A LEVEL OF TAPPING FREQUENCY OF LOWER LIMBS OF ELITE SLOVAK SOCCER PLAYERS AT DIFFERENT POSITIONS

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Abstract
The aim of the study was to compare a level of tapping frequency of lower limbs of elite Slovak soccer players at different playing positions (n = 48, age = 23.8 ± 4.9 years, height = 181.4 ± 6.9 cm, weight = 77.8 ± 7.2 kg; goalkeepers = 5, age = 25.9 ± 3.5 years, height = 190.4 ± 2.2 cm, weight = 85.6 ± 3.4 kg; defenders = 15, age = 25.4 ± 5.2 years, height = 181.2 ± 5.0 cm, weight = 78.0 ± 6.5 kg; midfielders = 19, age = 21.7 ± 3.7 years, height = 177.5 ± 6.3 cm, weight = 73.5 ± 5.9 kg; forwards = 9, age = 24.3 ± 4.5 years, height = 185.2 ± 6.6 cm, weight = 81.9 ± 6.7 kg). The level of tapping frequency of lower limbs was diagnosed with the device FiTROtapping, (FiTRONIC, Bratislava, Slovak Republic). The criterion of performance evaluation of every measured soccer player was total number of contacts with both legs on contact mats of mentioned device during 6 seconds in a standing position. One-way ANOVA was used for determination of difference significance (α = 0.05) between playing positions. The statistical analysis was realized by software IBM® SPSS® Statistics V19. The highest average level of tapping frequency of lower limbs in 6 seconds was observed by forwards (59.9 ± 5.9 contacts), then by defenders (58.5 ± 5.5 contacts), by midfielders (58.1 ± 6.8 contacts). The lowest average level of tapping frequency of lower limbs had goalkeepers (53.2±3.3 contacts). The statistical analysis did not show any significant differences between playing groups ($F_{(3.44)}$=1.405, p>0.05, η^2= 0.09).

Keywords: *defenders, fitness training, forwards, goalkeepers, midfielders*

Introduction

The condition according to Bunc (1999) presents 30-40% of playing performance in soccer. According to Reilly (1997), Psotta et al. (2006), Orendurff et al. (2010), the soccer is intermittent movement activity which contains very short, usually 1 to 5 seconds continuing intervals of endurance with high to maximum intensity, which alternate with intervals of endurance with lower intensity or inaction lasting from 5 to 10 seconds. Little & Williams (2006) include the running acceleration, maximal running speed and agility, which exist constantly in the match, into movement activities at high intensity.

Bangsbo, Mohr & Krustrup (2006), Bangsbo, Iaia & Krustrup (2007) state by players of the highest level 150 to 250 short intensive activities in a match. Hipp (2007) declares that in the soccer match we can observe by player around 100 to 150 sprints with different length. According to findings of Psotta et al. (2006) is 50-65% of all realized sprints shorter than 5m, 75-85% of all sprints is no longer than 10m and the average length of sprints is 9m in a single soccer game. Grasgruber & Cacek (2008) state the length of sprints is ca. 15m and usually no more than 30m, every ca. 90s, it means 0.8 to 1 km for the whole match. Mohr, Krustrup & Bangsbo (2003) found out by elite players about 28 to 58% bigger distance ($p < 0.05$) in runs at high intensity (> 19km.h^{-1}) and sprints compared to players of lower level (run at high intensity = 2.43±0.14 vs. 1.90±0.12km, sprint = 0.65±0.06 vs. 0.41±0.03km).

