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Original Article

THE EFFECT OF FOOTBALL BASIC TECHNICAL TRAINING USING UNILATERAL LEG ON BILATERAL LEG TRANSFER IN MALE CHILDREN

EFEITO DO TREINAMENTO DE HABILIDADES BÁSICAS DO FUTEBOL USANDO TRANSFERÊNCIA UNILATERAL E BILATERAL DE PERNAS EM MENINOS

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RESUMO

Este experimento investigou a transferência de habilidades do membro dominante da perna para o membro não dominante e vice-versa no drible com a bola, controle de bola e nas técnicas de passe/chute do futebol para meninos iniciantes. Participaram do estudo 24 estudantes de 10 anos de idade da terceira série que não tinham participado de nenhum clube de futebol como jogador. Nas práticas das técnicas básicas do futebol o grupo de perna dominante (PD) apenas usou a perna/pé dominante e o grupo de pernan não dominante (PND) apenas usou a perna não dominante. A fase de prática foi aplicada uma vez por semana entre fevereiro e maio no campo de futebol com grama sintética. Os resultados mostraram que não houve diferença significativa entre as transferências do grupo dominante das pernas para o grupo de pernas não dominantes e vice-versa. Por outro lado, o desempenho de todas as técnicas melhorou no grupo de pernas dominantes e não dominantes na comparação de pré-teste para o pós-teste. As descobertas sugerem que a transferência de habilidades de aprendizado poderia ser mais eficaz do membro não dominante para o membro dominante nas técnicas de controle de bola, drible e chute.

Palavras-chave: Transferência bilateral. Futebol. Unilateral. Crianças.

ABSTRACT

This experiment investigted transfer of skills from dominant leg limb to non-dominant leg limb and vice versa in dribbling with the ball, juggling and passing/shooting technics of soccer for inexperienced male children. 24 male student age of 10 years from 3th grade who have not involved in a football club as a player**.** In football basic technical practices, dominant leg (DL) group just used their dominand leg/foot, and non-dominant leg (NDL) group just used their non-dominant leg/foot. Practice phase applied one time a week between February and May on the football field with synthetic grass. The results showed there were not exist no significant difference between the transfers from dominant leg group to non-dominant group or vice versa. On the other hands, performance of all technics improved on dominant and non-dominant groups for the comparison of pre- and post-tests. The findings suggest that the transfer of learning skills could be more effective from non-dominant leg limb to dominant leg limb significantly for technics of juggling, dribbling and kicking.

Keywords*:* Bilateral transfer. Soccer. Unilateral leg. Motor skill.

Introduction

Humans show a more or less pronounced motor functional laterality that is reflected in a preferred body side (dominant side). Although acquisition of motor skills is mostly performed with that dominant side, a situation-specific action not only with the dominant but also with the non-dominant side of the body is crucial for many sports games like football. Football is a team game where each player has their duties, such as defender, midfielder, forward and goalkeeper. These duties must be supported by mastering the good football basic techniques. The football basic technique is a fundamental factor that must be mastered and understood by every football player. Football movement techniques consist of a variety of basic skills such as running, dribbling, passing and shooting, which are also named "technical skills". The basic techniques also might be called "closed skills" according to Gentile's taxonomy of motor skills. Technical training, that aims to improve ability of movement or skill in a sport, like in football, should be carefully carried out. In the football game and trainings, players

need to be able to dribble, pass, control, etc. with both feet. Using the dominant and non-dominant (recessive) feet has important advantages for the players while playing football. Therefore, the importance of bilateral and unilateral skill trainings for lower extremities in football has increased, and players' using both of their feet well has become necessary for them[1-8].

The ability to learn a particular skill more easily with one hand or leg after the skill has been learned with the opposite hand or leg is related to what is known as bilateral transfer. This is the most reasonable way to expedite the process of individual success[9,10].

