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Original article

CHANGE OF DIRECTION PERFORMANCE AMONG IN YOUNG BASKETBALL PLAYERS

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Abstract

Aim. The basketball game is characterized by repeated changes of rhythm and direction, numerous forward and backward movements performed at high speed. The ability to perform fast change of direction is considered a valid criterion for identified talented player. The purpose of the study is to evaluate the ability to change direction (COD) in young basketball players using some specific tests and the investigation of possible relationships between the change of direction and some physical performances such as standing long jump and speed running.

Methods. 32 young people between the ages of 13-14 (F + M) participating in the research participated in the basketball game. They were tested in several specific tests for the ability to quickly change of direction: T test – designed to evaluate lateral suffling and backpadeling, Little marathon – designed to evaluate turn 180^0 and shutlle sprint, Illinois test - designed to evaluated cutting movement, and standing long jump, sprint 20m

Results. The results show significant differences between boys and girls ($p<0.05$) and correlation between COD and standing long jump, and speed running 20m.

Conclusions. The results obtained are important, allowing the trainers to model the physical training sessions to provide physical and tactical advantage over opponent.

*Keywords***:** basketball, health, body compositions.

Introduction

Basketball is one of the most popular sport team in the world (Levinson & Christensen, 1999). Performance in the basketball game is dependent on some anthropometric, physical, psychomotor characteristics (Campa et al., 2019; Drinkwater et al., 2018). Moreover, there are other variables such as growth changes, basketball experience, training, and weight status that can affect the physical performance of young players (Rinaldo et. al, 2020). Differences in growth and development during adolescence can be a factor that affects performance and success in basketball (Towlson et al., 2018).

Juvenile basketball is characterized by dynamism (Fagaras, 2016).

Due to the technical specificity, basketball requires agility, movements in different directions with sudden changes of rhythm, jumps, throws executed with precision and finesse.

Changes of direction (COD) associated with a technical element used by attackers in the achievement. individual demarcation actions. Through this technical element, the player ensures his passage from one running direction to another, without having to stop. When executing direction changes, the player must take into account the following: the change of direction is performed at an optimal speed, which allows to keep the balance; during the change of direction it accentuates flexion of the lower limbs, and after performing the change of direction it accelerates to get rid of the opponent; stepping in the new direction is done with the inner foot, detours.

The ability of the players to move quickly in a new direction is an advantage not only in the game of basketball (Young et al, 2002). Travel speed, movement, can be differentiated into acceleration, maximum speed and agility (DeWeese & Nimphius, 2016).

In the basketball game, 20.7% of sprints represent changes of direction (COD) (Conte et al., 2015) and therefore the evaluation and training of this skill is particularly important for young basketball players. There are several factors that can influence COD performance: speed running for 5, 10, 20 m (Scanlan et al., 2014), and Spiteri et al. (2014) emphasized the importance of eccentric strength as a predictor of COD. CODs performance in basketball players has been measured by numerous tests (Stojanović et al., 2019).

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Objectives

The study aimed to investigate (1) the ability to change direction (COD) in young basketball players using some specific tests and (2) the investigation of possible relationships between the change of direction and some physical performances such as standing long jump and speed running.

Based on the authors' professional experience in physical activity and basketball game (player and coach) the research hypotheses of the study were intuitively established as follows:

H1: Boys perform better to COD test then girls

H2: There is a relation between COD and speed running.

H3: There is a relation between COD and strength in lower limb

Methods

31 young people participated in the study, boys and girls (F=15, M=16), basketball players of Gladius Sports Club from Targu Mures, participants in the U13 and U14 national championship.

For evaluation of COD we used 3 specific test: Little marathon (LMT), T test and Illinois test (ILT) and for speed running we used 20m speed running test (m20) and for explosive power of lower limb we used standing long jump test (SLJ).

The study was approved by the Ethics Committee of the University of Medicine and Pharmacy, Science, and Technology "G.E. Palade" Targu Mures and conducted under the Helsinki Declaration.

