DOI 10.2478/afepuc-2019-0017

© Acta Facultatis Educationis Physicae Universitatis Comenianae 2019, 59(2): 193-202

THE DEVELOPMENT OF THE PHYSIOLOGICAL ADJUSTMENT OF PHYSICAL LOADS AND ITS IMPACT ON THE CIRCULATORY SYSTEM AND THE SKILLS OF FOOTBALL PLAYERS

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Summary. This research was focused on the important question, what is the effect of the development of physiological adjustment of the physical load on the respiratory system and the performance of the skills of football players. In addition we tried to comfirm the relationship between the physical qualities and the performance of the skills. We have applied the experimental approach which best suits to this type of question. Proposing a program based on the physiological adjustment of the respiratory system, we applied the approach to a sample of twenty players (table 3), which were a deliberate sample divided into experimental and control, during the general physical preparation.The results confirmed that there are statistically significant differences between the pre-test and post-test of the experimental sample in both the respiratory system tests and the functional performance tests, in addition to statistical differences between the control and experimental groupe in the post-test.

Keywords: physiological adjustment, physical loads, respiratory system, skill performance.

Introduction

The modern requirements in the game of football have created the great need for the players to undergo high physical preparation. Especially as the changes in the achievement of the ball is linked to the recent acceleration of defence and offence with a high level of force. We see the defender is actively contributing to the attack and the striker going back to defend his team, and if the player wants to maintain this high effort and his physical fitness through the game for (80) minutes.

Here is the importance of the endurance as one of the most important factors affecting the level of performance of players during the course of the game, a player with physical endurance below the level will face the largest debt of oxygen, leading to slow the state of recovery and early fatigue and the consequent low level of skill (Joyner & Coyle 2008)

As football is classified as high-intensity as it can be observed during a competitive game of football, elite players run a distance ranging from 10-12 km in the medium intensity close to the anaerobic threshold with 80 – 90 % of the maximum frequency of the heart (Hfmax) or 70 – 80 % of the maximum consumption of oxygen (Vo2max .376). It is estimated that the aerobic metabolism provides 90% of the energy cost of the player in the football match. Therefore the modern game of the elite football players needs a high fitness endurance. (Pate & Kriska 1984) described a model of the three main factors that represent good athletes among athletes: the variance in aerobic performance, specifically Vo2max, the lactate threshold (LT) and the business economy (C), with many studies supporting this when studying features football players (MacDonald & Hawley 2012).

The purpose of performing aerobic exercise regularly is to significantly improve the ability to exercise as the development depends on the peak in the performance of the exercise, as it is clear according to the athletes endurance, including the physiological adjustments associated with these improvements in each of the exercise performance with maximum effort, Oxygen Absorption Rate ($\dot{V}O2max$), and stamina in exercise, with increases in both cardiovascular function and structural muscle oxidation capacity. Despite long periods of aerobic training, reductions in exercise performance occur at maximum and below extremes within week after the cessation of training. These loss of exercise performance coincides with a decrease in cardiovascular function and metabolic potential (Joyner & Coyle 2008). Significant reductions in $\dot{V}O2max$ were reported within two weeks to four weeks of discontinuation. This initial rapid decline in $\dot{V}O2max$ is probably associated with a similar reduction in maximal cardiac output, which appears to be caused by a decrease in movement size with little or no change in maximum heart rate (Neufer 1989). Therefore, the respiratory system is one of the most important devices that help the players to cope with this physical effort through the functional efficiency of this device, which is responsible for saturation of the body's cells in sufficient quantities of inhaled oxygen and energy production materials and then supply to the muscles after oxidation and disposal of CO_2 and waste from the process of oxidation (Mazic 2015). Therefore the process of breathing and utilization of it is of paramount importance (Mazic et al. 2015). The recognition of the abilities and capabilities of skilled athletes is an important necessity in the field of sports which aims to reach the best possible

level. Through the application of scientific theories of physiology and sports training, which is based mainly on the events of the effects and positive changes in the functional organs, including the respiratory system and periodic work, the length of competition in football requires coaches and players to pay attention to durability as one of the most important elements of fitness. It plays a central role in the level of performance of players during the game. Hence the interest of trainers training at the beginning of the season is focused on the evaluation of physical tests used by instructors during the training units (Joyner & Coyle 2008). From this we want to know the effect of the development of the physiological adjustment of the training loads on the respiratory system and the performance of the skilled football players

