



## THE FACTOR TESTING OF INDICATORS OF PHYSICAL AND FUNCTIONAL PREPARATION OF BASKETBALL PLAYERS

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### ABSTRACT

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The problem of physiological study of non-traditional means of coaching attracts a lot of scientists' attention in recent years. This is due to the need to provide a maximum development of certain muscle groups and direction of the coaching process. Proper use of simulators weight machines bring positive results (Valeria *et al.*, 2018). Obviously, an important step in the use of technology is the right choice for team sports coaches and personal trainers for the effectiveness of the coaching process. One effective component of this process is the inclusion to a coaching program with the help of physical exercises would be TRX® function loops. Among specialists of functional and physical coaching innovation as TRX® – coaching is one of the best equipment for complex solution of the tasks. This exercise is an exercise using body weight. It was designed to develop strength, power, core stability, flexibility and balance. TRX® is the valuable creation for the sports industry of any levels. TRX® Coaching –Suspension Coaching became commonly usable for Fitness Health Clubs, Professional Sports and Elite Strength Conditioning Workout for Sports Teams (Dao and Le, 2018). Therefore, it was suggested the use of TRX® exercises in preparation of basketball players. The results of the study clearly show that the inclusion in the 18-25 years old basketball player coaching program with the TRX® functional loop contributes to a significant increase in overall fitness levels and ability to foster gas of life. Using TRX® during coaching can be considered to be an important factor in increasing the effectiveness of basketball preparation

### 1. INTRODUCTION

Suspension Coaching (TRX®) is considering as the best option for both beginners and professional athletes because it's easy to operate and manage. For example, Nicholas Ratamess describes the body weight exercises that are highly popular and the suspension coaching or total body weight resistance exercise (TRX®), that is used in school- and community-based programs to track progress, develop personalized programs, provide motivation, and assess the effectiveness of a fitness program (Ratamess, 2012). In addition, working with elderly participants, many of whom with multiple chronic injuries, and required supervision to create modification that could help them maintain and improve performance without aggravating any preexisting conditions, Suspension Coaching was introduced into their regular coaching routines (Gaedtke and Morat, 2016). Further, the research was conducted, using TRX®, among 36 health but untrained men. Scientists were focused on exercises that could improve strength, power, speed and jumping ability. However, after the study was completed, the scientists determined there was no significant improvement (Maté-Muñoz *et al.*, 2014). In effect, very few scientists have compared the effects

of balance on performance measures in coaching programs performed under both unstable and stable conditions (Sparkes and Behm, 2010). Thus, exploring results of wrestlers 10-12 years old suggest that TRX® functional loops can be used in the coaching program, as this tool increases: strength, speed-strength performance muscles in the arms and legs. However, muscle growth, as indicated, is insignificant that is valuable for wrestlers who limited weight category (Miroshnikov *et al.*, 2011). During the research on the effectiveness of coaching for qualified handball players, changes were identified and aerobic physical performance of athletes for two leading microcycles with TRX® assistance to conduct four major exercises for the lower body (Humstring Runner, Side Lunge, Overhead Squats). This has led to positive dynamic (Miroshnikov *et al.*, 2011). However, in the study of a particular sport, such as basketball, scientists were focused on finding out if three weeks of TRX® suspension coaching were enough to enhance static balance in junior basketball players. Those three weeks of TRX® coaching seemed to be insufficient for modifications to occur in the static balance of junior players (Iuliana *et al.*, 2015). It is necessary to generate explosive muscular forces very rapidly to accelerate, change directions, and then reaccelerate over relatively short distances in Team Spots (Dao and Le, 2018). Therefore, maximal velocity is likely a greater predictor of success, and the ability to change velocity over short distances in multiple directions based on game-specific stimuli is prevailing (Dawes and Lentz, 2012). Because of that, athletes must apply greater muscular forces into the ground to overcome the oppositional forces of gravity to produce velocity (Kovacs, 2012). In addition, the testing of scientific methodic literature defied that there is a deficit of sport science and movement-specific functional resistance coaching data on strength and conditioning for basketball players at every level. Therefore, it requires a deep testing of every action would be taken and influenced on basketball. Recently, experts in various sports widely used factor testing technique that reveals the complex dominant components (Tishchenko, 2016). This causes the athletic performance, determines the nature of the relationship between the indicators. Also it allows determine the contribution of individual factors to the overall result. Relevant is the definition of the factor structure of preparedness in basketball, which is an extremely important task. However, the literature wasn't paying enough attention to this question. Establishing main components for preparedness would greatly enhance the effectiveness of their coaching and competitive activity.

