Effects of school based intervention on health and skill related fitness components on children

A 6 month intervention study on strength in basketball players aged 16-18 years

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(Accepted 15 march 2016)

Abstract

The aim of this study is to find out if a fitness and athletic program for a 6 month period, without changing the frequency and volume of the number of training sessions, would improve the performance of strength young basketball players. This study involved 48 basketball players, part of the youth teams in Albania. Measurements were taken before and after the program in strength of the lower limbs, *isometry* (10 seconds), and *isokinetic* (5 repetitions) regimes, in flexion and extension, the speed of response (*in force platform Leonardo Mechanography Drop jump test DJ*), All variables assessed in this study were tested for normality. The level $p < 0.05$ (significant difference) was admitted to this study. All statistical analyzes were performed using SPSS 20.0 software. The findings of our study support previous research and provide improvements in these variables: isokinetic and isometric strength,. Through our program which combined agility, fitness and athletic training, was made possible to register improvements in strength, as was measured with 2 tests before and post the program intervention. The studies should also examine the role of a program maintenance (on season) during the season, as well as to maintain the increase of equilibrium after the training and throughout the season.

Keywords: basketball, youth, strength, isometric

Introduction

In an extended conception of the argument, the term condition is used as a form of summary of all the psychic, physical, technical-tactic, professional and social factors of the appearance, within the meaning of the Latin word conditio (= conditions, the ability to accomplish something) (Bauer 1990). It is presented in a schematic form of an expanded concept (specifically in the case of condition of a basketball player). This concept, in a more simplified form - and that is exactly what is used in the practice of sport and exercise - as we mentioned, is limited to factors largely "physical", such as sustainability, strength, speed and articular movement. Konzag et al (1965) have studied the game and practice results of the post and forward players. The subject of their study has been only the man and women players of the highest level. In it, it is presented a summary of the obtained results (on average values). It shows that a player during a game runs a median distance of 3 - 3.5km, most of which without the ball.

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For the forwards, the total distance completed with a ball was 174m, much higher than the post players with 69m. Even the number of contacts with the ball, that the two groups performed moving rapidly, was twice higher for the forward players comparing to those of post players (33.9 forward, 14.5 post). The level of jumps for both groups was approximately 70 units, the number of shoots in the basket was approximately 17 (Konzag 1965 and continues to Hagedorn et al. 1985). The playmaker and the forward typically represent a lower stature than post players, and for this reason, they must possess excellent qualities in speed, movement and resistance in order to create advantages in the game. Players, who usually play near the basket, need not only a high strength in jumping, but also a considerable strength of the trunk, to dominate the fight for the ball down the basket (Brown et al. 1995). In the basketball game, the physical factors such as general and special resistance, the muscular strength, speed and movement, are never apart as separate elements. The aim of this study is to find out if a fitness and athletic program for a 6 month period, without changing the frequency and volume of the number of training sessions, would improve the performance of strength young basketball players.

Methods

This study involved 48 players, basketball players in the youth teams, regular participants in the national championship, with a basketball experience of 3-4 years. In this study participated 25 athletes who were used for the case study (break in group) and 23 other athletes as a control case (control group). These players (from the city of Tirana teams) were selected randomly from a group of 8 teams that regularly participate in the national championship. The program proposed by this study consists in training with two training sessions (40 min) per week within technical and tactical training sessions with duration of 120 minutes; a- athletic program based on speed and coordination training with duration of 10 min, b - fitness program based on strength/force training with a duration of 30 min. In this study the young (players) were divided into two groups; 1.-the intervention group were was developed the proposed program, 2. the control group, where they continued their normal program (training of physical qualities in the basketball court) and were carried out only tests (before and at the end of athletic fitness program). Measurements were taken before and after the program as follows: the strength of the lower limbs (in dynamometric isokinetic Easytech) in isometry regimes (10 seconds), and isokinetic (5 times) in flexion and extension 2. Speed of reaction (in force platform Leonardo Mechanography, Drop jump DJ test)

Statistical analysis

Descriptive statistics (averages, standard deviations, minimum and maximum values) for measurements before and after the intervention were calculated for variables assessed in this study (all tests performed in this study). ANOVA test (one way) followed by LSD test (post hoc) was used to compare the results of the difference between the control and the break in group measurements before and after the intervention. The level $p < 0.05$ (significant difference) was admitted to this study. All statistical analyzes were performed using SPSS 20.0 software.

Results

In this study participated 48 young basketball players divided into two groups (n = 23 control group into two teams and N = 25 intervention group into two teams). The players regularly participate in the youth national basketball championship. These four teams were selected randomly from a database which consisted of 12 teams.