Methodology

We used the experimental method to suit the nature of the study. **Sample of the research**: 20 players (U17 years) from a team in the second amateur national division has been divided into two groups: experimental group of 10 players and control group (10 players). **Training program**: After standardizing the characteristics of the sample and isolating the most confused variables that would affect the final results of the basic study, the training program was applied to the experimental group during the period devoted to the general physical preparation, programmed by the instructor where the focus was on the development of the functional efficiency of the respiratory system and learning skill performance. Accordingly, the training program included the following:

1 - Mesocycle general physical preparation period PPG
2 - Microcycle from the annual program followed by the trainer
3 - 36 training modules from 15/08/2017 to 15/09/2017

Since the sample was divided into experimental and control groups, the training program was applied to the experimental group while the sample was still trained according to the program led by the coach.

Search Tools: For the examination we chose from a number of tests dealing with the physical and skill aspects that can be applied to the sample members.

Physical and technical tests: Cooper Test, Harvard Stop Test, Physical Fitness Test PWC170, Test of The Accuracy of the Scrolling, Test the Power of Long Scrolling, Dribble Test l.

The training program. After consolidating the characteristics of the sample and isolating most of the confused variables that would affect the final results of the basic study, the training program was applied to the sample during the period of general physical preparation programmed by the trainer. Learned performance skill and the training program contains the following: the results since the sample is divided into two experimental and control sections, the training program was applied to the experimental sample while the sample was trained according to the program drawn by the trainer. The training modules were scheduled in time (Table 1).

Table 1

Content of weekly microcycle

Days	***SAT***	***SUN***	***MON***	***TUE***	***WED***	***THU***	***FRI***
First Training	Rest	Physical training	Physical training skills	Physical training	Physical training	Physical training skills	Friendly match
Second Training		Skills Training		Skills Training	Skills Training		

Table 2

Validity of physical and technical tests

Transactions / Tests		Validity	Reliability
Physical	Hardvard step test	0,87	0.93
	PWC170 Cycle Test	0,89	0.94
	Cooper test	0,81	0.90
Technical	Scroll accuracy	0,82	0.90
	Long scroll power	0,79	0.89
	Dribble Test	0,76	0.87

Level of significance = (0.05) - Table T = (0.60)

Table 3

Homogeneity of the study sample

Variable	**Control group**		**Experimental group**		**Test Levine forhomogeneity**		
	X'	**Y**	**X'**	**Y**	**F**	**Sig**	**Result**
Age (y)	16.60	0.51	16.70	0.48	**0.750**	0.39	homogeneous
Height (cm)	167.80	7.55	169.40	4.76	**0.587**	0.45	homogeneous
Weight (kg)	68.50	2.22	68.40	3.65	**2.362**	0.14	homogeneous
The training age (y)	6.60	0.51	6.60	0.51	**0.000**	1.00	homogeneous
box	68.46	3.80	62.05	3.24	**0.014**	0.90	homogeneous
PWC170 Cycle Test	2638.4	103.07	2528.07	416.70	**2.048**	0.16	homogeneous
Scroll accuracy	4.30	1.15	4.20	0.91	**1.204**	0.28	homogeneous
long scrolling force	6.90	0.73	7.10	0.99	**0.666**	0.42	homogeneous
Dribble Test (s)	23.80	1.13	24.80	1.75	**2.633**	0.12	homogeneous
Test cooper (12m)	2568.0	235.69	2460.0	238.51	**0.013**	0.91	homogeneous

The significance level is 0.05. N = 10

In the table showing the homogeneity of the sample, we note that the sample is homogenous, because the value of sig was greater than the value of (0.05).

Table 4 shows the results of the "T" test to indicate the differences between the mean scores of the respiratory system and the tribal and remote measurement of the two groups.