The fact that initial practice of a motor task with one body side leads to subsequent performance with the other body side was shown in many studies that investigated upper limb[11-13] and lower limb movements[1,14]. However, only a few studies investigated bilateral practice of sports skills for the lower extremities or included experienced athletes especially in team sports, and the few studies that were found indicate inconsistent results[15,16].

In a study by Teixeira et al.[15] the influence of bilateral practice on lateral asymmetries of performance was also studied in dribbling of a football. Their results indicate a higher rate of improvement speed of dribbling with the non-preferred leg in players who practiced with emphasis on the non-preferred leg. Haaland and Holf[16] revealed the bilateral motor performance effects of training with the nondominant leg in competitive soccer players. This study included just training with the non-dominant leg for players aged 15-20 years. Witkowski et al.[17] verified that 13-year-old soccer players were initially asymmetric in manipulations with their lower extremities. They found significant advantages in effectiveness of motor performance with both legs in both nondominant/dominant leg groups. In their study, Braun et al.[18] aimed to investigate the effectiveness of a bilateral compared to a unilateral practice schedule in football. The bilateral group trained alternately with both legs, while the unilateral group improved their performance exclusively with the dominant leg.

The current literature does not focus on the influence of unilateral leg training to bilateral transfer among inexperienced male children in middle childhood (under 10 years) for football. In this study, the aim was examination of transfer from dominant leg limb to non-dominant leg limb and vice versa in dribbling with the ball, juggling and passing/shooting techniques of football for inexperienced male children, and finding an answer to the question of whether the transfer of both members are equal (with no significant difference) to each other or not.

Material and methods

Participants

Twenty-four male students from 3rd grade in one of the elementary schools that has 60 3rd grade students in the Beykoz district in Istanbul participated in the study. According to the G*Power software (V.3.1.9.7) that is used in many studies, there was statistical power of 85%, alpha of 0.05 and effect size (ES) of 0.50[19-21] total of 24 male children aged under 10 years from classes A and B were randomly assigned to two groups. For age groups, the average age was taken on the day that the post-tests were conducted. The dominant leg group (n= 12) was aged 8.88±0.25 years and the non-dominant leg group (n= 12) was aged 8.90±0.26 years. Leg dominance was determined from the preferred kicking leg self-reported by students[22]. Students had never attended a football practice at school or at the club before, so they had no experiences for football.

Procedures

This study was approved by the Department of Physical Education and Sports at the Faculty of Sports Science of Marmara University (Turkey). Before the study, information about the practices and measurements was given to students and their parents and the necessary permission was obtained from the directorate of the elementary school.

Practice phase

The practice phase consisted of three parts. The parts were a) warm-up part which included jogging and joint mobility exercises (~5 minutes), b) main part that included drilling of football technical exercises (dribbling, juggling and kicking/passing) (~25 minutes) and 3 vs. 3, 4 vs. 4 game formats (~15 minutes), and c) cool-down part (~5 minutes).

The training protocol consisted of the drilling of technical exercises, but not in a game context. The exercises included the different specific motor skills of soccer, namely dribbling, juggling and kicking/passing[23]. In the part of football technical exercises, the dominant leg (DL) group students just used their dominant leg/foot, and the non-dominant leg (NDL) group students just used their non-dominant leg/foot in the part of football basic technical drills of dribbling, passing and juggling.

In the part in which main game formats, which may also be called small-sided games (SSG) were applied, these are also a fun training method for sports games with the use of technical training in the form of a game with a reduced size with a limited number of players[24]. The size of the field was designed as maximum 15 m. x 25 m. for students as 3 vs. 3 and 4 vs. 4 without a goalkeeper, who could use both legs/feet.

The practice phase was applied once a week according to the course schedules of the elementary school and university between February and May, 2019 on the university's football field with synthetic grass with number 4 balls.

