin running was determined by the athletes themselves. After the start, they would run 15meters trying as hard as they could to reach the highest velocity and without reducing acceleration until they crossed the last photocell barrier.

The athletes were randomly divided. 11 volunteers began the tests in grass while the other 11 began in sand. It was also randomly determined if the athlete would run with or without shoes first.

The tests were finished in a single day. Firstly, the anthropometric measures were taken (Body Mass and Stature); secondly the V15m was carried out. It was composed of 12 trails, 3 with shoes and 3 without shoes for each kind of surface (sand and grass). A 2-to-3 minute rest was respected between trials of the same surface. A 25-to-30 minute rest was respected each time a different surface test began. The best performance among the trials was the one used for statistical analysis.

Statistical Procedures

In order to statistically examine the information, a test of variance analysis (ANOVA) was used. The Post Hoc Tukey test was used to eliminate any different that could have appeared in the data. The significance level maintained the value of p<0, 05. All the analysis was done in the SPSS 13.0 Version Software.

Results

Table 2 shows the descriptive analysis of the time in each situation. Table 3 shows the results of the variance analysis with p<0, 05.

Comparing the average results, it was verified a significant difference among the performance of players during the TSG (average: 2, 50 and SD: 0,106), the TSS (average: 2, 75 and SD: 0,109), and the TWS (average: 2, 68 and SD: 0,106). It was found significant difference between the performance in the TSS and TWG (average: 2, 49 and SD: 0,096)

It has not been found significant differences between the average results of the TSG and the TWG, or between the average results of the TSS and the TWS. The results are shown in Graphic 1.

Table 2 Descriptive analysis of the time (second) in each situation.

Variables	N	Minimum	Maximum	Average	Standard Deviation (SD)
TSG	22	2,37	2,74	2,50	0,106
TSS	22	2,57	2,99	2,75	0,109
TWG	22	2,36	2,75	2,49	0,096
TWS	22	2,50	2,90	2,68	0,106

TSG (Test using Shoes in Grass), TSS (Test using Shoes in Sand), TWG (Test Without Shoes in Grass), TWS (Test Without Shoes in Sand).

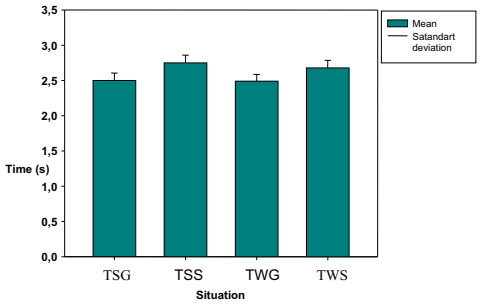
Table 3 Comparison between the experimental situations

Variables	Comparison	Sample (N)	Results
TSG	TSG	22	0,000*
	TWG	22	0,987
	TWS	22	0,000*
TSS	TWG	22	0,000*
	TWS	22	0,103

There was significant difference with p<0,05.

Discussion

This study verified the existing difference in the performance of the V15m in sand and grass, not depending on the "with or without shoes" condition. One of the aspects that influenced the results was the optimal use of the stretch-shortening cycle (SSC) during the motor tests.



Graphic 1 Average and Standard Deviation of the results (time) measured in the V15m in 4 different situations: TSG, TSS, TWG, TWS *p<0,05

* Significant Difference p<0,05 with regard to TSG e TWG.

* Significant Difference p<0,05 with regard to TSG e TWG.

So that, one of the factors that could have influenced the higher average time for the athletes to go through the 15meters in sand when compared to grass can be related to a higher time to execute the movement concentric phase.

This increased time during the concentric phase in sand, according to Morgan and Proske (1997), can be related to a higher contact time between the foot and the sand which results in degradation of the potential elastic energy and reduction of the muscle-joint efficiency.

This can happen to compensate for the degradation of the potential elastic energy stored by the elastic elements in series. This degradation is caused by the surface that presents the greater deformation (sand) and by the greater ankle difficult to move the body in the vertical axis (GIATSIS, KOLLIAS, and PANOUTSAKOPOULOS, 2004). It means there is a lower

participation of the SSC and, consequently, the contractile system is more frequently used during a specific task. However, because grass is a more rigid surface, there can be a better use of the SSC; thus a better use of the potential elastic energy and a better performance.

To Zamparo et al. (1992) the higher contact time between the foot and the surface in sand happens due to the necessity of getting stability. This increased contact period can alter the time of transition between eccentric and concentric muscular actions at the support phase of the run during the Short-Stretching cycle (SSC). This fact can lower the performance in sand because it also results in degradation of the potential elastic energy which contributes to a higher energy expenditure (PINNINGTON and DAWSON, 2001).