Table 1 presents the statistical comparison from the first measurement to the second one of the control group. Intervention and control*internevention in isometry.

a) In left isometry max strain muscle in rotation change in the control group is (F = 26.3; sig. = 0.00), in the intervention group (F = 24.00; sig. = 0.00) and in control * intervention (F = 45.0; sig. = 0.00).

b) In right isometry the max strain muscle in rotation change in the control group is (F = 1.303, sig. = 0.31), in the intervention group (F = 11.289; sig. = 0.02) and in control * intervention (F = 13.393; sig. = 0.02).

c) In the left isometry the average of twisting change in the control group it is (F = 8.261, sig. = 0.04), in the intervention group (F = 10.996; sig. = 0.02) and in control * intervention (F = 6.943; sig. = 0.05).

d) In the right isometry average strain muscle in rotation change in the control group is (F = 9.738, sig. = 0.03), in the intervention group (F = 38.44; sig. = 0.00) and in control * intervention (F = 14.14, sig. = 0.01)

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Table 1 The comparison between the control and the intervention group in the isokinetic force for the right and left (extension and flexion).

	Source	Type III Sum of Squares	Mean Square	F	Sig.
Izometri (Left) Max Torque	Control	20.167	20.167	26.304	0.00
	Intervention	24.000	24.000	24.000	0.00
	Control * Intervention	**54.000**	**54.000**	**45.000**	**0.00**
Izometri (Right) Max Torque	Control	2.042	2.042	1.303	0.31
	Intervention	12.042	12.042	11.289	0.02
	Control * Intervention	**37.500**	**37.500**	**13.393**	**0.02**
Izometri (Left) Avg Torque	Control	8.760	8.760	8.261	0.04
	Intervention	12.760	12.760	10.996	0.02
	Control * Intervention	**30.375**	**30.375**	**6.943**	**0.05**
Izometri (Right) Avg Torque	Control	12.760	12.760	9.738	0.03
	Intervention	10.010	10.010	38.44	0.00
	Control * Intervention	**26.042**	**26.042**	**14.14**	**0.01**

Table 2 presents a statistical comparison from the first measurement to the second one of the control group. Intervention and control * intervention, in isokinetic for the left leg:

a) In the left isokinetic the max strain max in rotation on extension change in the control group is (F = 18.462; sig. = 0.01), in the intervention group (F = 10.316, Sig. = 0.02) and in control*intervention (F = 45.455; sig. = 0.00).

b) In the left isokinetic the max strain max in rotation in flexion change in the control group is (F = 5.651, sig. = 0.06), in the intervention group (F = 13.966; sig. = 0.01) and in control*intervention (F = 06.779; sig. = 0.05).

c) In the left isokinetic the average strain max spin on extension change in the control group is (F = 5.934, sig. = 0.06), in the intervention group (F = 12.893; sig. = 0.02) and in control*intervention (F = 7.212, sig. = 0.04).

d) Inthe left isokinetic the average strain max in rotation in flexion change in the control group is (F = 9.826, sig. = 0.03), in the intervention group (F = 23.437; sig. = 0.01) and in control*intervention (F = 6.576; sig. = 0.05).

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Table 2 The comparison between the control and the intervention group in the isokinetic force for the left (extension and flexion).

	Source	Type III S of S	Mean Square	F	Sig.
Izokinetik (Left) Avg ofPeak Torque Extension	Control	6.000	6.000	18.462	0.01
	Intervention	8.167	8.167	10.316	0.02
	Control * Intervention	**16.667**	**16.667**	**45.455**	**0.00**
Izokinetik (Left) Avg ofPeak Torque Flexion	Control	7.594	7.594	5.651	0.06
	Intervention	7.594	7.594	13.966	0.01
	Control * Intervention	**26.042**	**26.042**	**6.779**	**0.05**
Izokinetik (Left) Avg Peak Torque Extension	Control	13.500	13.500	5.934	0.06
	Intervention	15.042	15.042	12.893	0.02
	Control * Intervention	**37.500**	**37.500**	**7.212**	**0.04**
Izokinetik (Left)Avg Peak Torque Flexion	Control	7.042	7.042	9.826	0.03
	Intervention	9.375	9.375	23.437	0.01
	Control * Intervention	**20.167**	**20.167**	**6.576**	**0.05**

Table 3 presents a statistical comparison from the first measurement to the second one of the control group. Intervention and control*intervention, in isokinetic for the right leg:

a) In the right isokinetic max muscular strain in rotation, in extension change, in the control group is (F = 5.559, sig. = 0.07), in the intervention group (F = 10.240; sig. = 0.02) and in the control*intervention (F = 16.000; sig. = 0.01).