Table 4

The results of T-test for both respiratory system and performance

Test / Set		Type of test	arithmetic mean	standard deviation	degree of freedom	Value of "T"	Significance	value of Sig
Physiological tests For the	box	Before	62.05	3.24	09	4.01	Significant	0.00
		After	71.84	9.20				
	Test PWC170	Before	2528.07	416.70		7.37	Significant	0.00
		After	3386.13	207.45				
	Test Cooper	Before	2460.00	238.51		3.05	Significant	0.00
		After	2673.3	145.89				
Physiological tests Control group	box	Before	68.46	3.80	09	1.81	Note Significant	0.09
		After	70.75	3.27				
	Test PWC170	Before	2638.40	103.07		8.92	Significant	0.00
		After	3065.22	161.39				
	Test Cooper	Before	2568.00	235.69		0.42	No Significant	0.16
		After	2526.00	325.99				

Level of significance: 0.05 - n = 10 - Tabularity: 1.83

Table 5

Results of the "T" test to indicate the differences between the mean scores of the respiratory system and the skill performance of the two groups

Test / Set		Type of sample	arithmetic mean	standard deviation	degree of freedom	Value of "T"	Significance	value of Sig
Physiological tests For the pre-test	Box	Experimental	62.05	3.24	09	5.13	Significant	0.00
		Officer	68.46	3.80				
	Test PWC170	Experimental	2528.07	416.70		1.03	Not Signif	0.22
		Officer	2638.40	103.07				
	Cooper test	Experimental	2460.00	238.51		1.19	Not Signifi	0.10
		Officer	2568.00	235.69				
Technical tests For the pre-test	Scroll accuracy	Experimental	4.20	0.91	09	0.27	Not Signifi	0.14
		Officer	4.30	1.15				
	long scrolling force	Experimental	7.10	0.99		0.77	Not Signifi	0.11
		Officer	6.90	0.73				
	Dribble Test	Experimental	24.80	1.75		1.92	Significant	0.02
		Officer	23.80	1.13				

Level of significance: 0.05 - N = 10 - T tabular: 1.83

Table 6

Results of the "T" test to indicate differences between the two in the post-measurement of the control and experimental groups in the skill performance.

Test / Set		Type of sample	arithmetic mean	standard deviation	degree of freedom	Value of "T"	Significanc	value of Sig
Physiological tests For the pre-test	box	Experimental	71.84	9.20	09	0.45	Note Significant	0.66
		Officer	70.75	3.27				
	Test PWC170	Experimental	3386.13	207.45		4.88	Significant	0.00
		Officer	3065.22	161.39				
	Test Cooper	Experimental	2673.3	145.89		1.65	Note Significant	0.22
		Officer	2526.00	325.99				
Skills tests For the pre-test	Scroll accuracy	Experimental	6.70	0.67	09	3.76	Significant	0.01
		Officer	5.30	1.33				
	long scrolling force	Experimental	13.40	1.17		3.97	Significant	0.01
		Officer	11.70	1.25				
	Dribble Test	Experimental	20.70	0.67		3.51	Significant	0.01
		Officer	21.90	1.19				

The level of significance: 0.05 - n = 10 - Tabularity: 1.83

Table 7

The relationship between the performance of the skill and the circulatory system

Circulatory system / Performance skills	Scroll accuracy	Long scroll power	Football Interview
Box	0.71	0.69	0.81
Test PWC170	0.72	0.81	0.68
Cooper	0.78	0.73	0.75

T tabular = 0.60 N = 10

Discussion

The hypothesis that there are statistically significant differences in the variables of the respiratory circulatory system and the skill performance variables between the pre and post measurement of the experimental sample at the level of significance of '0.05' is achieved. These differences are in favor of the post-measurement. The results of this hypothesis can be explained that the differences recorded are 100 % of the sample of the study as indicated by the significance level in the table, because this stage is a preparatory phase, where we sre starting from the stage of zero. With the general preparation begins the development of the respiratory system and with the application of the special program for the experimental sample there were

clear differences and therefore the program has been the results of this experiment, especially in the experimental sample, where the focus was on the improving the functional efficiency of the players. As the study is concerned with improving the physiological adjustment of the circulatory system and the skill performance, it is the same. Ledebt et al. (2009) suggests that increasing of the physical intensity helps the rate of success of the correction, in addition to the high intensity training can improve the muscular system, especially if we know the role played by a muscles in performance skills (Watson, n.d. 2008).

