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Management of effort intensity in young football players training with small-sided games

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Abstract

Background. Developing a model for the content of small-sided games in training, through physiological measurements of athletes, can make the way training is conducted more efficient.

Aims. The aim of this study was to analyze whether participation in a training programme with small-sided football games can develop speed and agility.

Methods. The subjects of this study were 40 16-18-year-old athletes divided into two equal groups: the experimental group (EG) and the control group (CG). Both groups participated in 20-week training programmes between 6.07.2020 - 27.11.2020 – EG in a small-sided football games training programme; CG in a classic exercise training programme. The following equipment was used: Hosand GT.a – to measure HR – and the WittyGateMicrogate2. Subjects took YYIRTL1 and Pro Agility 5-10-5 field tests. The data collected was processed with the SPSS programme, version 23.

Results. In the Pro Agility 5-10-5 field test there were no significant differences in the initial testing (IT) in the two groups, but in the final testing (FT) the difference between the final time score averages (Ft) in the two groups was significant (Mann-Whitney U = 88.50, N1 = 20, N_2 = 20, two tailed p = 0.003, d =.99).

Conclusions. The study revealed that speed and agility developed through the application of a training programme with small-sided football games.

Keywords: heart rate, small-sided games, speed and agility, football.

Introduction

In performance sport, players' results are at the highest level when the periodization and content of sports training are close in form and content to the competition's specificity (Platonov, 2015). For these reasons, in order to create a model of sports training, coaches use the integrated training method with small-sided football games (Aguiar et al., 2012).

Football is characterized by complexity, aerobic exercises must be combined with anaerobic exercises, given the varied content of the game, involving actions such as sprints, directional changes, accelerations and decelerations (Dellal et al., 2011b).

Taking an integrated approach to training through the use of small-sided games, but also to the physical, physiological and technical-tactical influences they may have, has, in recent years, increased their popularity in both training and scientific research in this field (Dellal et al., 2011a; Dellal et al., 2011b).

Several studies analyzed the effects of small-sided games in sports training, indicating that physiological responses (Aguiar et al., 2012; Dellal et al., 2011a; Dellal et al., 2011b) and technical-tactical requirements (Mendez-Villanueva & Delgado-Bordonau, 2012) can be modified during small-sided football training.

There are conceptual differences between integrated and traditional training, the main difference being to address all training factors and ball usage in the case of integrated training, in contrast to treating training factors separately in the traditional approach (Mendez-Villanueva & Delgado-Bordonau, 2012). The use of the analytical method results in the preponderant development of a quality according to the topic of training addressed (Clemente et al., 2014).

The main purpose of this study was to analyze the effects of heart rate routing in a training programme with small-sided football games on the speed and agility of young footballers.

Hypothesis

Monitoring and managing heart rate in training with small-sided football games will result in a change in players' speed and agility.

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Materials and methods

Research protocol

a) The period and place of the research

The research was carried out from 06.07.2020 to 27.11.2020 at the multifunctional facility of the sports complex at the Stadium in Deva.

b) Subjects and groups

The sample included in the study consisted of 40 16-18-year-old athletes divided into two groups of 20 subjects – the experimental group (EG) and the control group (CG) - all components of the same sports club. The subjects participated in a programme of 5 workouts per week. For the EG athletes, 3 of the 5 weekly training lessons included small-sided football games, and for the CG athletes, the training programme contained classic training means. All subjects and their parents gave their written consent to participation in this research.

c) Tests carried out

The subjects took Yo Yo intermitent test level 1 (Bangsbo et al., 2008; Bangsbo, 2008) at the start of the study, to measure HRmax and to delimit the specific effort zones of each sport. For the evaluation of speed and agility, both groups performed Pro Agility 5-10-5.

The Intervention Programme

The microcycles of training included 4 weekly workouts and a bilateral game in the weekend. Due to the situation caused by Sars CoV, official competitions being stopped for the competition season 2020-2021, friendly games were planned at the end of the weekly microcycles to model the training programme according to the specific content of each training stage.

The workouts had a duration between 60 and 110 minutes. For the EG athletes, the training programme with small-sided games had the following content of the effort: aerobic on Monday, aerobic and anaerobic lactacid on Wednesday, aerobic and anaerobic alactacid on Friday. CG subjects attended a training programme with classic exercises during this period. In both groups, the weekly cycle also included technical tactical training on Tuesday, with an intensity of 50-60% of HRmax. Both groups had theoretical lessons included in the weekly programme on Thursday. For the EG, the training programme was standardized by directing the intensity of the effort in small-sided football games, according to the structure of the microcycles for preparatory and competitive periods (Table I). To guide training intensity and pause duration, heart rate was monitored using the Hosand GT.a system. In the initial and final tests, Pro Agility 5-10-5, the WittyGateMicrogate2 electronic timing system was used.