For statistical calculation, we used SPSS 20.0 for Windows, and the data were represented as mean and standard deviation, based on which parametric t tests comparing the averages were applied. The t test for independent samples was applied to check whether there were significant differences between the groups. A Pearson correlation (r) was applied to determine the correlations between variables in the tests applied. A p-value under 0.05 was considered statistically significant. The item analysis was performed using Pearson correlation coefficients, and the associations were interpreted as not existing ($r = 0$), very weak ($0.00 < r < 0.10$), weak ($0.10 \leq r < 0.30$), moderate ($0.30 \leq r < 0.50$), strong ($0.50 \leq r < 0.70$), very strong ($0.70 \leq r < 1$), or perfect ($r = 1$), according to the value of r (Marôco, 2018).

Procedure

All tests used in this study are specific for assessing the COD, speed running and explosive power of the lower limbs. For assessing COD we choose 3 test: T test designed to evaluate lateral suffling and backpadelling; Little marathon test (98m) which is design to evaluate turn180^0 and shuttle sprint and Illinois test (ILT) designed to evaluated cutting movements. For speed running we choose 20m sprint test and for explosive power of lower limb we choose standing long jump (SLJ)

Data collection was performed by the same evaluator in all tests and for all moments of evaluation in this study. Players completed a standardized warm-up consisting of moderate-intensity jogging (8 minutes), static and dynamic stretching (5 minutes), and series of high-intensity running, including changes in direction. All testing was performed in similar environmental conditions, on the same indoor, both for girls and boys and all the players were familiarized with the CODS tests. All test performs in 2 trials with 3 minute rest between trial and 5 minutes between test. The best result of each test was recorded.

Test description

T test - The subjects perform different movement as follows i) forward sprinting from (A) to (B), ii) lateral shuffling to the left from (B) to (C), iii) lateral shuffling to the right from (C) to (D), iv) lateral shuffling to the left from (D) to (B), and v) backpedaling to the finish-position from (B) to (A)

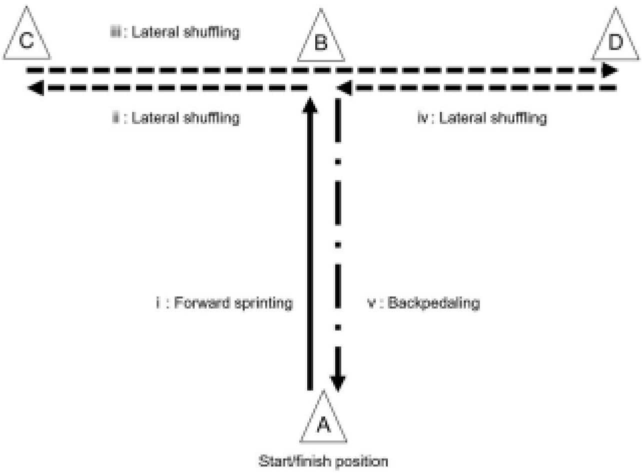

Figure 1 – T test procedure

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LMT - The player completes the route in figure 2, recording the resulting time in seconds.