The two intervention groups completed a specific and standardized intervention between pretest-posttest, conducted by three pre-service teachers of the sports faculty. While the contents of the practices were identical for each intervention group, the unilateral groups were trained in the exclusively DL group with the dominant leg and NDL group with the non-dominant/recessive leg by the pre-service PE teachers in each drilling of football technical exercises (dribbling, juggling and kicking/passing).

Testing phase

In this study, juggling, kicking to target, and dribbling/agility tests were applied for football technical skills with a number 4 ball on the football field with synthetic grass.

The testing phase consisted of two tests, a pre-test and a post-test. Both tests were conducted on each foot (the dominant and non-dominant legs). Tests were conducted by a sports scientist and three pre-service PE teachers of the sports faculty.

All participants were previously familiarized with the procedures of each test in their own session before the test session. Prior to the execution of the tests all students performed their usual warming-up of around 15 minutes, and were instructed to perform the tests with the dominant and non-dominant leg. The tests were performed just with one student at a time.

Dribbling Test: A test of dribbling the ball between uprights with a change of direction. The student was asked to dribble the ball as fast as possible on a specified route (slalom between poles) using only one leg: the dominant leg (DL) or the non-dominant leg (NDL). The subject started from step position and performed 2 tests for each leg, and further analysis concerned the better result for DL and NDL. The times for dribbling were measured by light barrier systems and the better of two attempts was counted in seconds[25].

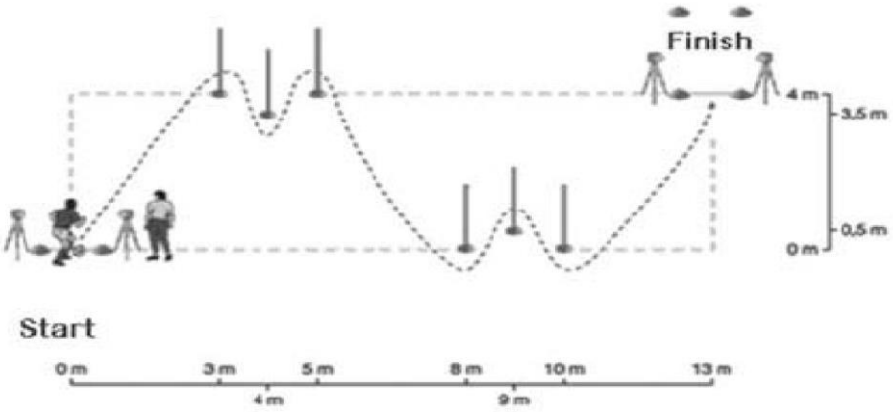

Figure 1. Dribbling Test
Source: Höner et al. [25]

Juggling Test: Only the number of foot/leg or foot and leg touching cycles without ground contact performed by a student with only one leg was determined. If the ball contacted the ground or any part of the body except part of the leg/foot, scores were not counted. The better result out of the 2 tests was collected separately for DL and NDL. The test was performed within a 5-meter-square area[26].

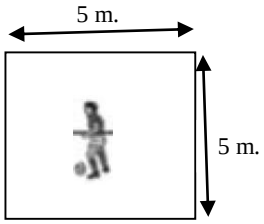

Figure 2. Juggling Test
Source: Adapted from Bozkurt and Kucuk [26]

Kicking to target: The student kicked the ball that was directly opposite from a distance of 10 meters to the goal (120 cm.x100 cm.). The test was adapted from Fabio et. al. Kicking was performed by using any part of the foot without the soles of the feet on the goal from the ground. If the ball bounced on the ground before reaching the goal, scores were not counted. The result was counted by the total points scored from 5 kicks, separately for DL and NDL[27].