Another fact that could contribute to a longer time to run the V15m in sand can be the increase of mechanical work and the decrease of the positive work done by muscles and joints (LEJEUNE, WILLEMS, and HEGLUND, 1998). These researchers verified an increase of the metabolic cost and the mechanical work, finding the reason for a higher time needed to walk and run in soft sand. Muramatsu et al. (2006) also used this argument to justify the greater effort required during jumps in sand than in a rigid surface. In addition, Muramatsu et al. (2006) indicates that the increased work necessary to maintain body equilibrium at an unstable surface and the lower exercise efficiency to coordinate body segments are reasons for higher energy expenditure, what confirms the idea of more energy expenditure for sprints in sand and a lower performance.

We can conclude that there was not any influence of the footwear in the test performances because the surface was always the same for those tests that did not show significant differences (TSG X TWS and TSS X TWS). In spite of Lees´s comments (1996), cited by Moreira (2001), about the existent interference of friction between footwear and surface on individual game quality, it did not affect the performance of any test. It is worth emphasizing that this study was carried out both in natural and synthetic surfaces.

However, despite the lower performance in sand, which reasons were already explained previously, there was no significant difference between the performance of players with or without shoes.

So, the parameters related to velocity performance in sand, which were found in this study as well as in other studies comparing sand with rigid surfaces (ZAMPARO et al., 1992; LEJEUNE, WILLEMS, and HEGLUND, 1998; PINNINGTON and DAWSON, 2001; MURAMATSU et al., 2006; IMPELLIZZERI et al., 2007), should be considered when elaborating a velocity training program in sand.

Conclusion

Accordingly, the performance of young soccer athletes was lower and significant in sand if compared to the performance of these players in grass and sand during velocity tests composed of a 15-meter straight line.

The fact of wearing shoes, independently of the surface, did not interfere in the performance of a V15m.

This way, it is possible to infer that methods, procedures, and training load to enhance the physical speed of young soccer players should be specific and differentiated, taking into account the environment influence and each surface own characteristics

Key words: soccer, velocity, surface

References

COMETTI, G., MAFFIULETTI, N. A., POUSSON M., CHATARD, J.C., MAFFULLI N., Isokinetic Strength and Anaerobic Power of Elite, Subelite and Amateur French Soccer Players. *Internacional Journal sports medicine* V.22 n.1 p. 45-51, 2001;

FORD, Kevin R., MANSON, Neil A., EVANS, Blake J., MYER, Gregory D., GWIN, Richelle C., HEIDT Jr, Robert S., HEWETT, Timothy E., Comparison of in-shoe foot loading patterns on natural grass and synthetic turf. *Journal of Science and Medicine in Sport* V.*9*, p. 433-440*;* 2006;

GIATSIS, G., KOLLIAS, I., PANOUTSAKOPOULOS V, et al. Biomechanical differences in elite beachvolleyball players in vertical squat jump on rigid and sand surface. *Sports Biomech* 2004;3:145-58.

HELGERUD, J.; EGEN, L.; WISLOFF, U.; HOFF, J.; Aerobic endurence improves soccer performance. Medicine and Science in Sports Exercise. V33, p 1925-1931, 2001;

IMPELLIZZERI, F. M., CASTAGNA, C., RAMPININI, E., MARTINO, F., FIORINI, S. and WISLOFF, U. Effect of plyometric training on sand versus grass on muscle soreness, jumping and sprinting ability in soccer players. *Br. J. Sports Med.*published online 25 May 2007;

LEJEUNE, T. M; WILLEMS, P. A e HEGLUND, Mechanics And Energetics Of Human Locomotion On Sand. *The Journal of Experimental Biology*, p. 20712080, 1998.

MIYAMA M, NOSAKA K. Influence of surface on muscle damage and soreness induced by consecutive drop jumps. *J Strength Cond Res* 2004;18:206-11.

MOHR, M., KRUSTRUP e BANGSBO, J., Match performance of high-standard soccer players with special reference to development of fatigue. *Journal Sports Science* V.21 N.7 p. 519-528, 2003;

MOREIRA, Geraldo M. D. A influencia do gramado molhado sobre o desempenho em um teste progressivo para jogadores de futebol. Dissertação (Mestrado em Ciências do Movimento Humano) - Universidade de Caxias do Sul - UCS, CAXIAS DO SUL RS MAIO / 2001;

MORGAN DL, PROSKE, U. Factors contributing to energy storage during the stretch- shortening cycle. J Appl Biomech 13: 464466,1997.

