

ORIGINAL SCIENTIFIC PAPER

The Effect of Physical Exercise according to a Programme for the Development of Flexibility in the Motor Abilities of Young Football Players

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Abstract

This research aims to establish the effect of flexibility exercise on the motor abilities of young football players. The total number of participants was 68 young football players (beginners, pioneers, and cadets) from the Ramiz Sadiku Football Club in Prishtina, Kosovo. The participants were divided into control and experimental groups. The research implemented seven variables for estimating motor abilities. The effect of physical exercise according to the programme of flexibility on the motor abilities of young football players was investigated using uni-variant analysis. The course of preparatory and competition period training programme was conducted three times per week, for both groups. Only the manner of execution of the experimental programme was different (17 exercises of static stretching) for the development of flexibility, which was conducted only with the experimental group within the frame of increased duration by the end of the training. The results acquired show that programme conducted for the development of flexibility (exercised of static stretching) has a statistically significant effect only on flexibility variable "sit-and-reach test" with the experimental group of cadets, and with no statistically essential influence on the motor abilities of beginners, pioneers, and cadets. Therefore, it can be confirmed that static exercises have an essential effect on the improvement of flexibility of participants older than 15 years old, but without positive or negative effects on other variables of the motor abilities of young players.

Keywords: flexibility, recovery, motor abilities, soccer players

Introduction

Football is a collective sport: poly-structural, acyclic and highly complex. Success in a football game depends on many factors, one of the most important of which is motor skills. Such skills or the conditional preparation of them is the basis for the execution of technical and tactical movements during the football game, during which a player carries out 1400–1600 activity (runs, dribbles, jumps, kicks, headers, tackles, etc.) changes; 700–800 of these changes consist in changes of direction and/or speed, and only 11% of the total travelled distance is run at high speed (Williams et al., 2005).

The execution of numerous movements during a football

game (speed runs, fast runs with changes of direction (acceleration and braking), jumping, execution of technical movements with the ball, depends on the flexibility of the locomotor system of the football player among others.

Therefore, only football players with optimal development of body flexibility can maximally exploit their motor skill potential, especially those skills characterized by explosive movements (sprint, strike, jumping) and agility. According to many authors, flexibility is defined as the skill to execute movements with higher amplitude (Walker, 2006; Gardasevic & Bjelica, 2013).

The importance of flexibility is seen in the results of a study between two groups of young football players: flexible and



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those less flexible. The research has confirmed that more flexible football players have shown better results in speed tests, jumping and agility, which indicates that flexibility should be developed- trained from a young age (Garcia-Pinillos, Ruiz-Ariza, Moreno del Castillo, & Latorre-Roman, 2015).

However, the specific application of flexibility exercises is one of the most discussed topics in sport and medicine. There are different thoughts about flexibility exercises: when and to what extent the use of flexibility exercises is favourable or not.

Many studies have proved that static stretching exercises have a negative effect if they are applied directly before testing the jumping force, speed, and agility (Kay & Blazeovich, 2011; Behm & Kibele, 2007).

Other studies have shown that the application of combined dynamic and static stretching during the warm-up phase increases the movement amplitude and has no adverse effect on motor skills (Behm, Chaouachi, Lau, & Wong, 2011; Kyranoudis et al., 2018).

Different concepts regarding this depend on the application methods, and when and to what extent the stretching forms should be applied for the development of flexibility (Brandey, Ajit, Richard, & Jennifer, 2012).

Easy runs and static stretching characterize the ending part of the training session. The main reason for the stretching exercises at the end of the sessions is the development of flexibility and muscle relaxation (Sands et al., 2013).

Many debates occur regarding the application of static stretching exercises at the end of the training sessions as a recuperation strategy, but there are no convincing data that static stretching exercises affect the recuperation of football players (Sands et al., 2013; Nedelec et al., 2013); only 50% of professional clubs of France apply static stretching at the end of the training as a strategy for recuperation (Nedelec et al., 2013).

From the research to date, we understand that it is not enough only to prove that applying static stretching exercises during the end of the training sessions should be applied only with football players of young age but to see which is the effect of these exercises on other motor skills.

From the above data, it is necessary to conduct experimental research to prove the impact of flexibility exercises (static stretching) on the motor skills of young football players.

The primary goal of this study was to ascertain the impact of flexibility exercise (static stretching) applied during a recovery stage of the training session (cool-down) on the motor abilities of young football players (age range 11–17).

Methods

To accomplish this research, all samples were initially conducted at a medical control centre of sports medicine in Pristina and confirmed that all the players are sufficiently healthy to train for football and, in accordance with the Helsinki Declaration, all participants were informed about the purpose and procedures of testing and experimental treatment.