The results of this hypothesis for the difference between the post-measurement of the experimental control groups showed that there were no statistically significant differences in the variables of the respiratory circulatory system and the skill performance between the control and experimental sample at the level of '0.05'. The researchers explained the absence of differences to the stage where the experiment is considered to be at the stage of general preparations for the football teams, where the normal prepartion for four weeks has given fruit and therefore there were no differences at the level of '0.05.' We may have mentioned earlier, perhaps due to lack of significance of differences in the test to the emphasis on the "Annabel," and "Hara" and "Buda" that the physiological adjustment is subject to the inherent factors and the quality of genes for each individual (Newton & May 2017). In terms of skill performance, the difference was statistically significant as described by the researchers in the interpretation of the first hypothesis and in the apartment of the skill performance.

It is clear from the results shown in Table 7 that there is a statistically significant correlation between the skill performance and the respiratory variables. The more the respiratory system develops, the higher the performance of the football players. When he is ready and physically prepared, he can perform the appropriate performance without any hindrance because the implementation of the technical movements remains dependent on the degree of physical readiness, which is in line with what he went for. This is confirmed by (Buchan et al. 2013; Di Paco 2014).

In addition, increasing physical fitness improves the skill performance because the skills are performed by parts of the body. These organs are subject to the state of the functional organs that control them. The improvement in the level of functional efficiency of breathing muscles reflects the improvement in the test capacity to meet the vital requirements of the body during the physical effort (Kerti, Balogh, Kelemen & Varga 2018).

Conclusions

1. The results of input and output measurements of the control group were for the benefit of telemetry in the measurements of the respiratory system and the performance of the skills.
2. There are statistically significant differences in the variables of the respiratory circulatory system between the pre and post measurement of the experimental sample at the level of significance of $p \leq 0.05$. These differences are in favor of telemetry.
3. There are statistically significant differences in the skill performance variables between the pre and post measurement of the experimental sample ($p \leq 0.05$) for the benefit of the post-measurement.
4. There are no statistically significant differences in the variables of the respiratory system in the post-measurement of the control and experimental sample ($p \leq 0.05$)
5. The circulatory system positively affects the performance of the skills, meaning that the more the evolution of the respiratory system increased, the more was the performance of the football players improved.

References

1. BARENE, S., P. KRUSTRUP, S. JACKMAN, O. L. BREKKE & A. HOLTERMANN, 2013. Do soccer and Zumba exercise improve fitness and indicators of health among female hospital employees? A 12-week RCT. *Scandinavian Journal of Medicine & Science in Sports. **24***. https://doi.org/10.1111/sms.12138
2. BUCHAN, D., S. OLLIS, J. YOUNG, S. M. COOPER, J. SHIELD & J. BAKER, 2013. High intensity interval running enhances measures of physical fitness but not metabolic measures of cardiovascular disease risk in healthy adolescents. *BMC Public Health. **13*** (498) https://doi.org/10.1186/1471-2458-13-498
3. Di PACO, A., G. A. CATAPANO, G. VAGHEGGINI, S. MAZZOLENI, M. L. MICHELI & N. AMBROSINO, 2014. Ventilatory response to exercise of elite soccer players. *Multidisciplinary Respiratory Medicine. **9***(1), 20. https://doi.org/10.1186/2049-6958-9-20
4. GREENWAY, F. L., 2015. Physiological adaptations to weight loss and factors favouring weight regain. *International Journal of Obesity. **39***(8), 1188-1196. https://doi.org/10.1038/ijo.2015.59
5. HAROLD W. KOHL, I. I. I., COOK, H. D., ENVIRONMENT, C. ON P. A. AND P. E. IN THE S., BOARD, F. AND N., & MEDICINE, I. of., 2013a. *Approaches to Physical Activity in Schools*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK201495/