MURAMATSU, S., FUKUDOME, A., MIYAMA, M., ARIMOTO, M. e KIJIMA, A., Energy Expenditure in Maximal Jumps on Sand, *Journal Physiological Anthropology* V.25, n.1, p. 5961, 2006;

PINNINGTON, H. C. e DAWSON, B. The energy cost of running on grass compared to soft dry beach sand *Journal of Science and Medicine in Sport,* V.4, n.4, p. 416-430, 2001;

REILLY, T., BANGSBO, J., e FRANKS, A. Anthropometric and physiological predispositions for elite soccer. J. Sports Sci. V.18, 669-683, 2000.

SZMUCHROWSKI, L. A., DIAS, R. F., CARVALHO, R. G. S., Análise do impulso e força de impacto de saltos verticais em diferentes superfícies. Temas Atuais em Educação Física e Esportes IX. Escola Educação Física Fisioterapia e Terapia Ocupacional, Universidade Federal de Minas Gerais, Belo Horizonte, 2004;

YOUNG, W.B.; JAMES, R.; MONTGOMERY, I. Is muscle power related to running speed with changes of direction? *J. Sports Med. Phys. Fitness*. V.42, 282-288, 2002;

ZAMPARO, P. PERINE, R. ORIZIO, C. SACHER, M. E FERRETI, G. The Energy Cost of Walking or Running on Sand. European Journal of Applied Physiology. V.65, p.183-187, 1992.

RUA DESEMBARGADOR PAULA MOTA, NO. 30/302 - BAIRRO OURO PRETO - BH-MG - CEP: 31310-340
pedroamaral@msn.com

THE RELATIONSHIP BETWEEN THE PERFORMANCE IN THE VELOCITY TEST OF YOUNG SOCCER PLAYERS IN DIFFERENT SURFACES

ABSTRACT

The purpose of this study was to compare the performance of young soccer players during velocity tests composed of a 15-meter straight line in two different surfaces, sand and grass. 22 volunteers from a Belo Horizonte soccer team were involved: 18 of a younger category (16 and 17 years) and 4 of an older category (16 and 17 years). The photocells were located in the 0m mark and in the 15m mark, and the players would begin the test from a stationary position. Each athlete was submitted to 12 test trials. Three were realized with bare foot in sand, three with cleat shoes in sand, three with bare foot in grass, and three with cleat shoes in grass. A 25-to-30 minute rest was respected between the different surface trials, as well as a 2-to-3 minute rest between the same surface trials. The best trial was the one used for statistical analysis. The data was studied through a parametric test of variance analysis (ANOVA) and its differences were identified through the Post Hop Tukey. The significance level maintained its rightful value of p<0, 05. The study showed that there is a significant difference among the performance of players during the V15 m test using shoes in grass (TSG) (2, 50 ± 0,106 s), using shoes in sand (TSS) (2,75 ± 0,109 s), and without shoes in sand (TWS) (2,68 ± 0,106 s). However, it was not found any difference between the performance of players during the TSS and the test without shoes in grass (TWG) (2,49 ± 0,06 s). It has also not been found significant differences between the average results of the TSG and the TWG, or between the average results of the TSS and the TWS. Concluding, young soccer players spent more time to run in sand than in grass.

LA RELATION ENTRE LES PERFORMANCES DANS LA VITESSE D'ESSAI DES JEUNES JOUEURS DE SOCCER DANS LES DIFFÉRENTES SURFACES

RÉSUMÉ

Le but de cette étude était de comparer les performances des jeunes footballeurs pendant les essais de vitesse de 15 mètres de la ligne dans deux domaines différents, de sable et d'herbe. 22 bénévoles ont participé à une équipe de soccer de Belo Horizonte: une classe de 18 jeunes (14-15 ans) et 4 d'une catégorie plus âgés (16-17 ans). La photo peut être trouvé à 0m et 15m de la marque, les joueurs et commencer l'essai d'une position stationnaire. Chaque athlète a été soumis à 12 tests d'essai. Trois ont été faites avec les pieds nus dans le sable, trois à capuchon avec des chaussures dans le sable, trois pieds nus sur l'herbe, et trois à capuchon avec des chaussures sur l'herbe. Les 25-30 minutes de repos a été observée entre les différents essais de surface et de 2-3 minutes de repos entre leur surface d'essai. Le meilleur test a été utilisé pour les statistiques. Les données ont été analysées en utilisant un test paramétrique de l'analyze ANOVA et ses variations ont été identifiés par Tukey post Hoc (p,0,05). L'étude a révélé qu'il existe une différence significative entre le rendement des joueurs au cours de l'essai v15 suis le port de chaussures sur l'herbe (STG) (2, 50± 0106s), en utilisant les chaussures dans le sable (TSS) (2,75±0109s) Et Shoeless dans le sable (TWS) (2,68 ± 0,106s). Toutefois, il n'y avait pas de différence entre le rendement des joueurs au cours de la SAT et sans chaussures sur l'herbe (GTT) (2,49±0,06 s). Il n'y avait pas de différence significative entre la moyenne des résultats de la STG et le groupe de travail technique, ou entre la moyenne des résultats de la SAT et TWS. En conclusion, les jeunes joueurs de football ont plus lentement que dans le sable sur l'herbe.