## 2. MATERIALS & METHODS

**Participants.** The study involved 26 basketball players between the ages of 18 to 25 years old team of Vietnam. **Goals and procedures.** The goal of this study was to use TRX® to determine the effect on the functional readiness for basketball players. To solve this goal, we have the following tasks:

1. Assess the level of physical and aerobic performance in a coaching process for basketball players 18-25 years old.
2. Analyse the dynamics of physical condition and aerobic capacity of basketball players' primary and experimental groups.
3. Collocate the leading factors of functional readiness for basketball players.

**Overall design.** The coaching in both groups was within the base stabilizing mesocycle specially preparatory phase. The control group of 13 athletes was involved in accordance to the traditional coaching program. Conventional exercises that meet the stated objectives of each part were used. The experimental group of 13 engaged involving specially designed complex exercises using TRX® equipment. Each exercise was performed 45 seconds, break – 15 seconds, every round – by 2 sets. The break between sets – 1 minute. The total duration of one set – 7 minutes. The total duration of the coaching – 45 minutes.

The study was undertaken in Vietnam after approval by the Institutional Research Ethics Committee at HoChiMinh City National University. Participation was voluntary; participants received no incentives. They were provided with information about the aims, objectives and methods of the study before the start of monitoring.

Data was anonymous and confidential, and data protection was observed at all the time. Each basketball player gave voluntary informed consent for the inclusion in the study.

Measuring methods. Estimated overall physical performance using the method Astrand – determined level of overall physical performance, aerobic power and capacity. In the beginning and at the end of the preparatory and competitive macrocycle periods of basketball players, both groups were assessed by level of physical capacity and aerobic performance using submaximal test PWC170. Exact and relative values were calculated PWC170 (aPWC170, kgm/min; rPWC170, kgm/min/kg) and maximal oxygen consumption (aMOC, l/min; rMOC, l/min/kg), coefficient of efficiency of blood supply (CEBS), the power index (PI), index hypoxia (IH).

Statistical testing. Generalization of the studied characteristics was assessed by mean arithmetic value, standard deviation, error of mean arithmetic and factor analysis. Confidence of differences between mean values was stated by Student's t-criterion. Assessment of statistical hypotheses based on 5% significance level. For statistical processing of data, we used licensed program (SPSS 20.0).

### 3. RESULTS

Preliminary physical fitness testing of basketball players who participated in the study made it possible to establish the following. As seen from the results in early coaching in preliminary and experimental groups were characterized by substantially equal values and overall physical performance aerobic productivity (Table 3.1).

Levels aPWC170, rPWC170, aMOC, and rMOC matched low value. In general, the pre-test results determined the insufficient level of physical fitness of the surveyed groups (Table 3.1). The conclusive evidence of the above results was the data relative changes in the study of physical performance and aerobic productivity for basketball players in the control and experimental groups. In the testing of the functional state of the body on the subject to maintain the overall physical performance, it can be stated that for the period of rest not the adaptive stereotypes embodied for the past seasons have been lost. Therefore, with an average energy at the beginning of the season, the leading role of aerobic mechanisms in central and vice versa could be saved, to ensure the efficiency of the anaerobic organism in point guards laid down as a result of the coaching process, as well as according to their physiological characteristics. As a matter of fact, the implementation of the coaching program leads to a significant increase in performance and efficiency of power supply arrangements for the players. It should be noted for preservation of specific stereotype for all players' positions in basketball. Further, to summarize the last phase of the survey, the attention should be paid about the rising level of fatigue and the partial depletion of energy systems. It should be emphasized that this decline is not dramatic and disastrous nature of all the indicators of power supply is not reduced to a level that allows speak of exhaustion and inability to maintain physical condition of basketball players.

**Table-3.1.** Dynamics of indicators of functional preparation for basketball players 18-25 years old during the annual macrocycle

Indicators	BPP	EPP	tBPP, EPP	BCP	ECP	tBCP, ECP	tBPP, BCP	tEPP, BCP	tEPP, ECP
<b>Control group</b>									
aPWC170	1559.7±22.81	1614.4±26.63	1.63	1619.72±25.64	1564.3±26.1	1.68	1.71	0.06	1.58
rPWC170	17.19±0.16	17.39±0.19	1.03	17.17±0.12	17.09±0.13	0.37	0.05	1.03	1.44
aMOC	4548.8±59.25	4683.7±49.95	1.69	4708.08±60.22	4536.61±64.32	1.89	1.84	0.34	1.69
rMOC	47.84±0.38	51.34±0.63	2.78	51.04±0.37	48.97±1.24	1.27	2.09	1.17	1.78
<b>Experimental group</b>									
aPWC170	1569.72±25.68	1726,86±31,9	3,51	1668,2±29,3	1558,84±24,3	2,87	2,22	1,35	4,19
rPWC170	17.14±0.16	18.68±0.15	6.43	18.07±0.19	17.12±0.17	4.83	4.18	2.37	6.19
aMOC	4541.15±59.3 2	4871.21±68.23	3.49	4739.12±54.63	4497.64±50.51	2.73	2.21	1.27	4.33
rMOC	48.65±0.37	53.75±0.35	6.71	52.91±0.36	49.53±1.27	1.78	4.61	2.38	2.71

**Notes:** BPP – the beginning of the preparatory period; EPP – the end of the preparation period; BCP – the beginning of the competition period; ECP – the end of the competition period

The results obtained in all phases made it possible to determine the orientation of quality changes in the studied parameters during the basketball season, the quantitative characteristics and the possibility of correction in coaching and competitive process for greater optimization and an increase in the functional state of the organism.