b) In the right isokinetic max muscular strain in rotation, on change in the control group is (F = 9.275, sig. = 0.03), in the intervention group (F = 11.154; sig. = 0.02) and in control *intervention (F = 12.656; sig. = 0.02).

c) In the right isokinetic average muscular strain in rotation, in extension change, in the control group is (F = 13.286; sig. = 0.02), in the intervention group (F = 16.574; sig. = 0.01) and in the control*intervention (F = 6.361, sig. = 0.05).

d) In the right isokinetic average muscular strain in rotation, in flexion change, in the control group it is (F = 4.971, sig. = 0.08), in the intervention group (F = 14.745; sig. = 0.01) and in the control*intervention (F = 8.176, sig. = 0.04).

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Table 3 The comparison between the control and intervention group in the isokinetic force for the right leg (extension and flexion).

	Source	Type III S of S	Mean Square	F	Sig.
Izokinetik (Right) Avg ofPeak Torque Extension	Control	7.042	7.042	5.559	0.07
	Intervention	10.667	10.667	10.240	0.02
	Control * Intervention	**24.000**	**24.000**	**16.000**	**0.01**
Izokinetik (Right) Avg ofPeak Torque Flexion	Control	7.594	7.594	9.275	0.03
	Intervention	8.760	8.760	11.154	0.02
	Control * Intervention	**22.042**	**22.042**	**12.656**	**0.02**
Izokinetik (Right) Avg Peak Torque Extension	Control	12.760	12.760	13.286	0.02
	Intervention	14.260	14.260	16.574	0.01
	Control * Intervention	**30.375**	**30.375**	**6.361**	**0.05**
Izokinetik (Right) Avg Peak Torque Flexion	Control	7.042	7.042	4.971	0.08
	Intervention	12.042	12.042	14.745	0.01
	Control * Intervention	**20.167**	**20.167**	**8.176**	**0.04**

Table 4 presents a statistical comparison from the first measurement to the second one of the control group. Intervention and control*intervention, in Drop Jump test:

a) Drop Jump F max (k/N) change in the control group is (F = 6.36; sig. = 0.05), in the intervention group (F = 15.01; sig. = 0.01) and control*intervention (F = 8.68, sig. = 0.03).

b) Drop Jump F max (N/kg) change in the control group is (F = 7.28, sig. = 0.04), in the intervention group (F = 9.79, sig. = 0.03) and control*intervention (F = 7.84, sig. = 0.04).

c) Drop Jump F max (w/kg) change in the control group is (F = 38.19; sig. = 0.00), in the intervention group (F = 61.12; sig. = 0.00) and control*intervention (F = 28.44; sig. = 0.00).

d) Drop Jump time of contact (tc) change in the control group is (F = 0.35; sig. = 0.58), in the intervention group (F = 5.07; sig. = 0.07) and control*intervention (F = 1.87, sig. = 0.23).

e) Drop Jump air time (ta) change in the control group is (F = 3.61, sig. = 0.12), in the intervention group (F = 0.22; sig. = 0.66) and control*intervention (F = 0.04; sig. = 0.85).

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Table 4 The comparison between the control and the intervention group in the Drop Jump Test.

	Source	Type III Sum of Squares	Mean Square	F	Sig.
Drop Jump Fmax (k/N)	Control	0.16	0.16	6.36	0.05
	Intervention	0.22	0.22	15.01	0.01
	Control * Intervention	**0.67**	**0.67**	**8.68**	**0.03**
Drop Jump Fmax (N/kg)	Control	33.16	33.16	7.28	0.04
	Intervention	40.53	40.53	9.79	0.03
	Control * Intervention	**139.11**	**139.11**	**7.84**	**0.04**
Drop Jump Power (W/Kg)	Control	11.13	11.13	38.19	0.00
	Intervention	16.60	16.60	61.12	0.00

Discussion

From this study, we can emphasize the verification of our hypothesis on the improvement of strength in the young basketball players, which is clearly observable from the statistical analysis in the result section. The purpose of the improvement of these parameters, through this program, is to emphasize the improvement of the motor skills system, and increasing challenges of neuro-muscular control, in young basketball players, as a necessity in achieving maximal results in this game. Through our program which combined agility, fitness and athletic training, was made possible to register improvements in strength, as was measured with 2 tests before and post the program intervention. Findings from our study support our previous research and improve these variables: isometric and isokinetic force, aerobic capacity, velocity, coordination etc. Although the purpose of this study was to measure the changes in the variables above in a six month long athletic fitness program, it is important to understand that, there is a number of published studies which follow the same line with the results of this study. During the statistical result in the first measurements (before the intervention with the athletic/fitness program) of all variables, isometric and isokinetic, jumping high and falling, turns out that, when comparing the control group and the interventionist group, there are not significant changes ($p>0.05$). This means that both groups, after the first measurements, start in the same level for all the values of the variables. During the testing for the maximal force measurement in isometry (left foot and right foot) we acknowledge significant changes between the control group and the interventionist group, in favor of the group we worked on with our training program (the interventionist group). Specifically, the improvement for the left foot in the control group is 0.5N, and for the right foot there is a decrease of -0.7N. Whereas for the interventionist group on the left foot the improvement reaches to +3.5N and on the right foot +1.9N. This improvement is significant for the interventionist group, referring to the statistical test between groups ($p=0.00$; $p=0.02$).

