UDC:796.332.093.111:572.087.1(497.7)
Original scientific paper

THE IMPACT OF DIFFERENT PLAY POSITIONS ON SOME MORPHOLOGICAL INDICATORS FROM THE YO-YO IR1 TEST IN YOUNG FOOTBALL PLAYERS

Armend Myftiu

Faculty of Physical Education, University of Tetova, RNM
Corresponding author e-mail: armendmyftiu@hotmail

Abstract

The aim of this study is to observe if there are any differences between different team play-positions based on the characteristics of functional capacities, namely: (VO_2 max.) maximum oxygen uptake during load, (HR) maximum heart rate frequency, (Lactate) lactic acid accumulation in the blood and (Distance) running distance after completing the specific endurance test (Yo-Yo Intermittent Recovery 1) in young football players. This study involved a total of 33 football players (age: 15.8 ± 0.4; body mass: 60.9 ± 7.7 kg; body height: 173.2 ± 6.2 cm) from two elite football clubs in North Macedonia. Players were divided in three groups: defenders, midfielders and strikers. After examining functional parameters through the method of multivariate analysis of variance (MANOVA), the group mean value differences of the three team play positions in the same field (VO_2 max., HR, Lactate, Distance) from the Yo-Yo IR1 specific endurance test were examined, where a significant impact effect was observed, Wilk`s $\lambda = .46$, $F(8, 54) = 3.18$, $p < .005$, multivariate $n^2 = .32$. Through the univariate analysis of variance (ANOVA), a statistically significant effect related to the difference of the team play position profile was observed in the accumulation of the lactic acid in the blood $F(2, 30) = 5.1$, $p < .005$, $n^2 = .25$. Following the Yo-Yo IR1 test based on this research, young football player profiles in different play positions in the team showed no significant difference in: running distance, heart rate frequency and maximum oxygen uptake. A significant difference in the accumulation of lactic acid in the blood was observed in the group of strikers, compared to those of defenders and midfielders. Strikers, although running the shortest distance, had higher lactic acid concentration in the blood compared to midfielders or defenders.

Keywords: Yo-Yo IR1, VO_2 max., lactate, heart rate frequency.

Introduction

In modern times, a junior professional football match is characterized with high speed movements subject to advanced psychophysical performance. Young football players are now devoted to specific exercises, thus explicitly increasing endurance and strength, and together with strength, their determining parameters: maximum speed and acceleration force. Based on the physiological point of view, specific exercises are used to increase the heart rate frequency volume, aiming at increasing the maximum oxygen uptake that influences on the improvement of the game performance, especially on the running distance volume during the match, the increased repeated high-speed actions and increased frequency of contacts with the ball during the match (Hoff J., Kähler N., Nelgrud J., 2006).

If possible, football players should be able to keep the same physical performance level throughout the match, but many studies point out that in the second half of the match it comes to

a reduction of the relevant skills parameters: heart rate frequency, blood glucose and lactic acid (Tumilty D., 1993; Ekblom B., 1986).
Players with higher capacity of maximum oxygen uptake (Vo2 max.) possess higher glycogen reserves which enable them, from the energy point of view, to perform with a higher intensity for a longer time. They also possess faster recovery capacities and at the same time they complete the biggest number of high-speed running distances (Bangsbo J.,Mizuno M., 1988). In general, these types of players are mostly engaged in final actions throughout the match, and play a crucial role for the final result (Smaros G., 1980). Also, these types of players possess higher glycolytic reserve capacity and better usage of lipolytic reserves (Reilly T., Thomas V., 1979), considering the fact that glycogen reserves are necessary for higher intensity loads and that during the time of the match the level of lactic acid concentration in the blood is increased, which influences with a reduction of the performance quality of the technical and tactical elements of the match. (One study shows that football players before conditioning-specific training were able to juggle the ball for an average of 64 times, while after the training they juggled the ball for an average of 3 times; Ekblom B.: Sports Medicine3, 1986, 50-60).
Football players are able to run with high intensity for phases with a period of 3-8 minutes, where the maximum heart rate frequency volume achieves its maximum within 1-2 minutes. There is a drastic decrease of performance of up to 50% after 4 minutes (RognmoØ., Hetland E., Helgerud J., Hoff J., Slørdahl S., 2004), which results with high lactic acid levels in the blood and muscles, followed by necessary load phases with low intensity to achieve the specific recovery at this phase, while loads with an intensity up to 70% of the maximum heart rate frequency has been shown as very effective (Hermansen L., Stensvold I. 1972). Based on the fact that within a 90-minute match the effective participation makes up only 61-62 minutes with an average running distance of 8-12 km, of which 24-28% is at high speed (>15 km/h) and the running distance with the ball takes a total of 2-3% of the total running distance during a match, the high-speed running reaches an average distance of 17 meters (Reilly T., Thomas T., 1976; Harald T., Roman B., Gerhard S., Norbert B., 2001), which implies that players must be able to undergo complex movement patterns achieved with subsequent intensive running and require high conditioning performance which is directly or indirectly determined by: oxygen uptake during load, level of lactic acid in the blood and the heart rate frequency volume influenced by different play positions that are characterized by certain positions in the team.