Participants

In this study, 68 young players of 11 to 17 years (beginners U13, n=20; pioneers U15, n=24; and cadets U17, n=24) participated, from the Ramiz Sadiku Football Club in Pristina.

Procedures

To achieve this objective, the participants were divided into control and experimental groups. The control group was

composed of 34 football players of the following categories: beginners U13 (n=10; age 11.9±0.5; body weight 42.36±7.29; body height 153.8±7.8), pioneers U15 (n=12; age 14±0.4; body weight 52.3±8.9; body height 169±9.6), and cadets U17 (n=12; age 15.6±0.4; body weight 61.1±10.2; body height 175.7±6.4); the experimental group was composed of 34 football players of the following: beginners U13 (n=10; age 12.0±0.4; body weight 38.91±5.5; body height 151.8±6.1), pioneers U15 (n=12; age 13.8±0.5; body weight 53.45±8.48; body height 167.8±7.6), and cadets U17 (n=12; age 15.9±0.6; body weight 62.7±7.6; body height 176.7±6.7). Both groups were compared at the initial and the final measurements. The initial testing took place before the beginning of the pre-season while the final testing was performed at the end of the season (after four months of intervention with static stretching exercise).

All measurements were performed on parquet flooring in College Sports “Universi” in Prishtina at the same time and day, with a specialized framework and directly with the participation of the author of the study.

After 10 minutes of warm-up, all participants (players) in this study underwent testing variables of motor abilities for flexibility (Sit-and-Reach test), explosive strength (Vertical Jump - Maximal Counter Movement Jump-CMJmax), speed (sprint 5 m, 10 m and 30 m) and agility (20 m running zig-zag with and without a ball).

The flexibility (Sit-and-Reach test) test measures the flexibility of the lower back and hamstring muscles. The test was conducted indoors using a static sit-and-reach box, supplied with a tape measure. The participant was given the instruction to sit with legs together and extended in front of him, so that the feet (shoes off) touch the first step. Both knees were held together and flat on the floor. The scale (in centimetres) for measuring the distance was drawn on the first step. The end of the feet (i.e., the beginning of the step representing the starting point of the scale) was regarded as point zero). All measurements, in centimetres, above zero were positive, whereas the ones below, toward the knees, were negative. The task was to perform the furthest possible front bend with arms extended, and hands on top of each other, palms facing downward. That position was held for 2s to measure the distance. The test was performed three times (3 trials). The maximal reach distance was recorded in centimetres for all three trials (Sermaxhaj, 2019; Fernandez, Sanchez, Rodriguez Marroyo, & Villa, 2016; Popovic, Radosav, & Molnar, 2009).

The explosive strength (Vertical Jump - Maximal Counter Movement Jump-CMJmax, the CJMmax) test begins in an upright posture with hips and body centre of mass lowering until knees become about 90° bent and with hands flexed at chest height in the function of momentum before a final vertical push. The test of vertical jump is realized on a tenziometric platform (Powertimer 300, Newtest Oy, Tyrnävä, Finland). The system used in this study consisted of a controlling computer and a high sensors-density of 84×95 cm (Gonçalves, Pavao, & Dohnert, 2013; Enoksen, Tønnessen, & Shalfawi, 2009).

The sprint test (5 m, 10 m, and 30 m) consisted of a 30 m track, with 5 m and 10 m split time recording. The photocells were placed at starting positions at 5 m, 10 m, and 30 m in the finish line test. Testing was completed from a standing start, with the front foot placed 30 cm behind the photocell's start line. The test is realized with of Powertimer 300 (Newtest Oy, Tyrnävä, Finland) photocells with a precise time of 0.01 sec (Sander, Keiner, Wirth, & Schmidbleicher, 2013; Little & Williams, 2006; Verheijen, 1997).

The agility test of 20 m running zig-zag with and without the ball was completed from a standing start, with the front foot

placed 30 cm behind the photocells' start line. The photocells were placed at the starting position and finish line test. This test was measured with Powertimer 300 testing system (Newtest Oy, Tyrnävä, Finland), with an exact time of 0.01 sec (Sermaxhaj, Arifi, Bahtiri, & Alaj, 2017b; Idrizovic, 2014; Little & Williams, 2006). All measurements were performed on parquet flooring at College Sports "Universi" of Pristina.

The programme of control and experimental group was realized within the frame of regular training of the Ramiz Sadiku Football Club. In the course of preparatory and competition period, the training programme was conducted three times per week, for both groups. Only the manner of the execution of the experimental programme was different (17 exercises of static stretching) for the development of flexibility, which was conducted within the frame of increased duration by the end of the training.