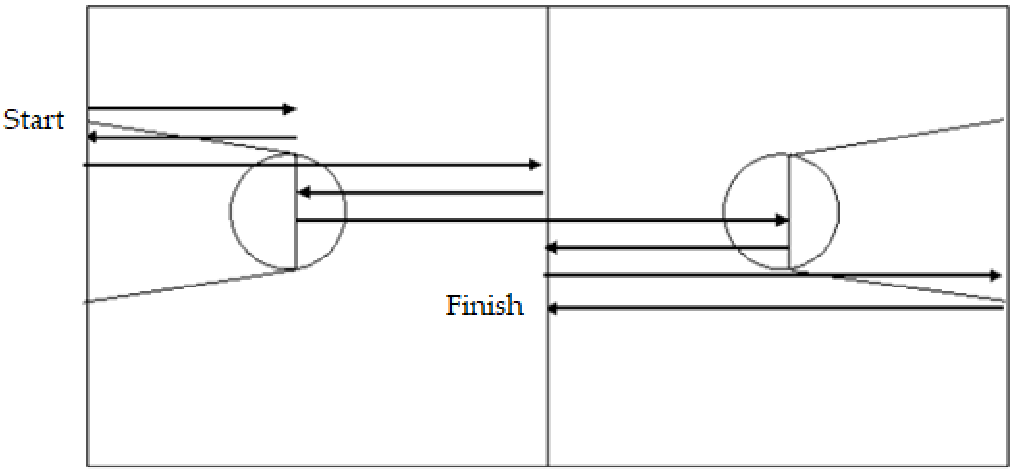

Figure 2 – LMT procedure

ILT- The test involves completing the route as quickly as possible according to the diagram 1. The subject is placed at the START, behind the first cone; at the whistle signal, the player will start to cover the route, and also start the timer. The timer will stop when the player passes the last cones

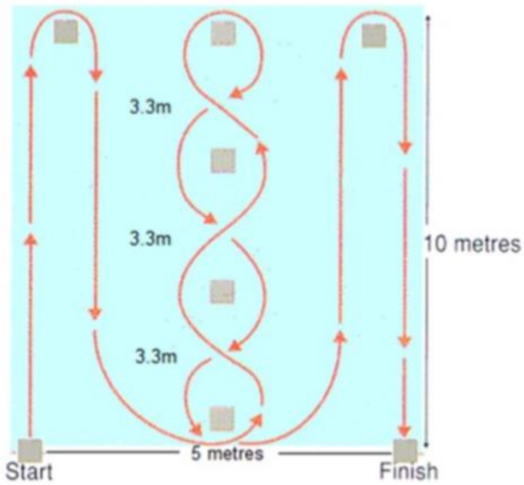

Figure 3 – ILT test procedure

20 m test - The sprint running test consisted of 2 maximal sprints of 20 m, with a 2 mintes rest period between each sprint.

Standing long jump (SLJ) - From standing with the feet slightly apart behind a line, a standing long jump is performed with a release from both feet on a drawn mark. Players are entitled to 2 jumps, the best score measurement in metre is taken into account.

Results

For all participants in the study we collected data on height, weight, gender and field test results. Descriptive statistics for the entire lot of subjects per girls/boys are presented in table 1.

Table 1 – descriptive statistics entire lot of subjects per girls/boys

Statistics

gender			**height**	**weight**	**m20**	**LMT**	**T_test**	**ILT**	**SLJ**
G	N	Valid	16	16	16	16	16	16	16
		Missing	0	0	0	0	0	0	0
	Mean		168.63	59.00	3.5119	26.4500	11.7112	18.9019	180.4813
	Median		169.00	57.00	3.5500	26.4600	11.6000	18.9400	178.0000

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	Std. Deviation		9.150	8.989	.23404	1.20854	.72269	.74691	7.74159
	Minimum		156	48	3.17	23.40	10.46	17.66	172.00
	Maximum		185	74	3.87	28.24	12.85	20.30	200.00
B	N	Valid	15	15	15	15	15	15	15
		Missing	0	0	0	0	0	0	0
	Mean		173.60	63.80	3.4627	27.3753	11.5593	18.6813	186.4000
	Median		177.00	62.00	3.3000	27.0500	11.3200	19.0600	187.0000
	Std. Deviation		10.716	23.370	.37733	2.57801	.99643	1.03651	16.55640
	Minimum		154	38	3.04	22.42	10.02	17.10	151.00
	Maximum		188	136	4.20	32.02	13.12	20.10	212.00

After analyses the results obtained we can observe that boys are taller than the girls (173,6 B and 168,63 G) and are heavier than girl. The heaviest boy has 136kg,

At the COD test the boys obtained better results than girls at 2 test (Ttest and ILT) and the girls obtain better result at LMT. Boys have better results at 20m and SLJ than the girls.

