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Original Article

Time limit in two interval training models derived from the futsal intermittent endurance test in brazilian male and female futsal players

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Abstract:
This study compared the physiological responses and time limits (TL) in two interval training (IT) models based on peak speed (PS_{FIET}), featuring one change of direction ($IT_{7.5X7.5}$) and three changes of direction (IT_{15X15}). Fifty-six male (M1; M2) and female (F1; F2) futsal players participating in regional and national futsal leagues were randomly assigned to three different exercise intensities, with each group performing $IT_{7.5X7.5}$ and IT_{15X15} at specific intensities (TL_1, TL_2 and $PS_{100\%FIET}$). The $IT_{7.5x7.5}$ model involves a run with a 180º change of direction, two accelerations and one deceleration, with featuring 4 min sets and a 3 min break between sets, with work-to-rest: 1:1. On the other hand, the IT_{15x15} includes three changes of direction, four accelerations and three decelerations, with four 4 min sets and a 3 min break between sets, maintaining work-to-rest: 1:1 Our results revealed no differences in mean heart rate and maximum heart rate obtained in the Futsal Intermittent Endurance Test (FIET) tests. In addition, our main results showed that the groups that performed TL_1 (M1: p =0.018 and F1: $p = 0.019$) and $TL_{PS100\%FIET}$ (p = 0. 014) had lower TL for $IT_{15x15\ compared}$ with $IT_{7.5X7.5}$. Moreover, o IT_{15x15} at TL_2 performed by F2 group, showed higher maximum heart rate value than $IT_{7,5x7,5}$ ($p = 0.002$). In conclusion, our results showed that IT with one change of direction allows athletes to have a higher TL when compared to IT with three changes of direction. These findings may be directly related to the increase in muscle demand caused by a greater number of changes of direction, which leads to more accelerations and decelerations, thus generating a reduction in TL.
Key words: team sports, change of direction, interval training, futsal

Introduction

Futsal is a sport authorized by the Fédération Internationale de Football Association (FIFA) in which each team has five players on the field (Spyrou et al., 2020). A futsal match consists of two 20-minute halves with a 10-minute rest (Barbero-Alvarez et al., 2008). In addition, each team can have a maximum of 14 players in its squad for a match. (FIFA, 2020). Futsal is a team sport that has an innumerable characteristic, such as unlimited substitutions, time, and the size of the playing space that differs from other team sports, such as football. (Barbero-Alvarez et al., 2008; Naser et al., 2017). In this sense, futsal is considered an intermittent sport that involves repeated actions at high-intensity at 1:1 effort-to-pause ratios. During the matches, sprints, accelerations, decelerations, and changes of direction occur repeatedly ((Barbero-Alvarez et al., 2008; Teixeira et al., 2019). Therefore, these physical capacities are considered a determinant factor for a team to be successful in futsal, demonstrating that futsal has important neuromuscular demands (Spyrou et al., 2020).

In this context, futsal requires significant contributions from the aerobic and anaerobic systems (Caetano et al., 2015). It has been showed that during the futsal match, the oxygen consumption (VO2) values are above 75% of VO_{2max}, and 90% of their maximum heart rate (HR_{max}) (Castagna et al., 2009). Studies using video analysis have reported that the average distance covered by a futsal athlete is 3-4 km and that 5-12% of the playing time is spent running at higher speed, which corresponds to a speed of over 15.5 $km.h^{-1}$ and sprints of over 18 $km.h^{-1}$ (Castagna et al., 2009; De Oliveira Bueno et al., 2014). However, the physical demands performed during a futsal match are related to characteristics such as competitive level, gender, and the tactical roles played by the players (Spyrou et al., 2020). Thus, it can be seen that high-intensity actions are required by the sport, which suggests the need for specific training programs such as Interval Training (IT) (Campos et al., 2021).