Haugen, Tønnessen & Seiler (2013) discovered that Norwegian national soccer players and players of the Norwegian Premier league achieved higher performance from the point of view of the acceleration and running speed ($p < 0.05$) than players of 2nd division (difference 1.0-1.4%), 3rd – 5th division (difference 3.0-3.8%), junior national team (difference 1.7-2.2%) and junior players (difference 2.8-3.7%). Considering that this research lasted more years (1995-2010, n = 939, age = 22.1±4.3 years), the authors had the possibility to determine that players in years 2006-2010 were faster about 1-2% in 20m run and had achieved rather maximal speed in comparison with players in years 1995-1999 and 2000-2005. Within maximal intensive running of the soccer player, the tapping frequency of lower limbs is also one of partial sections of complex speed performance. We agree with the statement of Grasgruber & Cacek (2008), who say that speed of runner (soccer player) is the result of mutual interaction of frequency and stride. According to Doležajová & Lednický (2002) in evaluation of complex demonstration of speed abilities, it is mainly maximal movement speed in forward direction, acceleration and maximal frequency of circular movements. The level of speed abilities is genetically determinated and depends on neuromuscular coordination and composition of fast muscle fibres. In spite of that it is necessary to focus on diagnostics and in the case of detection of inadequate level we have to focus on stimulation of tapping frequency of individual players too.

We agree with Zemková, Chren & Štefániková (2013), who write that there is little knowledge in literature about tapping frequency of sportsmen despite the fact that this ability presents one of important factors of sport performance in various kinds of sports. This was also the reason why we deal with the level of tapping frequency of lower limbs of elite Slovak soccer players from the point of view of playing positions in presented study.

Methods

The observational group consisted of players (n = 48, age = 23.8 ± 4.9 years, height = 181.4 ± 6.9 cm, weight = 77.8 ± 7.2 kg; goalkeepers = 5, age = 25.9 ± 3.5 years, height = 190.4 ± 2.2 cm, weight = 85.6 ± 3.4 kg; defenders = 15, age = 25.4 ± 5.2 years, height = 181.2 ± 5.0 cm, weight = 78.0 ± 6.5 kg; midfielders = 19, age = 21.7 ± 3.7 years, height = 177.5 ± 6.3 cm, weight = 73.5 ± 5.9 kg; forwards = 9, age = 24.3 ± 4.5 years, height = 185.2 ± 6.6 cm, weight = 81.9 ± 6.7 kg) from three Slovak elite soccer teams (MŠK Žilina, FK Dukla Banská Bystrica and AS Trenčín). In competition year 2010/2011 the players MŠK Žilina and FK Dukla played the highest Slovak soccer league and AS Trenčín was the leader of the second highest soccer league. This team won this league and promoted to the highest league too. The measurements were realised during February and March 2011 (MŠK Žilina – 8.2.2011, FK Dukla - 26.2.2011 and AS Trenčín – 23.3.2011) in morning hours when we can speak about the first daily peak of performance in accordance with Jančoková (2000). The measurements of the level of tapping frequency of lower limbs took place in training complex Fitaréna in Banská Bystrica in the same standard conditions. The research was approved by the Ethical Committee of Matej Bel University in Banská Bystrica. The measurements were carried out in accordance with the ethical standards of Declaration of Helsinki and ethical standards in sport and exercise science research (Harriss & Atkinson, 2011). Before measurements soccer players went through general warm-up (10 minutes) and speed warm-up (10 minutes). We had measured the tapping frequency of lower limbs with the device FiTROtapping, (FiTRONIC, Bratislava, Slovak republic) which consists of two contact mats placed and fixed on the floor, connected with interface to computer. The distance between mats was 10 cm. At the beginning of measurement the soccer player poses himself into standing position in the middle of mats. His task was to make maximally fast touches-contacts on mats alternately with left and right leg (leg tapping) during 6 seconds. The evaluation criterion of the level of tapping frequency of lower limbs was number of contacts of both legs on mats of the device FiTROtapping (FiTRONIC, Bratislava, Slovak Republic) during 6 seconds. The measurement was made two times and we chose a better trial to the evaluation.

In presented study we have used within periphrastic characteristics of descriptive statistics arithmetic average (x) from position measures and standard deviation (SD) from variability measures. We determined statistically the importance of differences of the level of tapping frequency of lower limbs between playing groups with One-way analysis of variance (ANOVA).