We applied Student's T-Test to see if there are statistically significant differences between girls and boys for all variables (H3) on independent sample.

Table 2 – Student T-test per girls/boys

Group Statistics

	gender	N	Mean	Std. Deviation	Std. Error Mean
Age	F	16	13.75	.447	.112
	M	15	13.73	.458	.118
height	F	16	168.63	9.150	2.287
	M	15	173.60	10.716	2.767
weight	F	16	59.00	8.989	2.247
	M	15	63.80	23.370	6.034
m20	F	16	3.5119	.23404	.05851
	M	15	3.4627	.37733	.09743
LMT	F	16	26.4500	1.20854	.30213
	M	15	27.3753	2.57801	.66564
T_test	F	16	11.7113	.72269	.18067
	M	15	11.5593	.99643	.25728
ILT	F	16	18.9019	.74691	.18673
	M	15	18.6813	1.03651	.26763
SLJ	F	16	180.4813	7.74159	1.93540
	M	15	186.4000	16.55640	4.27484

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Age	Equal variances assumed	.042	.839	.103	29	.919	.017	.163	-.316	.349
	Equal variances not assumed			.102	28.767	.919	.017	.163	-.316	.350
height	Equal variances assumed	.236	.631	-1.393	29	.174	-4.975	3.571	-12.279	2.329
	Equal variances not assumed			-1.386	27.631	.177	-4.975	3.590	-12.333	2.383
weight	Equal variances assumed	2.139	.154	-.764	29	.451	-4.800	6.281	-17.647	8.047
	Equal variances not assumed			-.745	17.833	.466	-4.800	6.439	-18.337	8.737
m20	Equal variances assumed	4.785	**.037***	.439	29	.664	.04921	.11197	-.17980	.27822

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	Equal variances not assumed			.433	23.114	.669	.04921	.11365	-.18582	.28424
LMT	Equal variances assumed	5.320	**.028***	-1.293	29	.206	-.92533	.71555	-2.38879	.53812
	Equal variances not assumed			-1.266	19.587	.220	-.92533	.73100	-2.45223	.60157
Ttest	Equal variances assumed	2.618	.117	.488	29	.629	.15192	.31113	-.48443	.78826
	Equal variances not assumed			.483	25.439	.633	.15192	.31438	-.49499	.79882
ILT	Equal variances assumed	3.362	**.077****	.683	29	.500	.22054	.32290	-.43986	.88095
	Equal variances not assumed			.676	25.343	.505	.22054	.32633	-.45108	.89217
SLJ	Equal variances assumed	8.398	**.007***	-1.289	29	.208	-5.91875	4.59313	-15.3127	3.4752
	Equal variances not assumed			-1.261	19.560	.222	-5.91875	4.69255	-15.7213	3.8838

* statistical significance for p-value < 0.5
** Statistical significance for p-value < 0.1

After analyzing the data we found that we have statistical significance for: m20, t=.037 and LMT t= .028, SLJ t=.007 for p-value<0.5 and ILT, t=.077 for p value <0.1 between boys and girl .

For m20 test boys obtained better results than the girls with a mean = 3.46 and SD = .3773 is bigger with t= .439 for signifiace p=0.037 .

For LMT girls obtained better results than boys with a mean = 26.45 and SD=1.20 is bigger with t=-1.29 for signifiance p = .028

For SLJ boys obtained better results than girl with a mean = 186.4 and SD= 16.55 for t=-1.26, p= .007.

For ILT boys obtained better results than girl with a mean = 18.68, SD = 1.03 for t = .676, p =.077.

In this case we can say that hypothesis 1 is confirmed, there are differences between boys and girls regarding to CODs tests, m20 test and SLJ test.

A Pearson correlation (r) was applied to determine the correlations between variables in the tests applied.