RELACIÓN ENTRE EL DESEMPEÑO EN LA PRUEBA DE VELOCIDAD DE LOS JÓVENES JUGADORES DE FÚTBOL EN DIFERENTES SUPERFÍCIES

RESUMEN

El estudio tuvo como objetivo comparar el rendimiento de los jóvenes atletas de fútbol en las pruebas de velocidad en 15 metros (V15m) en una línea recta, sobre diferentes superficies, hierba y arena. 22 atletas participaron en calidad de voluntarios, y 18 de los niños de la categoría ninõ (14 a 15 años) y 4 de la categoría juvenil (16 a 17 años). Para el análisis de la velocidad se utilizó una prueba (V15m) en una línea recta. Las fotocélulas fueron colocadas en el inicio del partida (0 m), y, en la final de 15 metros. Cada atleta corrió 6 veces: 3 descalzo y 3 de zapatos para fútbol para cada tipo de superficie, con un total de 12 repeticións. Se le dio un descanso de 25 a 30 minutos antes de comenzar el ensayo en otro tipo de superficie con 2 a 3 minutos de descanso entre intentos. El mejor rendimiento se utilizó para el análisis estadístico. Para comparar el tiempo empleado se utilizó ANOVA, p<0,05, Y el Post Hoc - Tukey fue usado para determinar si hubo diferencia entre los datos. El estudio encontró una diferencia significativa entre el desempeño en las pruebas sobre la hierba V15m calzado (TGC) (2,50±0,106s) en comparación con el rendimiento del calzado en la arena (TAC) (2.75±0,109s), y la tiempo arena descalzos (TAD) (2,68±0106). No hubo diferencias significativas en los rendimientos de los TAC con los tiempos de hierba descalzo (TGD) (2,49±0,096). Tampoco hubo diferencias significativas al comparar la media de las puntuaciones en las pruebas de rendimiento en el TGC con TGD, y entre el TAC con el TAD. Se llegó a la conclusión de que los tiempos en V15m recto, los jóvenes atletas de fútbol, fueron mayores cuando se ejecuta en la arena con respecto al rendimiento sobre el hierba.

RELAÇÃO ENTRE O DESEMPENHO NO TESTE DE VELOCIDADE DE JOGADORES JOVENS DE FUTEBOL EM DIFERENTES SUPERFÍCIES

RESUMO

O objetivo do estudo foi comparar desempenhos de jovens atletas de futebol em testes de velocidade em 15 metros (V15m) em linha reta, em diferentes superfícies, grama e areia. Participaram como voluntários 22 atletas, sendo 18 da categoria infantil (14 a 15 anos) e 4 da categoria juvenil . Para a análise da velocidade foi utilizado um teste de (V15m) em linha reta, partindo do repouso. Cada atleta realizou 6 tentativas sendo 3 descalços e 3 calçados de chuteiras para cada tipo de superfície, totalizando 12 tentativas. Foi dada uma pausa de 25 a 30 minutos antes de se iniciar o teste no outro tipo de superfície com 2 a 3 minutos de pausa entre as tentativas. O melhor desempenho entre as tentativas foi utilizado para a análise estatística. Para comparar os tempos utilizou-se um teste paramétrico de análise de variância (ANOVA) para múltiplas comparações com o nível de significância p<0,05. E o teste *Post Hop Tukey* foi utilizado para identificar onde ocorreu diferença entre os dados. O estudo mostrou que existe diferença significativa entre o desempenho nos testes de V15m na grama calçado (TGC) (2,50±0,106 s) quando comparado com o desempenho na areia calçado (TAC) (2,75±0,109), e com os tempos areia descalço (TAD) (2,68±0,106). Não foram encontradas diferenças significativas nos desempenhos dos TAC com os tempos grama descalço (TGD)(2,49±0,096). Também não houve diferenças significativas ao comparar os resultados médios nos desempenhos nos testes TGC com os TGD, e entre os TAC com os TAD. Pode-se concluir que os tempos no teste V15m em linha reta, de jovens atletas de futebol, foram maiores quando executados em areia em relação ao desempenho na grama.