The effect size coefficient was assessed using "Eta Squared – η^2", calculated as common ratio of intergroup and total amount of squares. Levene´s Statistic was used within adequacy of usage One-way ANOVA for determination of homogeneity of variances. Normal division of residuals was observed with Shapiro-Wilk test. In the study we have determined importance on standardly used α – level (alpha) = 0.05. Statistical analysis was realized with software IBM® SPSS® Statistics V19.

Results

We discovered the highest average level of tapping frequency of lower limbs by forwards, then by defenders and midfielders. The lowest average level of tapping frequency was determined by goalkeepers (Table 1).

Table 1 The average level of tapping frequency of lower limbs in individual groups according to playing positions (n = 48)

Playing group	Average number of contacts in 6 s
Goalkeepers (n = 5)	53.2±3.3
Defenders (n = 15)	58.5±5.5
Midfielders (n = 19)	58.1±6.8
Forwards (n = 9)	59.9±5.9

One-way ANOVA has shown that there were no significant differences between playing positions ($F_{(3.44)}$ = 1.405, p > 0.05, η^2 = 0.09). Upon this deduction we did not determine differences between individual playing groups with adequate post hoc test.

Discussion

We agree with statements of Reilly, Bangsbo & Franks (2000) that soccer players do not have to dispose with extraordinary performance in any field of physical performance but they have to have appropriate high level in all fields. The authors Bunc & Psotta (2001) mention that physiological presuppositions and norms represent necessary conditions for success at the professional level, but neither sufficient. Speed and speed-dynamic abilities are limiting factors of individual playing performance of soccer player, especially on elite professional level. In spite of high demands from the point of view of speed abilities during the match dividing at accelerating, decelerating and maximal speed and agility, it is necessary to perceive these components integrated. Integral component of complex speed performance of soccer player is his tapping frequency too.

Fast come-backs into defense, sprint tendencies behind the defense line, offensive backup of outside players (mostly defenders) and fast "switching" from defense to offense (or vice versa) have a complementary character from the point of view of speed presuppositions of players. In the study we have measured the tapping frequency during time interval of 6 seconds. Zemková, Chren & Štefániková (2013) state the test of tapping frequency of mainstream population usually lasting 10 seconds. According to definition of intermittent movement structure of soccer as state Reilly (1997), Psotta et al. (2006), Orendurff et al. (2010) we have changed time interval of the test on 6 seconds because speed performance of a soccer player in a match lasts longer very rarely. The problems of comparison of the level of speed presuppositions of soccer players from the point of view of playing positions can be helpful partial indicator in monitoring and evaluating of different successful playing situations, e.g. microsituations forward – defender. Forwards have achieved the highest performance from the point of view of comparison of movement performance of tapping frequency at individual playing positions. This result corresponds with finding of authors Sporiš et al. (2011) who present that the best results achieve forwards. Sporiš et al. (2009) also found out by elite Croatian soccer players (n = 270) in seasons 2005/06 and 2006/07, that forwards achieved the highest performance from the point of view of running speed in 5, 10 a 20 m. Gil et al. (2007) state the highest performance by forwards in all measured parameters of speed and agility. The authors allege that they did not work with young elite soccer players (n = 241, age = 17.31 ± 2.64 years). In our study we have not found out significant differences between playing positions because forwards have achieved higher performance in comparison with defenders 2,3 %, midfielders 3,0 % and goalkeepers 11,2 %.

In studies of speed abilities Taskin (2008) came to similar results. He has not found out significant differences ($p > 0.05$) by professional soccer players (n = 243) between playing groups according to their playing positions, even running speed was measured for 30 m. Alike Rampinini, Sassi & Impellizzeri (2003) did not determine significant differences between the groups of defenders, midfielders, forwards and goalkeepers at professional or amateur level (n = 78, age = 21.0±4.9 years) from the point of view of running speed in 30m.