The same line of events is observed when comparing the average force in isometry. The control group on the left foot improves by 0.3N and on the right foot by 0.2N. The interventionist group improves on the left foot by 2.5N and on the right foot by 2.3N. Referring the statistic, the interventionist group has a significant improvement ($p=0.05$; $p=0.01$), comparing with the improvement in force with the control group.

During isometric measurements, we observed that in the interventionist group, for both values of the force in isometry (maximal and average force) there is a higher improvement on the left foot. This can be explained because 97% of the players are right handed, which makes the left foot dominant when

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the player executes a lay ups. It becomes clear that the trainers should pay more attention when planning exercises during the training sessions, so that the players practice both left and right arms. Referring the measurements during the isokinetic test (in a range of 5 repetitions) in the left foot, for the average value (the sum of all repetitions) we observe significant improvements for the control group (p=0.01) and the interventionist group (p=0.02) in extension, as well as the control group (p=0.06) and interventionist group (p=0.01) in flection.

Referring the statistical analysis in comparing the improved values for the control group and the interventionist group, we conclude that there are higher improvements of the average values (sums ∑), for the maximal number of repetitions in extension (p=0.00), and flection (p=0.05) of the interventionist group. Researches show that training of the movement stimulation and the functional force of the central part of the body, improves the dynamic balance (Holm et al., 2004; Paterno et al., 2004; Myer et al., 2006). The improvement of this parameter interferes not only in the basketball game but even in the prevention of the injuries especially the injuries on the knee ligament (ACL), as the most damaged ligament in the basketball game. Holm et al (2004) studied 35 women handball players, and used KAT 2000 to evaluate the performance of the balance before and after the 7 weeks program of preventing the ACL injuries. The authors concluded that after the program there were no significant improvements in dynamic balance; although there were no improvements in the static balance as well. Meanwhile in the isokinetic test (during five repetitions) for the left foot, for the average of the force (on the peak of the rotation of muscular strain) we observe significant improvement in the control group (p=0.06) and the intervention group (p=0.02) in extension, and the control group (p=0.03) and the intervention group (p=0.01), in flexion. During the statistical analysis in comparing the improved values of the control and intervention group, we conclude that there are higher improvements on values in extension (p=0.04) and flexion (p=0.05) for the interventionist group. In the isokinetic test (during 5 repetitions), for the right foot, for the average of the repetitions, we observe non significant improvements in the control group (p=0.07), and in the interventionist group (p=0.02), in extension, and in the control group (p=0.03) and interventionist group (p=0.02), in flexion. Statistical analysis shows that in comparison the interventionist group has higher improvements in average (the sum of the values ∑) in extension (p=0.01) and flection (p=0.02). The same results found in the study of Andi et al., (20015 a, b). Paterno et al (2004) evaluated the improvements of standing on one foot after the six weeks program on neuromuscular training. They used the Biodex system of stability to measure the postural stability of one limb, for every limb before and after the program which prevents ACL injuries. Important improvements were found in the total stability of one limb alone, as well as anteroposterior stability, but there was not found any change in mediolateral stability

In conclusion the evidence of these improvements through participation in the training program can increase the compatibility of athletes, which can give them benefits of these programs such as how to prevent injuries. Furthermore, the component of functional strengthening in our program and should be added to the ball stability exercises, which have provided evidence of an improvement in static equilibrium in the study of Cosio-Lima et al., (2003). Future research should be directed to the study of equilibrium and other tasks to increase the performance of athletes from different sports, using a randomized controlled projection to improve the generality of the findings. The studies should also examine the role of a program maintenance (on season) during the season, as well as to maintain the increase of equilibrium after the training and throughout the season.

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Spahi, A. Jarani, J. Bilali A (2015a).: An Intervention Study on Velocity, Agility and Jump Ability in Youth Basketball Players in Albania. Mediterranean Journal of Social Sciences 07/2015; 6(4):504-508. DOI:10.5901/mjss.v6n4s1p504

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