The characteristics of small-sided games are shown in Table II.

Table I

The structure of the weekly microcycle used by the EG, training specific to the preparatory period.

SSG	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Preparatory period							
1	5vs5/6vs6 50%-60% FCmax	Antre Th-Ta 60% FCmax	4vs4/5vs5 65%FCmax	TL	6vs6+2 Gk 60%FCmax	Game	Day off
2	5vs5/6vs6 50%-60% FCmax	Antre Th-Ta 60% FCmax	5vs5/6vs6 65%FCmax	TL	1vs1 90%FCmax	Game	Day off
3	3vs3/3vs3+1 70%- 80% FCmax	Antre Th-Ta 60% FCmax	2vs2/3vs3 >80%FCmax	TL	1vsGk 90%FCmax	Game	Day off
4	3vs3/3vs3+1 >70%FCmax	Antre Th-Ta 60% FCmax	2vs2/3vs3 >80%FCmax	TL	-	Game	Day off
Competitional period							
1	4vs4/5vs5 50%-60% FCmax	Antre Th-Ta 60% FCmax	4vs4/5vs5 65%FCmax	TL	6vs6+2 Gk 60%FCmax	Game	Day off
2	5vs5/6vs6 50%-60% FCmax	Antre Th-Ta 60% FCmax	2vs2/3vs3 >80%FCmax	TL	1vs1 90%FCmax	Game	Day off
3	5vs5/5vs5+1 50%- 60% FCmax	Antre Th-Ta 60% FCmax	2vs2/3vs3 >80%FCmax	TL	1vsGk 90%FCmax	Game	Day off
4	3vs3+3 >70% FCmax	Antre Th-Ta 60% FCmax	—	TL	1vs1 90%FCmax	Game	Day off

Note: TL = Theoretical lessons; FCmax = Maximum heart rate; SSG = Small-sided games.

Table II

The characteristics of small-sided games used in the intervention programme.

Type of SSG	Round sec./min.	Break min.	No.rounds	Dimensions	HR/ effort	HR/break	Effort zone
1vs Gk	6``	2`	10	10x15	190	110/120	>90%FCmax
1vs1	12``	2`	4	10x15	190	110/120	>90%FCmax
1vs1	1`	45``	4/6	10x18	170/190	140/150	>81%FCmax
2vs2	2`	1`	6	15x15	180/185	150	>81%FCmax
3vs3	3`	1`30``	6	15x20	180/190	140/150	>81%FCmax
4vs4	4`	3`	4	20x20	150/160	120/130	<81%FCmax
5vs5	5`	3`	4	40x20	150	120	<81%FCmax
6vs6	5’	2’50”	4	30x30	155	122	<81%FCmax

Note: FC = Heart rate; SSG = small-sided games.

d) Statistical processing

The analysis and interpretation of the results was carried out using the SPSS programme, version 23.0, with the materiality threshold p <0.05 applied. The Shapiro Wilk test was used in the analysis of data distribution normality and parametric or non-parametric tests were used to compare the results obtained by subjects in the two groups depending on the distribution of the data. The size of the effect (Cohen, 1988) was also calculated.

Results

From the analysis of data distribution and interpretation of the Shapiro-Wilk test for Pro Agility 5-10-5, it was found that in the initial testing (IT) the data were distributed normally to the final time (Ft) parameter in both EG (p = .622) and CG (p = .380), but in the final test (FT) they did not have a normal distribution, EG (p = .400) and CG (p = .036). Therefore, parametric tests (independent t-test and paired samples t-test) were used for comparison of the averages when the data were normally distributed, and non-parametric tests (Mann-Witney U or Wilcoxon) when the data were not normally distributed. The size of the effect was also calculated (Cohen, 1988).

The independent samples t-test shows that the difference between the averages of the two groups for parameter Ft (final time) is not statistically significant (Table 3), the groups being homogeneous.

After the completion of the intervention programme, the measurements for the sample under investigation were repeated and the results were also analyzed statistically (Table IV). The difference between the score averages of the two groups was significant (U = 88.50, N_1 = 20, N_2 = 20, two-tailed p = .003, d = .99).

For the analysis of the effect of intervention programmes on the subjects in the two groups, the averages recorded by the subjects at the two points of the study were compared, using tests according to the data distribution. Thus, the paired samples t-test (Table 5) shows that in the test group the differences were significant for the variable Ft (t = 6.235, df = 19, p = .000, d = 1.52). The Wilcoxon test was used when comparing the control group averages (Table V) and there were no significant statistical differences for the variable Ft (Z = -1.954, p = .051, d = .51).