Methods

Participants

This study involved a total of 33 football players (age: 16 ± 3.2; body mass: 60.47 ± 6.3 kg.; body height: 173.20 ± 8.4 cm) from two elite football clubs in North Macedonia. Players were divided in three groups: defenders, midfielders and strikers. The players were engaged in regular training sessions with their teams 3 times a week, and they were regular participants in the North Macedonia Junior Football Championship. Participation in the research was on voluntary basis.

Procedure

All players underwent a YoYo IR1 specific endurance test. YoYo IR1 test measurements were carried out in synthetic football field with electronic sensors (Powertimers). The maximum reached distance during the YoYo IR1 test for each subject was marked by an observer. During the test, each subject has been monitored, and the heart rate frequency was recorded with the digital measuring system 'Polar' (Firstbeat-HearthbeathAnalytis) using a transmitting signal from the chest. After completing the running test, each subject was tested for their lactic acid

level in the blood using a digital meter (Lactat Scout+). The calculation of maximum oxygen uptake was performed using the following formula:
YoYoIR1:V02 max (mL/min/kg) = IR1 distance (m) × 0.0084 + 36.4 (Bangsbo et al. 2008).

Results and Discussion

Table 1 shows the results of descriptive statistics including group mean values and standard deviations in the variables: YoYo IR1 distance, HR max., lactate, and Vo2 max. The most obvious difference of the lactic acid accumulation is noticed in the striker group, who also possess the highest mean heart rate pulse (200) of all player groups. These types of players are characterized with emphasized outburst and faster speeds in short distances, mainly in the opponent's danger zone. Midfielders make up the highest mean running distance (1351 m), which was expected, keeping in mind the total running distance covered during a match that is completed by this type of players. These types of players are mainly expected to run from one danger zone to the other (box to box), covering a large area in the field, both in the attack and the defense zone, and this is why their specific endurance level is expected to be more pronounced. The distance covered by the defenders in the YoYo IR1 test does not show a pronounced difference compared to that of the strikers, while a more pronounced difference, although not statistically significant, is evidenced between defenders and midfielders. Side defenders are known for long running distances, while central defenders mostly run short distances during a football match and this may be the reason for a lower mean value compared to midfielders. There is no pronounced difference in the maximum oxygen uptake in the three groups and it can be considered as a gross physiological criterion rather than direct endurance performance, because as it is known, the specific endurance depends on a number of relevant factors.

Table 1. Descriptive statistics (mean±SD) of soccer players

	Yo-YoIR1 Distance	HR max.	Lactate	Vo2 max.
Defender (n=12)	1263 ± 134	195 ± 6.5	11.5 ± 2.1	47.1 ± 2.8
Midfield (n=9)	1351 ± 291	193 ± 9.5	10.4 ± 2.3	47.7 ± 2.4
Striker (n=12)	1230 ± 322	200 ± 6.6	13.9 ± 3.1	46.7 ± 2.7

Table 2 shows the significant effect of the factor in the group of dependent variables, $\lambda = .46$, $F(8, 54) = 3.18$, $p < .005$, *multivariate* $n^2 = .32$, describing a variability impact of 32% on the play positions in the common field with physiological characteristics examined using the Yo-Yo IR1 specific endurance test.

Table 2. Multivariate Tests

λ	F	Sig.	n^2
.463	3.18	.005	.32

Table 3 shows subject comparison based on play positions calculated using the analysis of variance (ANOVA), where a statistically significant influence on the lactic acid accumulation in the blood after Yo-Yo IR1 test completion is observed. Previously, the Leven test revealed variance homogeneity of dependent variables.

Table 3. Tests between subjects' effects

	F	Sig.	n^2
Yo-Yo Distance	.37	.69	.02
HR max.	1.96	.15	.11
Lactate	5.08	.01 *	.25
Vo2 max.	.37	.69	.02

** Play position*

Table 4 shows a comparison between groups classified according to play positions using the post-hoc test (Tuckey HSD). There is a pronounced concentration of lactic acid in the blood depending on the play positions of defendants and strikers (p.03). There is also a difference between midfielders and strikers (p.01), while at players playing in the midfield and defense position there is no statistically significant difference in the lactic acid accumulation in the blood after the completion of the YoYo IR1 specific endurance test.

Table 4. Multiple Comparisons

		Mean Diff.	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Defender	Midfield	1.09	1.14	.34	-1.23	3.43
	Striker	-2.38*	1.05	.03	-4.54	-.22
Midfield	Defender	-1.09	1.14	.34	-3.43	1.23
	Striker	-3.48*	1.14	.01	-5.81	-1.14
Striker	Defender	2.38*	1.05	.03	.22	4.54
	Midfield	3.48*	1.14	.01	1.14	5.81

** Lactate*

Conclusion

Based on these research results, it can be concluded that different play positions among young football players cannot be classified as important predicting factors in the same field using measuring parameters such as: running distance, maximum heart rate frequency and maximum oxygen uptake from the Yo-Yo IR1 test. The difference of lactic acid accumulation in the blood of midfielders and strikers describes once again the need of classifying the training process, especially the conditioning one, of the play positions. The physiognomy of midfielders' physical load (speed endurance) differs from that of the strikers (explosive sprint force) and is determined by the distribution of muscle fibers which are mainly genetically determined. Although the lactic acid is considered as a very sensitive physiological parameter to exogenous factors and is treated with caution especially in young football players, it plays an important role, especially in determining the limits of aerobic and anaerobic loads during the training process.

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