Table 3 shows the results obtained after the Pearson correlation. There are correlations between the players' height and weight (r= .620 p = .01(2 tailed)). The weight of the player is correlate at moderate level with m20 test (r=.541, p=.01(2 tailed)) and COD test (LMT, r=.439, T-test r= .412, ILT r=.233 for p =.05) There is a negative medium correlation between weight of player and performance of SLJ (r=-368, for p =.042) From the analysis of the results we can see that the 20m sprint test correlates positively and strongly for p = .01 with the tests for evaluating the change of direction (LMT, r=.755, T-test r= .807, ILT r = .591) and there is an inverse correlation of high intensity with SLJ test (r=.-674). Other correlation we obtain between COD test and exist an negative correlation between COD test and SLJ test (LMT, r=-738, T test, r = -.705, ILT r = -.700, for p =.000)

Table 3 – Pearson correlation between test for all group

		height	weight	m20	LMT	Ttest	ILT	SLJ
height	**Pearson Correlation**	1	.620**	.288	.207	.284	.104	.031
	Sig. (2-tailed)		.000	.116	.264	.121	.578	.870
	N	31	31	31	31	31	31	31
weight	**Pearson Correlation**		1	.541**	.439*	.412*	.233	-.368*
	Sig. (2-tailed)			.002	.014	.021	.206	.042
	N		31	31	31	31	31	31
m20	**Pearson Correlation**			1	.755**	.807**	.591**	-.674**
	Sig. (2-tailed)				.000	.000	.000	.000
	N			31	31	31	31	31
LMT	**Pearson Correlation**				1	.765**	.614**	-.738**
	Sig. (2-tailed)					.000	.000	.000
	N				31	31	31	31
Ttest	**Pearson Correlation**					1	.607**	-.705**
	Sig. (2-tailed)						.000	.000
	N					31	31	31

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		height	weight	m20	LMT	Ttest	ILT	SLJ
ILT	**Pearson Correlation**						1	-.700**
	Sig. (2-tailed)							.000
	N						31	31
SLJ	**Pearson Correlation**							1
	Sig. (2-tailed)							
	N							31

**Correlation is significant at the0.01 level (2 tailed)
*Correlation is significant at the level 0.05 (2 tailed)

In the table 4 we applied Pearson Correlation for girls. The result shows that there are correlations between the girls' height and weight (r= .855 p = .00). The weight of the girls is correlate at moderate level with T test (r=.538, p=.031) The 20m sprint test correlates positively and strongly for p = .000 with the COD tests (LMT, r=.801, T-test r= .855) Other correlation we obtain between LMT and T test (r = .801, p=.000). Significant and negative correlation of strong intensity is found between COD test and SLJ (LMT, r= -.771 p = .000; T test, r = -.593, p = .015; ILT, r = -498, p=.050).

Table 4 – Pearson correlation for girls

		height	weight	m20	LMT	Ttest	ILT	SLJ
height	**Pearson Correlation**	1	.855**	.265	.079	.445	.243	-.323
	Sig. (2-tailed)		.000	.321	.772	.084	.364	.223
	N	16	16	16	16	16	16	16
weight	**Pearson Correlation**		1	.322	.232	.538*	.214	-.369
	Sig. (2-tailed)			.224	.388	.031	.425	.160
	N		16	16	16	16	16	16
m20	**Pearson Correlation**			1	.801**	.855**	.351	-.485
	Sig. (2-tailed)				.000	.000	.182	.057
	N			16	16	16	16	16
LMT	**Pearson Correlation**				1	.801**	.402	-.771**
	Sig. (2-tailed)					.000	.123	.000
	N				16	16	16	16
Ttest	**Pearson Correlation**					1	.263	-.593*
	Sig. (2-tailed)						.326	.015
	N					16	16	16
ILT	**Pearson Correlation**						1	-.498*
	Sig. (2-tailed)							.050
	N						16	16
SLJ	**Pearson Correlation**							1
	Sig. (2-tailed)							
	N							16