Guner, Kundaracioglu & Ulkar (2006) did not observe important differences between playing positions from the point of view of speed expectations as well. It is also necessary to mention the limits of carried research. The tapping frequency of lower limbs is just partial indicator of complex unspecific and specific speed demonstration and speed performance of a soccer player. We also have to evaluate other components as jump abilities, reaction speed, direct accelerating and running speed, but specific speed performance with the ball too, so that we can create evaluation of complex speed of soccer players. The limit presents the way of measurement too and evaluations of tapping frequency of lower limbs in our study. We recommend to focus not only on measurement of contacts with both legs in certain time interval, but especially focus on right and left leg as a result of laterality in finding of defects from the point of view of tapping frequency of individuals. It would be useful to analyze time of contact on the mat and time of contact out of mat (time of support and non-support phase) as well as we analyzed number of contacts on mats of used device. It would be useful to check correlation relationships between particular speed components too. The unrepeated testing is certain limitation too and it is joined with limitation in reliability. The unrepeated measurement can be influenced by external conditions but also by actual internal disposals of tested individual. We proceeded from time limits and organizational matters of individual teams.

Conclusion

The results of statistical analysis has shown that elite Slovak soccer players dispose of even performance from the point of view of tapping frequency of lower limbs ($F_{(3.44)} = 1.405$, $p > 0.05$, $\eta^2 = 0.09$). The highest average level of tapping frequency of lower limbs during 6 seconds was recorded by forwards (59.9 ± 5.9 contacts on the mat of device FiTROtapping, FiTRONIC, Bratislava, Slovak Republic), then by defenders (58.5 ± 5.5 contacts) and midfielders (58.1 ± 6.8 contacts). The lowest average level of tapping frequency of lower limbs had goalkeepers (53.2 ± 3.3 contacts). Presented data can serve as certain norm or standard of elite soccer players from the point of view of the level of tapping frequency of lower limbs. Results of this study can be a useful material for scientists, but for soccer and condition coaches, experts and people interested in soccer too.

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RAZINA TAPING FREKVENCIJE DONJIH EKSTREMITETA ELITNIH SLOVAČKIH NOGOMETAŠA RAZLIČITIH POZICIJA U IGRI

Sažetak

Cilj istraživanja bio je usporedba razine taping frekvencije donjih ekstrmiteta kod elitnih slovačkih nogometaša različitih pozicija u igri, (n = 48, uzrast = 23.8 ± 4.9 g., visina = 181.4 ± 6.9 cm, težina = 77.8 ± 7.2 kg; vratari = 5, uzrast = 25.9 ± 3.5 g., visina = 190.4 ± 2.2 cm, težina = 85.6 ± 3.4 kg; obrana = 15, uzrast = 25.4 ± 5.2 g., visina = 181.2 ± 5.0 cm, težina = 78.0 ± 6.5 kg; sredina = 19, uzrast = 21.7 ± 3.7 g., visina = 177.5 ± 6.3 cm, težina = 73.5 ± 5.9 kg; napad = 9, uzrast = 24.3 ± 4.5 g., visina = 185.2 ± 6.6 cm, težina = 81.9 ± 6.7 kg). Razina taping frekvencije utvrđena je uređajem FiTROtapping, (FiTRONIC, Bratislava, Slovak Republic). Kriterij procjene izvedbe svakog mjerenja nogometađa bio je totalni broj kontakata s obje noge na kontaktnoj površini uređaja za vrijeme od 6 sekundi u stojećem položaju. Analiza One-way ANOVA je korištena za utvrđivanje razlika (α = 0.05) na igračkim pozicijama. Statistička analiza je urađena softwareom IBM® SPSS® Statistics V19. Najveća razina frekvencije tapinga je utvrđena kod napadača (59.9 ± 5.9 kontakata), zatim obrane (58.5 ± 5.5), sredine (58.1 ± 6.8). Najniža razina je utvrđena kod vratara (53.2±3.3). Statistička analiza nije pokazala značajne razlike između grupa ($F_{(3.44)}$ = 1.405, $p > 0.05$, $\eta^2 = 0.09$).

Ključne riječi: *nogomet, frekvencija, vratari, obrana, sredina, napad, razlike*

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