The protocol of control group was as follows: general and specific warm-up (15–20 min), the main part (35–45 min), cool down (10 min), recovery by running. Meanwhile, the protocol of the experimental group was as follows: general and specific warm-up (15–25 min), the main part (35–45 min), cool-down (25 min), which includes recovery by running (10 min) and static stretching (15 min) (Sermaxhaj et al., 2018). The experimental programme was developed by the author of the study based on recommendations of the other researchers in this area (Anderson, 2006; Walker, 2006).

The experimental programme consisted of 17 exercises of extension/static stretching upper body-flexibility exercises as follows: neck stretch upper back, chest and back, shoulder and mid-upper back, shoulder and triceps, lateral flexion right-left, and lower body flexibility exercises (hamstring two-leg stretch, Achilles and back stretch, quadriceps stretch, hamstring and groin stretch, standing groin stretch, groin stretch, chest stretch, stretch sitting hamstring, lower back stretch, the hamstring seat leg stretch, and Achilles tendon stretch. Each exercise was executed for 20 seconds (Sermaxhaj et al., 2018).

Statistical analysis

Data analyses were performed using SPSS version 21.0. The arithmetic mean and standard deviation were calculated for both groups with initial and final measurements for motor abilities (sit-and-reach test, CMJmax, sprint 5m, 10m, 30m, 20m zig zag with and without ball). Analyses of variance (ANOVA) are calculated differences between the arithmetic mean of each variable of control and experimental group before and after the experimental treatment (static stretching). The level of significance is $p < .05$.

Results

The parameters are shown in Table 1 for both groups (control and experimental) of initial and final measures.

Table 1. The significance of differences between arithmetic means of variables data of motor abilities of the control and experimental group of beginners (U-13), pioneers (U15) and cadets (17) at the initial measurement

Category	Variables	Control Group Mean±SD	Experimental Group Mean±SD	F	p level
beginners U13	Sit-and-Reach test	-1.00±7.37	-0.40±4.32	.049	.827
	CMJmax	31.93±4.27	29.62±4.14	1.506	.236
	Sprint 5 m	1.31±.12	1.35±.16	.322	.577
	Sprint 10 m	2.22±.13	2.17±.09	.796	.384
	Sprint 30 m	5.30±.36	5.37±.29	.220	.645
	20 m zig-zag without ball	7.21±.69	6.93±.31	1.29	.270
	20 m zig-zag with ball	9.04±.39	9.17±.66	.316	.581
pioneers U15	Sit-and-Reach test	.41±5.08	-1.41±8.2	.109	.520
	CMJmax	38.45±4.97	39.65±4.51	.427	.543
	Sprint 5 m	1.21±.12	1.22±.12	.002	.961
	Sprint 10 m	2.05±.16	2.12±.15	.023	.880
	Sprint 30 m	4.95±.39	4.91±.39	.074	.789
	20 m zig-zag without ball	7.00±.28	6.89±.36	.599	.447
	20 m zig-zag with ball	8.79±.54	8.47±.55	2.02	.169
cadets U17	Sit-and-Reach test	-3.25±5.4	1.58±7.9	3.00	.097
	CMJmax	38.30±3.7	38.95±4.9	.134	.718
	Sprint 5 m	1.21±0.09	1.23±0.12	.934	.344
	Sprint 10 m	1.92±0.09	1.95±0.16	1.50	.233
	Sprint 30 m	4.75±0.28	4.58±0.17	2.52	.126
	20 m zig-zag without ball	6.47±0.3	6.50±0.4	.028	.868
	20 m zig-zag with ball	7.99±0.6	7.97±0.4	.013	.912

The measurement data in Table 1 show that univariate analysis of variance (ANOVA) based on the coefficient value F-relations and statistical significance (significance) p-value

are proved statistically insignificant among the control and experimental groups; this confirms the homogeneity of the groups' initial measurements.

All of the participants come from the same club; the control and experimental group belong to the same category. The selection of participants was based on their motor perfor-

mance; therefore, there were no statistically significant differences between the control and experimental group to all three categories.