**Correlation is significant at the0.01 level (2 tailed)
*Correlation is significant at the level 0.05 (2 tailed)

In the table 5 we applied Pearson Correlation for boys. The result shows that there are correlations between the boys' height and weight (r= .576 p = .025). The weight of the boys is correlate at strong level with 20m sprint test (r=.634, p=.011). The 20m sprint test correlates positively and strongly for p = .005 with the COD tests (LMT, r=.805, T-test r= .786, ILT, r = .702) and there is a negative correlation for strong intensity with SLJ test (r = -741, p = .002). Other positive correlation for strong intensity we obtain between LMT and Ttest (r = .837, p=.000) between LMT and ILT (r = .779 p = .001). Significant and negative correlation of strong intensity is found between COD test and SLJ (LMT, r= -.853 p = .000; Ttest, r = -.765, p = .001; ILT, r = -784, p=.001).

Table 5 – Pearson correlation for boys

		height	weight	m20	LMT	Ttest	ILT	SLJ
height	Pearson Correlation	1	.576*	.356	.200	.236	.075	.094
	Sig. (2-tailed)		.025	.192	.474	.398	.791	.738
	N	15	15	15	15	15	15	15
weight	Pearson Correlation		1	.634*	.460	.419	.280	-.426
	Sig. (2-tailed)			.011	.085	.120	.313	.113
	N		15	15	15	15	15	15
m20	Pearson Correlation			1	.805**	.786**	.702**	-.741**
	Sig. (2-tailed)				.000	.001	.004	.002
	N			15	15	15	15	15
LMT	Pearson Correlation				1	.837**	.779**	-.853**
	Sig. (2-tailed)					.000	.001	.000
	N				15	15	15	15
Ttest	Pearson Correlation					1	.794**	-.765**
	Sig. (2-tailed)						.000	.001
	N					15	15	15
ILT	Pearson Correlation						1	-.784**
	Sig. (2-tailed)							.001
	N						15	15
SLJ	Pearson Correlation							1
	Sig. (2-tailed)							
	N							15

**Correlation is significant at the0.01 level (2 tailed)
*Correlation is significant at the level 0.05 (2 tailed)

Discussions

COD is one of the most important ability for young basketball player. The T-test was most frequently used in basketball by the following reasons: The T test involves several specific movement seen in basketball - forward sprinting (acceleration) and rapid deceleration, lateral shuffling, and then backpedaling (Stojanović, et al., 2019a). The T-test appears to be highly reliable and measures a combination of components, including leg speed, leg power, and agility (Pauole et al., 2000). Chaouachi et al. (2009) didn't found significant correlation between Ttest and 5, 10, 30 m sprint in U23 basketball player. Our result indicated significant relationship between Ttest and 20 m (r = .807), and ILT and 20 m (r = .591) in young basketball players. Similar result were obtained by Abbas (2016).

SLJ performances are correlated with subjects' weight. Thus, subjects with a higher weight obtained poorer results in this test. Our results are similar to other studies. (Nikolaidis et al, 2015). The SLJ has also been shown to significantly correlate to 10, 20, 30, and 40 m average velocity and acceleration values (Brechue et al., 2010, Abbas, 2016)

Some authors ((França, et al., 2022) found the significant and negative relationships between lower-body strength tasks, the t-test, and linear sprints.

Conclusions

H1: Boys perform better to COD test then girls. Because the result of boys are statistical significant in two of the 3 COD tests we can say that hypothesis 1 was partially confirmed

H2: There is a relation between COD and speed running. The analysis performed on the obtained data certifies us that there is a correlation between the 20m speed test and the tests for changing direction, so hypothesis 2 is confirmed.

H3: There is a relation between COD and strength in lower limb The analysis performed on the obtained data certifies us that there is a correlation between COD test and strength in lower limb, so hypothesis 3 is confirmed.

The results show us that the tests used to evaluate the change of direction can determine the modeling of the training of young basketball players and allow evaluation of this ability in several aspects.

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