6. AROLD W. KOHL, I. I. I., COOK, H. D., ENVIRONMENT, C. ON P. A. AND P. E. IN THE S., BOARD, F. AND N., & MEDICINE, I. of., 2013b. *Physical Activity and Physical Education: Relationship to Growth, Development, and Health*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK201497/
7. HUONKER, M., M. HALLE & J. KEUL, 1996. *Structural and Functional Adaptations of the Cardiovascular System by Training*. https://doi.org/10.1055/s-2007-972919
8. JOYNER, M. J., & E. F. COYLE, 2008. Endurance exercise performance: The physiology of champions. *The Journal of Physiology. 586*(Pt 1), 35-44. https://doi.org/10.1113/jphysiol.2007.143834
9. KERTI, M., Z. BALOGH, K. KELEMEN & J. T. VARGA, 2018. The relationship between exercise capacity and different functional markers in pulmonary rehabilitation for COPD. *International Journal of Chronic Obstructive Pulmonary Disease. **13***, 717-724. https://doi.org/10.2147/COPD.S153525
10. LEDEBT, A. (n.d.). *Developmental changes in temporal patterns during supported walking in infants*. Retrieved from https://www.academia.edu/18589806/Developmental_ changes_in_temporal_patterns_during_supported_walking_in_infants.
11. LEVINE, B. D., 2008. V̇O2,max: What do we know, and what do we still need to know? *The Journal of Physiology*, *586*(Pt 1), 25–34. https://doi.org/10.1113/jphysiol.2007.147629
12. MAZIC, S., B. LAZOVIC, M. DJELIC, J. SUZIC-LAZIC, S. DJORDJEVIC-SARANOVIC, T. DURMIC, … V. ZUGIC, 2015. Respiratory parameters in elite athletes – does sport have an influence? *Pulmonology. 21*(4), 192-197. https://doi.org/10.1016/j.rppnen.2014.12.003
13. MILOŠEVIĆ, B. M. & M. M. MILOŠEVIĆ, 2010. Physical preparation of elite athletes: *Standardization of management processes.* Belgrade, Serbia: APP.
14. MILOŠEVIĆ, M. B., V. NEMEC, P. NEMEC & M. M. MILOŠEVIĆ, 2017. Programming methodology and control of aerobic training by running. *Acta Kinesiologica. **11***(1), 53-57.
15. MILOSEVIC, M., M. MILOSEVIC, P. NEMEC, D. ZIVOTIC & R. IZET, 2014. A New Approach to Developing Human Maximal Muscular Force: A Case Study. *Journal of Exercise Physiology Online*.
16. MILOŠEVIĆ, M., M. MUDRIĆ, R. MUDRIĆ & M. MILOŠEVIĆ1, 2011. Using the mind in reprogramming the limits of muscle force in the process of creating champions. *SCIENCE & PRACTICE*, 39.

17. NEUFER, P. D., 1989. The effect of detraining and reduced training on the physiological adaptations to aerobic exercise training. *Sports Medicine (Auckland, N.Z.).* ***8***(5), 302-320. https://doi.org/10.2165/00007256-198908050-00004
18. NEWTON, E. R., & L. MAY, 2017. Adaptation of Maternal-Fetal Physiology to Exercise in Pregnancy: The Basis of Guidelines for Physical Activity in Pregnancy. *Clinical Medicine Insights. Women's Health*, *10*. https://doi.org/10.1177/1179562X17693224
19. OWEN, A. L., D. P. WONG, D. PAUL & A. DELLAL, 2014. Physical and technical comparisons between various-sided games within professional soccer. *International Journal of Sports Medicine.* ***35***(4), 286-292. https://doi.org/10.1055/s-0033-1351333.
20. PATE, R. R. & A. KRISKA, 1984. Physiological basis of the sex difference in cardiorespiratory endurance. *Sports Medicine (Auckland, N.Z.).* ***1***(2), 87-98. https://doi.org/10.2165/00007256-198401020-00001
21. TENENBAUM, G. & E. FILHO, 2018. Psychosocial Measurement Issues in Sport and Exercise Settings. *Oxford Research Encyclopedia of Psychology*. https://doi.org/10.1093/acrefore/9780190236557.013.225
22. WATSON, S. (n.d.). Balance Training: Benefits, Intensity Level, and More. Retrieved 19 September 2019, from WebMD website: https://www.webmd.com/fitness-exercise/a-z/balance-training