Discussions

In a study by Faude et al. (2012), the influence of anaerobic speed and skills on increasing efficiency and scoring football goals was investigated. The results of this experiment, carried out at the level of professional football in Germany, show that anaerobic power, speed and manifestations are decisive in determining the results of football. It is therefore necessary to include these components of physical training in sport-specific testing and physical training programmes (Faude et al., 2012).

Table III

Means, standard deviations, comparison of means and effect size for Pro Agility 5-10-5 – Ft – before the intervention programme (N = 40).

Time	Variable	Group	Average	AS	ES	t	df.	Sig.	Cohen'd
T1	Ft	EG (20)	5.5010	.24645	.05511	-.768	38	.447	.20
		CG (20)	5.5495	.13801	.03086				

Note: EG – experimental group; CG – control group; Ft – final time.

Table IV

Comparison of the averages and the size effect at the end of the intervention programme (N = 40).

Variable	Ft – Pro Agility 5-10-5
Mann-Whitney U	88.50
Z	-3.017
Asymp. Sig. (2-tailed)	.003
Cohen d	.99

Table V

Comparison of averages and effect size of Pro Agility 5-10-5, for the variable Ft, in the experimental and control groups, before and after the intervention programme (N = 40).

Pair	Time	Variable	Paired Samples Statistics		Paired Samples Test[a,b]			
			Mean	Std Deviation	t[a]\Z[b]	df	p	d
Pair 1 EG	IT	Ft	5.501	0.24645	6.235[a]	19	.000	1.52
	FT	Ft	5.1845	0.15275				
Pair 2 CG	IT	Ft	5.5495	0.13801	-1.954[b]	19	.051	.51
	FT	Ft	5.4155	0.29795				

Note: a. EG t-test; b. CG Wilcoxon Signed Ranks Test; IT – initial testing; FT final testing; Ft -final time.

For coaches and team sports athletes, developing these physical qualities represents the main goal. As highlighted in the meta-analysis carried out by Hammami et al. (2017), several studies address the development of these qualities as a research theme by using small-sided football games.

Thus, a study carried out in elite footballers (M = 14.2, A.S. = 0.9) shows that after 6 weeks of small-sided games training, significant improvements were achieved in short distance travel speed, directional changes and the agility specific to football actions (Chaouachi et al., 2014). These speed and other physical quality improvements with specific anaerobic effort can be explained by the multitude of specific actions encountered in small-sided games at a higher intensity (Hammami et al., 2017).

In our experiment, it is shown that after a 20-week period of small-sided football games training, athletes' performance in speed and agility was significantly better than the results achieved by athletes who used classic methods in their training programme. We also noticed significant differences between the average scores of the Ft, between the two tests of the EG athletes, which indicates that this training time and the content of the training programme were effective in improving speed and agility. Compared to the results obtained by EG, where we observed significant statistical differences between the tests after 20 weeks of training, the results obtained by CG do not show any significant statistical differences between IT and FT.

A 7-week study with U19 Australian footballers shows that small-sided games improve agility but do not produce significant speed improvements with short-range directional changes (Young & Rogers, 2014). These data indicate that a longer period of small-sided games workouts is needed to influence speed development.

In another study, the results of a small-sided football games training programme were compared with the results of classical exercises over a period of 6 weeks (Amani-Shalamzari et al., 2019). The results of this study show that both the small-sided games methods and the classical-field ones produce significant improvements in aerobic and anaerobic capacity, but do not have a significant impact on agility development (Amani-Shalamzari et al., 2019). Unlike the study mentioned above, the results of our research show significant improvements in agility, but after applying a training programme with small-sided football games over a longer period of time.

In the study by Devies et al. (2013), in a group of professional football players from Australia, it is shown that the standardization of a small-sided games training programme can only influence the development of agility if the rules used in the structure of exercises are effectively selected. The results obtained from our experience and those presented in these studies show that a training programme, which is correctly standardized and time-limited, with small-sided football games, produces significant improvements in speed and agility.

Conclusions

The analysis of results and the experience gained from this experiment led us to the following conclusions:

1. Going through a training programme with small-sided football games over a period of 20 weeks develops speed and agility in 16-18-year-old athletes.
2. The guidance of the training intensity by measuring heart rate and the constant re-standardization of the means used, as the body adapts to the stress stimuli, have positively impacted the physical potential of athletes.
3. By monitoring the training intensity we can know the physiological profile of the athletes according to the effort zones.
4. The small-sided football games training method can be more effective in developing physical performance than traditional training methods.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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This research paper is part of a larger research that investigates the concept of small-sided games and the possibilities to improve physical capacity through football training with small-sided games. All authors have equally contributed to the elaboration of the research design, data collection and writing of the research paper.

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