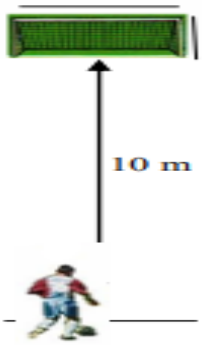

Figure 3. Kicking to Target Test
Source: Adapted from Barbieri et al. [27]

The data obtained from the study were analyzed with the SPSS program. Descriptive statistics were presented as arithmetic means, standard deviations, and minimums and maximums. The Shapiro-Wilk test was used to find out whether the data showed normal distribution. According to the Shapiro-Wilk Test results, the data showed abnormal distribution. Therefore, non-parametric tests were used. The Mann-Whitney U test for paired comparison of the groups and the Wilcoxon test for the comparison of pre-test and post-test of the groups were used. A result was considered to be significant if p was less than 0.05.

Results

The pre-test analyses of juggling, dribbling and kicking to target measurements of the dominant and non-dominant groups in the study are displayed in Table 1.

Table 1. Mann-Whitney U analysis of pre-test juggling, kicking to target, and dribbling measurements of the Dominant Leg and Non-Dominant Leg Groups

			X	**Ss**	**U**	**p**
Juggling (number)	Dominant	DL Group	5.41	1.62	70.500	.929
		NDL Group	5.41	2.23		
	Non-Dominant	DL Group	4.16	1.46	52.500	.227
		NDL Group	3.41	.79		
Dribbling (seconds)	Dominant	DL Group	29.69	7.36	57.000	.386
		NDL Group	30.71	15.88		
	Non-Dominant	DL Group	31.68	7.80	75.000	.931
		NDL Group	33.05	12.18		
Kicking to target (number)	Dominant	DL Group	1.00	.73	69.000	.855
		NDL Group	1.00	1.04		
	Non-Dominant	DL Group	.83	.71	60.000	.462
		NDL Group	1.08	.90		

Source: The authors

The post-test analyses of juggling, dribbling and kicking to target measurements of the dominant and non-dominant groups in the study are displayed in Table 4. There were no statistically significant differences between any pre-test values of the DL and NDL groups ($p>0.05$).

Table 2. Wilcoxon analysis of pre-test and post-test juggling, dribbling and kicking to target measurements of Dominant Leg Group

			X	Ss	Z	p
Juggling (number)	Dominant	Pre test	5.41	1.62	-2.270	**.023***
		Post test	8.16	3.61		
	Non-Dominant	Pre test	4.16	1.46	-.807	.420
		Post test	3.83	2.08		
Dribbling (seconds)	Dominant	Pre test	29.69	7.36	-3.059	**.002***
		Post test	22.65	3.96		
	Non-Dominant	Pre test	31.68	7.80	-1.956	**.050***
		Post test	28.65	6.89		
Kicking to target (number)	Dominant	Pre test	1.00	.73	-2.834	**.005***
		Post test	2.58	1.31		
	Non-Dominant	Pre test	.83	.71	-1.848	**.065**
		Post test	1.66	.98		

Source: The authors

Table 2 shows the pre-test and post-test analysis of juggling, dribbling and kicking to target measurements of the DL group.

There was a statistically significant difference in dominant leg for juggling performance (Z=-2.270; p<0.05), dribbling performance (Z=-3.059; p<0.05), and kicking to target performance (Z=-2.834; p<0.05) and in non-dominant for dribbling performance (Z=-1.956; p<0.05) between the pre-test and post-test in the DL group.

The results show that a transfer of learning occurred from dominant leg limb to non-dominant leg limb significantly for the dribbling technique.

Table 3. Wilcoxon analysis of pre-test and post-test juggling, dribbling and kicking to target measurements of Non-Dominant Leg Group

			X	Ss	Z	p
Juggling (number)	Dominant	Pre test	5.41	2.23	-2.629	**.009***
		Post test	7.08	2.10		
	Non-Dominant	Pre test	3.41	.79	-2.555	**.011***
		Post test	5.08	1.78		
Dribbling (seconds)	Dominant	Pre test	30.71	15.88	-1.962	**.050***
		Post test	24.82	9.35		
	Non-Dominant	Pre test	33.05	12.18	-2.824	**.005***
		Post test	24.46	7.74		
Kicking to target (number)	Dominant	Pre test	1.00	1.04	-2.410	**.016***
		Post test	2.08	1.16		
	Non-Dominant	Pre test	1.08	.90	-2.810	**.005***
		Post test	2.16	.83		