IT is a training method that involves high-intensity sessions, usually performed above or near to critical power/speed (Laursen & Buchheit, 2019). In addition, IT can be prescribed based on heart rate, maximum

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aerobic speed, anaerobic speed reserve, perceptual effort scales, time limit (TL), and through effort and pause ratio (L. V. Billat, 2001; Campos et al., 2021). IT allows athletes to remain at intensities close to $VO2_{max}$ for a longer time (L. V. Billat, 2001; Buchheit & Laursen, 2013). Finally, a few studies have evaluated the responses of the IT with one or more changes of direction in futsal players based on a specific test for the sport. And the studies that performed this, for example, have not investigated variables such as mean heart rate, $HR_{max,}$ and perceptual effort responses in athletes of both genders related to the TL (Dal Pupo et al., 2013; do Nascimento et al., 2015; Teixeira et al., 2019). In this sense, TL can be a useful tool for prescribing the duration and intensity of IT (L. V. Billat, 2001). TL is the maximum time an individual can endure in an exercise at a given intensity and provides important information about the subject's physical fitness (V. Billat et al., 1995). In addition, TL is considered an important indicator of aerobic power and can be used to equalize and prescribe the loads and sets of interval training sessions on an individual basis (L. V. Billat, 2001). Given this, it has been demonstrated that female athletes can have different physiological and physical responses to male athletes, such as heart rate, VO_{2max}, maximum aerobic speed, ability to perform sprints, TL and lower strength, and power performance of the upper and lower limbs (Clemente & Nikolaidis, 2016; Ramírez-Campillo et al., 2016; Teixeira et al., 2019).

In this perspective, to improve knowledge of training models for futsal, (Guglielmo et al., 2015) proposed two different models of specific interval training for futsal based on the Futsal Intermittent Endurance Test (FIET), a model with one change of direction and another with three changes of direction to evaluate the physiological and physical responses related to futsal in futsal athletes. However, the responses and differences to the models proposed by (Guglielmo et al., 2015) on TL in futsal players of both genders are unclear. Current theory has shown higher values in blood lactate concentrations, peak heart rate, subjective perception of effort, time spent during acceleration, and greater use of skeletal muscles in activities with changes of direction when compared to actions without change of directions (A. R. Akenhead et al., 2015; Dellal et al., 2010). The literature reports that the ability to change direction in high-intensity activities is fundamental in sports such as futsal (Serrano et al., 2020). In this perspective, a study by (R. Akenhead et al., 2015) showed that increases in number of changes of direction during a single submaximal sprint increased the time spent accelerating in each curve in the physiological and effort responses; however, this study did not evaluate TL.

Thus, to date, no information has been found in the literature on TL in male and female futsal players in two IT models derived from FIET. It is important to note that this is the first study to evaluate TL derived from FIET in futsal players. The findings of this study can support coaches and other professionals in choosing the ideal IT model for their teams. Therefore, this study aimed to compare the physiological responses and TL in two interval training models based on FIET at different intensities, one with one change of direction ($IT_{7.5X7.5}$ = 86-91% of PS_{FIET}) and the other with three changes of direction (IT_{15X15} = 83-88% of PS_{FIET}) in male and female futsal players. Based on the hypothesis that the IT in the model with one change of direction, the TL, and the number of series supported will be higher than in the model with three changes. Moreover, perceptual responses, heart rate, and TL will be higher in the model with three changes of direction, and the responses found will differ between males and females.

Material & methods

Fifty-six young futsal players competing in the Brazilian Regional and National Division League participated in the study. Fifty-six male and female futsal players competing in regional and national futsal leagues were randomly assigned to three different exercise intensities, where each group performed $IT_{7.5X7.5}$ and IT_{15X15} at specific intensities (TL_1, TL_2 and $PS_{100\%FIET}$). Female groups 1 (F1) and Male group 1 (M1) performed TL_1, teams F1 and Male group (M2) performed $TL_{100\%PV}$ and finally team Female group (F2) performed TL_2. Inclusion criteria for the study were defined as: (i) minimum of three futsal training session per week; (ii) self-report of no continuous use of any medication; (iii) negative answer to all questions in PAR-Q. It was excluded players who had injuries or had not completed any tests. All young players presented written consent from a parent or guardian to participate in this study. This study was approved by the local ethics committee (protocol number: CAAE 19398213.3.0000.0121), and all procedures in this work were in accordance with the Declaration of Helsinki.

Study Design

To assess physiological differences between IT at different intensities and with different changes of direction, a three randomized groups design with seven occasions was used. On the first occasion, the participants underwent anthropometric assessments. For men, (Faulkner, 1968) protocol was used, and for women, (Jackson et al., 1980) protocol was used, validated for male athletes aged between 11 and 27 (HEYWARD; STOLARCZYK, 2000). Evaluation was followed by FIET test to determine the intensity of IT. From the second to the seventh occasion, each group performed $IT_{7.5x7.5}$ or IT_{15x15} at specific intensities with one-week between IT sessions.