This tendency is to increase the total of all indicators of physical performance and energy mechanisms including the competitive level, maintaining the level of these indicators in the first half of the season and reduce them to the background processes, developing due to fatigue at the end of the season.

Therefore, participants of the experimental group during the study were characterized by a significantly higher magnitude aPWC170 gain values, rPWC170, aMOC and rMOC, basketball players than the control group (Table 3.1). According to the algorithm method of prime component, the accuracy of survey results is achieved if the percentage of the sample is substantially between interconnected elements is not less than 60% of the total variance. When analyzing the factorial study of functional readiness for basketball players, the structure value of mentioned values in all groups exceeds the desired range, which was 78%. One of the key points of our study was to determine the relationship between the level of functional manifestations of athletes and the effectiveness of physical fitness using TRX®. The table 3.2 evidenced how interconnected TRX® certain exercises between each other, and the level of manifestation for functional readiness. Factor testing procedure allowed to generate the system load factor and determine the three factors of physical fitness, eigenvalues were higher than one (Table 3.2). In general the composition factor (whose contribution to the total dispersion made 16.34 %) entered parameters which characterize TRX® exercise for the upper body: Roll up  $r = 0.868$ ; Table Row  $r = 0.903$ ; TRX® Twist  $r = 0.882$ .

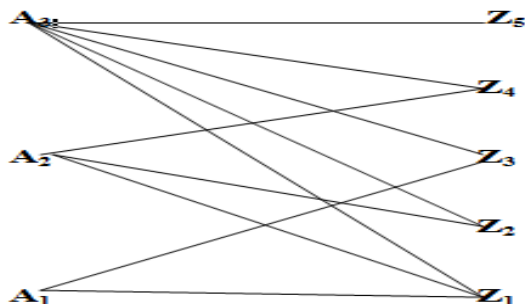
The second factor (20.37 %) clustered index, which reflected the TRX® exercises for the thighs and buttocks: TRX® Frog  $r = 0.916$ ; Sprinter Start  $r = 0.778$ ; Wide Jump  $r = 0.747$ . The third factor (41.26 %) was above the threshold load variables that reflect TRX® exercise for the upper and lower body: Burpee  $r = 0.925$ ; Push up +Tuck Knee  $r = 0.865$ ; Mountain Climber  $r = 0.875$ .

**Table-3.2.** The grouping and distribution of the elements of physical fitness for basketball players 18-25 years old by using the primary method component

No	Components	Factors		
		A1	A2	A3
z1	aPWC170	0.321	0.647	0.777
z2	aMOC	0.448	0.719	0.567
z3	CEBS	0.755	0.215	0.842
z4	PI	0.246	0.596	0.695
z5	IH	0.638	0.329	0.589
	%	18.27	20.42	61.28

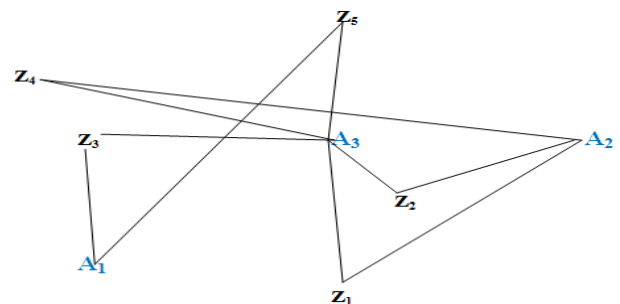
Note: The factor loadings are significant ( $p = 0.05$ )

Subsequent graphic testing of the influence factors on the selected parameters  $A_i \dots Z_i$  possible to determine it in the form of a bipartite graph (chromatic number is 2), since a plurality of vertices can be broken into two parts (A) and (Z), so that neither one vertex in (A) is not connected with vertices (A) and no vertex in (Z) with vertices (Z) (the subset of vertices (A) and (Z) called lobes bipartite graph G). This clearly shows the effect of each factor on the performance aPWC170, aMOC, CEBS, PI, IH (Figure 3.1).