Source: The authors

The pre-test and post-test analysis of the measurements of the NDL group can be seen in Table 3. There was a statistically significant difference in dominant leg for juggling performance (Z=-2.629; p<0.05), dribbling performance (Z=-1.962; p<0.05), and kicking to target performance (Z=-2.410; p<0.05) and in non-dominant leg for juggling performance (Z=-2.555; p<0.05), dribbling performance (Z=-2.824; p<0.05), and kicking to target performance (Z=-2.810; p<0.05) between the pre-test and post-test in the NDL group.

The results show that a transfer of learning skills occurred from non-dominant leg limb to dominant leg limb significantly for the techniques of juggling, dribbling and kicking.

Table 4. Mann-Whitney U analysis of post-test analysis juggling, dribbling and kicking to target measurements of the Dominant Leg and Non-Dominant Leg Groups

			X	Ss	U	p
Juggling (number)	Dominant	DL Group	8.16	3.61	60.500	.502
		NDL Group	7.08	2.10		
	Non-Dominant	DL Group	3.83	2.08	39.500	.055
		NDL Group	5.08	1.78		
Dribbling (seconds)	Dominant	DL Group	22.65	3.96	71.000	.954
		NDL Group	24.82	9.35		
	Non-Dominant	DL Group	28.65	6.89	50.000	.204
		NDL Group	24.46	7.74		
Kicking to target (number)	Dominant	DL Group	2.58	1.31	54.500	.297
		NDL Group	2.08	1.16		
	Non-Dominant	DL Group	1.66	.98	51.000	.202
		NDL Group	2.16	.83		

Source: The authors

The post-test analyses of juggling, dribbling and kicking to target measurements of the dominant and non-dominant groups in the study are displayed in Table 4. There were no statistically significant differences between any post-test values of the DL and NDL groups ($p>0.05$). There were no significant differences between the transfers from dominant leg group to non-dominant group or vice versa.

Discussion

The present study aimed to examine transfer from dominant leg limb to non-dominant leg limb and vice versa in dribbling with the ball, juggling and passing/shooting techniques of football for inexperienced male children and to find an answer to the question of whether the transfer of both members are equal (with no significant difference) to each other or not.

According to our research, performances of techniques improved in dominant and non-dominant groups for the comparison of pre- and post-tests, although transfers of both members were not equal to each other. Performances of techniques were in dribbling of 26% (NDL), 19.18% (DL); feet juggling of 32.88% (NDL), 23.59% (DL) and kicking to target of 50% (NDL), 51.93% (DL) for Non-Dominant Leg Group, and in dribbling of 23.72% (DL), 9.57% (NDL); feet juggling of 33.71% (DL), -9.20% (NDL) and kicking to target of 61.25% (DL), 50% (NDL) for Dominant Leg Group.

Witkowski et al.[17] verified significant advantages in effectiveness of motor performance with both legs in both nondominant/dominant leg groups in 13-year-old soccer players. This shows that practice with dominant and non-dominant limbs can be important in initial motor learning to improve the performance of both members and to reinforce the bilateral capability of learners. An improvement in performance values can be expected as a result of the training carried out, yet improvement is also natural when it occurs especially in groups that have not practiced before. The results of our study also support this situation.

The results showed there were no significant differences between the transfers from dominant leg group to non-dominant leg group or vice versa ($p>0.05$). According to Nagasawa et al.[28] there was no significant difference between the scores of the lower position targets of dominant and non-dominant legs in the soccer group. In the findings of Tousi et al.,[29] there was no significant difference between the two training groups in terms of basketball dribbling skill acquisition. Witkowski et al.[17] noted that the bilateral relationship between dominant and non-dominant extremities is very conservative, and even 1 year of training is probably not enough time to completely change this pattern. In our study, the fact that there was no statistically significant difference in terms of transfer between groups ($p>0.05$) can be evaluated as corresponding with the study findings of these researchers.