FIET and peak speed

The FIET is an intermittent shuttle run test consisting of bouts of 45 meters (i.e., 3 x 15 meters) with speed increments performed until exhaustion. Throughout the test, the speed of the repetitions (45 m) was dictated by prerecorded audio cues. After each 45m repetition, participants were allowed to actively rest for 10 seconds, and after each 8 x 45 m, participants passively rested for 30 seconds before resuming the test. The FIET started set at 9 $km \cdot h^{-1}$, and speed increments of 0.33 $km.h^{-1}$ during the first nine bouts (9 x 45m). Then there was a change in the speed increment pattern, shifting to 0.20 $km \cdot h^{-1}$ every 45 m until exhaustion. The test ended each time the participant did not reach start line in time with beeps for 2 consecutive times. Peak speed (PS_{FIET}) was defined as the velocity at the end of the test. The test was performed in groups of 6 to 8 players.

Interval Training Protocols ($IT_{7.5x7.5}$ and IT_{15x15}) The $IT_{7.5x7.5}$ model consists of a run with a 180º change of direction, two accelerations, and one deceleration, with four 4-minute sets and a 3-minute break between sets, with work-to-rest: 1:1 (Figure I). The IT_{15x15} model consists of three changes of direction, four accelerations, and three decelerations, with four 4-minute sets and a 3-minutes break between sets, with work-to-rest: 1:1 (Figure II)

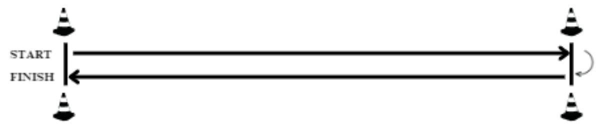

Figure I. Schematic representation of the $IT_{7.5x7.5}$ model.

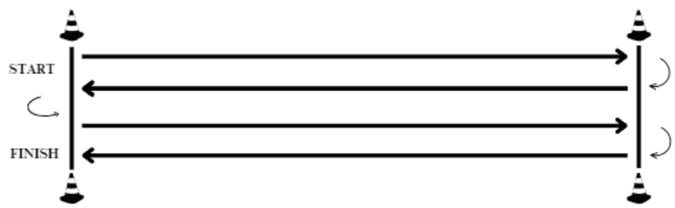

Figure II. Schematic representation of the IT_{15x15} model.

Time Limit (TL_1, TL_2, $TL_{PS100\%FIET}$)

All the initial procedures at the TL_1, TL_2, $TL_{PS100\%FIET}$ were similar. The protocols were performed on the field, using cones to mark the distances, and the speed was dictated by a prerecorded audio cue for each player. Warm-up was similar for all three different times to exhaustion. First, the players performed a 5-minute warm-up, with change of direction and stretching exercises. Next, a specific 3-minute warm-up was carried out using the shuttle run model, which was previously defined and was performed with 2 meters less than the original test. At last, 3 minutes after the specific warm-up, 3 repetitions were performed at 100% of PS_{FIET} to acclimatation to the protocol. After the warm-up, two-minute recovery intervals were standardized and then the tests began. To determine the TL, players performed the $IT_{7.5x7.5}$ and IT_{15x15} protocols until exhaustion. TL_1 was performed by 26 players (females = 12; males = 14) and was determined as the time of the first audio signal until exhaustion. TL_2 was carried out by 12 females' players and was defined as total number of bouts performed until exhaustion. The TL_1 and TL_2 intensities for the $IT_{7.5x7.5}$ and IT_{15x15} models were based on the PS_{FIET} and were 86 to 91% of PS_{FIET} for the $IT_{7.5x7.5}$ and 83 to 88% of PS_{FIET} for the IT_{15x15}. $TL_{100\%PVFIET}$ was performed at 100% PS_{FIET} for 24 players (females = 9; males = 15) and was determined as the time of first audio signal until exhaustion.

Physiological and perceived variables

The heart rate was monitored during the FIET test, TL and TRIEF protocols by a HR monitor (model S610, RCX5; Polar Electro Oy, Kempele, Finland) and SportGPS (Australia). Psychophysiological responses were assessed through Borg CR-10 proposed (Foster et al., 1996.). Borg CR-10 scale was measured at least 30 minutes after TI to calculate the Session-RPE. All subjects were asked individually: "How was your training session?".