Table 2. The significance of differences between arithmetic means of variables data of motor abilities of the control and experimental group of beginners (U-13), pioneers (U15) and cadets (17) at the final measurement

Category	Variables	Control Group Mean±SD	Experimental Group Mean±SD	F	p level
beginners U13	Sit-and-Reach test	1.40±7.67	2.00±3.71	.050	.826
	CMJmax	34.89±6.62	31.46±4.14	1.924	.182
	Sprint 5 m	1.19±.07	1.21±.08	.678	.421
	Sprint 10 m	2.08±.10	2.04±.09	.556	.466
	Sprint 30 m	5.19±.41	5.23±.28	.081	.779
	20 m zig zag without ball	6.91±0.4	6.58±0.4	2.69	.118
	20 m zig zag with ball	8.75±0.9	8.27±0.5	2.05	.169
pioneers U15	Sit-and-Reach test	-.50±6.00	1.66±7.2	.635	.434
	CMJmax	38.78±5.23	39.93±6.44	.230	.636
	Sprint 5 m	1.20±.09	1.20±.15	.113	.740
	Sprint 10 m	2.04±.14	2.04±.15	1.472	.237
	Sprint 30 m	4.89±.33	4.90±.31	.001	.975
	20 m zig-zag without ball	6.75±.31	6.66±.43	.342	.565
	20 m zig-zag with ball	8.46±.62	8.35±.77	.126	.726
cadets U17	Sit-and-Reach test	-.41±3.5	6.25±7.6	7.49	.012
	CMJmax	43.34±3.7	41.51±4.0	.943	.342
	Sprint 5 m	1.18±0.10	1.14±0.09	.149	.704
	Sprint 10 m	1.92±0.08	1.88±0.07	.259	.616
	Sprint 30 m	4.66±0.20	4.55±0.16	1.73	.201
	20 m zig-zag without ball	6.23±.29	6.16±.33	.324	.575
	20 m zig-zag with ball	7.73±.52	7.73±.48	.000	.997

The final measurement data in Table 2 show that univariate analysis of variance (ANOVA) based on a coefficient F-relations and value of statistical significance p-value proves that between the control and experimental group statistically significant differences are only found in the flexibility variable (sit-and-reach test, on the level of $p=.012$) in favour of the experimental group of the cadet category, and without any positive or negative effect on the other motor skills variables.

Authentication of the difference between the control and experimental group only on the flexibility variable (sit-and-reach test) shows that the experimental programme (static stretching exercises) has caused positive changes only in the variable that characterizes the flexibility of cadet football players.

The research results show that the average flexibility variable value (sit-and-reach test) is different at young ages, beginners (2.00 cm), pioneers (1.66 cm), and cadets (6.25 cm), which proves that cadets have better results comparing to beginners and pioneers. It is understood that body flexibility peaks after 15 years of age, which corresponds with the previous research (Smajic, Molnar, & Popovic, 2009).

However, the results of this research show that the flexibility of these categories (beginners, pioneers and cadets), is lower than the flexibility of U19 football players of Croatia with an average value of 12.42 cm, which also is lower than

the results of professional football players with average values of 8–18 cm and more (Milanovic, Sporis, Trajkovic, James, & Samija, 2013).

Discussion

The positive long-term effect of the application of static stretching exercises to the flexibility of the cadet category of football players is also proved by other authors (Fernandez et al., 2016; Gonçalves et al., 2013; Akbulut & Agopyan, 2015; Zakas, 2005).

With young football players, the non-effect of the long-term application of static stretching on motor skills is proved in speed 30 m (Fernandez et al., 2016; Bazett-Jones, Gibson, & McBride, 2008) and vertical jump (Gonçalves et al., 2013; Kinugasa & Kildinga, 2009), in agility with and without the ball (Brandey et al., 2012; Rey, Carlos, Luis, & Joaquin, 2012; Sermaxhaj et al., 2017b), in the isokinetic force (Sermaxhaj, Popovic, Bjelica, Gardasevic, & Arifi, 2017a; La Roche, Lussier, & Roy, 2008).

The results acquired show that the programme conducted for the development of flexibility (static stretching exercises) have a statistically significant effect only on the “sit-and-reach test” flexibility variable with the experimental group of cadets, and with no statistically essential influence on the motor abilities of beginners, pioneers, and cadets. Therefore, it can be

confirmed that static exercises at the end of the training sessions have an essential effect on the improvement of flexibility of participants older than 15 years old, but without positive or negative effects on other variables of motor abilities of young players.

The results of this research present further development in recognizing when and in which manner the static stretching exercises should be implemented and their effect on the motor abilities of football players.

Furthermore, this research is of practical value especially in that it clearly explains whether flexibility exercise has a positive or negative impact on some specific motor abilities of young football players, and precisely recommend when to

employ it.

Based on the data obtained from this research, we can suggest the application of static stretching exercises at the end of the training session (during the regeneration phase) on subjects older than 15 years old (after puberty), two to three times a week with the purpose of further optimal development of football players flexibility. For those younger than 15 years old, the application of combined dynamic and static stretching exercises is enough at the beginning of the training session (during the warm-up phase), and supplemental extension exercises can be programmed according to individual needs (before and after regular training sessions) with the purpose of the optimal development of football players' flexibility.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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