**Fig-3.1.** Bipartite graph G (VFX, E)

Source: Dao and Le (2018)



**Fig-3.2.** Graphical representation of the optimized graph G (VFX, E) based on the weights of the vertices

Source: Dao and Le (2018)

The values of  $z_1$ ,  $z_2$  and  $z_4$  are determined by the combined effect of the factors  $A_2$  and  $A_3$  and the indexes  $z_3$  and  $z_5$  - the combined effect of  $A_1$  and  $A_3$ . The graph of the optimization based on the weights of the vertex allows us to determine that the graph contains an Eulerian circuit:  $A_3 - z_1 - A_2 - z_2 - A_3 - z_5 - A_1 - z_3 - A_3 - z_4 - A_2$ . (Fig 3.2)

That confirms that the graph is connected (Euler's cycle if and only if the graph is connected) and, accordingly - the impact of the factors determined in the parameters studied. Optimized G graphing (VFX, E) allows to determine the peak of the graph vertices  $k_{A_3} = 4$ , confirming the effect of  $A_3$  (TRX® exercise for the upper and lower). (Fig 3.2).

#### 4. DISCUSSION

A number of experts in the field of theory and methodology of sports coaching indicate that the modern technology of preparation of top class athletes is based on the results of scientific research, and has scientific and methodological platform (Ratamess, 2012; Dao and Le, 2018). Various scientists have developed biomechanical and psycho-pedagogical bases of an activity for athletes, as well as key aspects of their coaching: technical, physical, psychological and theoretical (Kovacs, 2012; Dao and Le, 2018). Thus, numerous studies suggest that a scientific approach to the coaching qualified athletes capable of providing high achievements (Dao and Le, 2018).

Basketball is a dynamic and explosive sport, full of intensity and contacts (Valeria *et al.*, 2018). That's the reason why a lot of basketball players can perform elements of the game, such as dunking the ball or quick movements through defenders and dribble to the net effortlessly. All those aspects take the huge influence on the athlete's body.

With the use of Suspension Coaching exercises the player can simulate the way his body moves on the court, making him more able to handle challenges of practices and matches. By the variety of coaching and uneven load of work on the body, the TRX® Trainer better develops core strength and stability element to the required moves which can help the basketball players to be stronger and have better balance on the court (Valeria *et al.*, 2018).

In recent years, due to the increase of the struggle on the international arena of Vietnamese basketball teams, the issue of coaching competitive basketball players has gained a special meaning.

Moreover, in the past several Olympic cycles formed the trend has been focused on increasing the system of complexity of technical and tactical action. To solve the problem and to achieve better results, the question has been awakened to use the advanced technology. In this regard, it is particularly important and urgent to train and prepare highly qualified basketball players. In particular, Vietnamese basketball is an urgent requirement to implement and implement higher complexity factors and their impact on competitive outcomes. They do not exist or can not be included in the preparation of the structure depending on the coaching personnel.

The coach's main purpose of the practice is to concentrate on the players physical abilities developing their speed, strength and explosive power to make sure they have a good balance and able to jump high, etc. The biggest importance to joint stability is not necessarily strength or endurance but motor control. Instability resistance exercises promote co-contractions, increasing joint stability (Behm *et al.*, 2011). The idea is to involve the whole athlete's body during the practice, and how capable it is to challenge the ball and work under the net on the basketball court. TRX® allows the coach to create coaching programs for the players using progressing and regressing movements for strength, conditioning, stretching, rehabilitation, and to give additional bust to their bodies needed on scheduled practices or before competitions (Valeria *et al.*, 2018).

Suspension bodyweight coaching has many advantages. Moreover, many benefits it has brought to sports performance particularly in basketball. Jungle Gym, TRX®, Rotational Bodyweight Trainer from CrossCore180® helped bring this form of coaching to the forefront of the sports performance and fitness industries (Valeria *et al.*, 2018). The latter of which has an added component of rotation with a greater equalization. These are all great options that may increase an athlete's strength through a full range of motion, while utilizing a fully portable unit

for convenience (Hess and Camacho, 2014). Using TRX® Coaching programs would benefit basketball players in order to achieve better balance and coordination on the both sides of the hardwood. The programs could vary from Beginner to Advance depending on the athletes' physical condition. TRX® assists the athletes to develop and perform basketball movements, concentrate on specific muscles and improve coaching outcomes. Based on these facts, several exercises TRX® are proposed that could be valuable as a part of the coaching program designed to increase preparedness of basketball players 18-25 years old.

## 5. CONCLUSIONS

The results of the study have clearly demonstrated that the introduction of training for basketball players with the TRX® function rings has contributed to a significant increase in overall fitness levels and ability to foster Body gas. Our research study element allows us to determine the presence of internal relationships between the indicators of the Super League's functional and physical preparation for the Vietnamese team.

Obviously, the use of TRX® can be considered a factor to increase the efficiency of the training process. The main advantage - is to work with its own weight, without additional complications that allow the athlete to remove the vertical load. In the study, dynamics allows for accurate use, to make changes at all stages of the training process as a whole team and as individual players, who tend to higher.

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