However, in this study, in the dominant leg practice group, there was a statistically significant effect when using the dominant leg in the performance of all techniques ($p<0.05$), while there was a statistically significant effect only on dribbling performance with the non-dominant leg ($Z=-1.956$; $p<0.05$).

The analysis of the results of Teixeira et al.[15] indicated a consistent asymmetry of performance throughout the tests, favoring the preferred leg. The greatest effectiveness in terms of improvement of the technical skills was demonstrated in the dominant leg[17]. In their study, Braun et al.[18] aimed to investigate the effectiveness of a bilateral compared to a unilateral practice schedule in football. The bilateral group, who were 4th grade students, trained alternately with both legs, while the unilateral group improved their performance exclusively with the dominant leg. Shapiro[30] showed that for wrist rotation in people who have been practicing with the right hand and have never involved their left hand, in the final

test both hands had the same time and performance, and therefore, practicing with the right hand can be effective on the left hand.

On the other hand, in the non-dominant leg practice group, there was a statistically significant improvement in the performance of all techniques not only when using the non-dominant leg ($p<0.05$), but also in the performance of all techniques when using the dominant leg, namely juggling ($Z=-2.555$; $p<0.05$), dribbling ($Z=-2.824$; $p<0.05$) and kicking/passing to target ($Z=-2.810$; $p<0.05$).

Young players, even after one year of training, still have unrealized reserves to improve the basic elements of playing techniques in the non-dominant leg[17]. Despite this, Teixeira et al.[15] reported a higher rate of improvement speed in dribbling a football with the non-preferred leg in players who practiced with emphasis on the non-preferred leg. Haaland and Hoff[16] found a positive effect of non-dominant limb practice on performance significantly for non-dominant leg in soccer-specific dribbling, shooting, and passing tasks for experienced soccer players aged 15-20 years. Another research study showed that practice of the non-dominant leg side can also improve the performance of the dominant leg side[1]. Thut et al.[31] showed that movement time transferred best from the dominant to the nondominant hand, whereas spatial accuracy transferred best from the nondominant to the dominant hand. These results were similar to the results of our study regarding movement time (dribbling with the ball, $p<0.05$) and transferred and spatial accuracy (kicking to target and juggling, $p<0.05$). Our findings are generally in agreement with these results.

The present study has some limitations. The fact that our study was planned especially according to the elementary school and university timetable and to the availability of facilities created certain limitations. One of these was the short study period and low number of weekly training sessions. Another was the number of classes and students who were able to participate in the study. Since it was determined that there was an insufficient sample number in terms of gender and that this would not show normal distribution, female students were not included in the study. Furthermore, the results concern male students for children's football or grassroots football, so they should not be generalized to female children or children with different levels of sports skills.

Conclusion

Although transfer of both limbs did not occur in equal levels and the same degree of development was not shown in both feet, developments were determined in technical performances. The findings suggest that the transfer of learning could be more effective from non-dominant leg limb to dominant leg limb significantly especially for the techniques of juggling and kicking. Practicing with the non-dominant leg may also be effective in terms of saving practice time for development of football skills.

In football training, the child can be encouraged with an enjoyable learning approach in which he/she uses not only the dominant leg/foot but also the recessive leg/foot. The use of both feet can be encouraged in the organization of training programs with the principle of easy-to-difficult and simple-to-complex and the implementation of basic techniques like small-sided games.

The small number of participants could give the study the character of a pilot study for bilateral transfer in children's football. Future studies should be investigated in physical education analyzing different age and gender groups and wider samples, as well as a longer intervention period to better understand the phenomena of bilateral transfer in football with children in physical education.

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