Statistical Analysis

Data normality was analyzed by Shapiro-Wilk tests. An independent t-test was applied to compare age, body mass, height, body fat (%), peak speed and HRmax in the FIET test between females and males' soccer players. Afterwards, to compare TL_1, TL_2 $TL_{100\%PS}$ and HR_{max}, HR_{mean}, $HR_{mean}TL_1(\%HR_{max})$ of the maximal percentual of the TL_1 and TL_2, it was used a dependent t-test. The effect size was calculated to verify the magnitude of differences and was classified as follows, trivial (< 0,2), small (≥ 0,2 - 0,6), moderate (≥ 0,6 - 1,2), large (≥ 1,2 - 2,0) and very large (≥ 2,0) (Batterham & Hopkins, 2006). All analyses were performed on SPSS 25.0 (IBM SPSS Statistics, IBM Corp., version 25.0). Results are expressed as mean ± standard deviation (SD).

Results

The mean age found for the TL_1 group for M1 (n = 14) was 18.4 ± 0.9, while for the F1 group (n = 15) it was 20.1 ± 3.1, so no statistical differences were found between the ages of the subjects ($p > 0.05$). In addition, the average body mass of the M1 group was 71.1 ± 6.6, while for the F1 group, the values was 59.6 ± 6.5, with statistically significant differences ($p < 0.001$). As far as the subjects' height is concerned, no differences were found between the two groups, but the average for the M1 group was 175.9 ± 5.3 and for the F1 group 163.6 ± 6.0 ($p > 0.05$). In addition, there were found statistical differences in body composition, the percentage of fat differed between the male and female groups, percentage of fat for the M1 group was 11.5 ± 1.1, while the F1 group was 14.3 ± 2.2 ($p = 0.001$). The peak speed found in the test was another variable that differed between the subjects, in which the M1 group obtained average values of 16.2 ± 0.6 and the F1 group 15 ± 1.0 ($p < 0.001$). Furthermore, another internal load variable, $HR_{maxFIET}$, did not differ between groups, M1 = 196 ± 8 and F1 = 196 ± 6 ($p < 0.001$).

Table I shows the TL_1 and physiological variables for $IT_{7.5x7.5}$ and IT_{15x15} for the M1 team. Time limit was lower in the IT_{15x15}, compared to the $IT_{7.5x7.5}$ ($p = 0.018$). There were no significant differences between the average heart rate, maximum heart rate, and heart rate mean in $HR_{mean}TL_1$ (%HR_{max}) ($p > 0.05$).

Table I. Descriptive results that were found in M1 team (n = 14) that performed the TL_1 in the models ($IT_{7.5x7.5}$ and IT_{15x15}) respectively:

Variables		Values	Values	
		Mean ± SD	Minimum	Maximum
TL_1 (min)	$IT_{7,5x7,5}$	14,5 ± 3,0	9,3	18,0
	IT_{15x15}	13,7 ± 2,6*	10,2	16,8
$HRC_{max}TL_1$ (bpm)	$IT_{7,5x7,5}$	196 ± 8	185	215
	IT_{15x15}	196 ± 9	183	217
$HR_{mean}TL_1$ (bpm)	$IT_{7,5x7,5}$	186 ± 10	172	211
	IT_{15x15}	186 ± 10	170	211
$HR_{mean}TL_1$ (%HRmax)	$IT_{7,5x7,5}$	94,6 ± 1,6	92,4	97,4
	IT_{15x15}	94,6 ± 1,8	91,9	97,2

* Significant difference ($p = 0.018$).

Time limit and physiological variables for the F1 team during the $IT_{7.5x7.5}$ and IT_{15x15} are presented in the table II. For the TL_1, there was only a significant difference for the IT_{15x15} ($p < 0.019$). Nevertheless, there were found no significant differences between HRmax, HRmean, and heart rate mean in $HR_{mean}TL_1$ (%HRmax) for $IT_{7.5x7.5}$ and IT_{15x15} ($p > 0.05$) during o TL_1.

Table II. Descriptive results in mean, standard deviation, minimum, and maximum values for the F1 team (n = 08) which performed the TL_1 in the models ($IT_{7.5x7.5}$ and IT_{15x15}) respectively:

Variables		Values	Values	
		Mean ± SD	Minimum	Maximum
TL_1 (min)	$IT_{7,5x7,5}$	15,2 ± 3,0	10,0	17,9
	IT_{15x15}	14,6 ± 2,8*	10,3	17,3
$HR_{max}TL_1$ (bpm)	$IT_{7,5x7,5}$	195 ± 7	186	208
	IT_{15x15}	195 ± 6	186	204
$HR_{mean}TL_1$ (bpm)	$IT_{7,5x7,5}$	185 ± 6	176	193
	IT_{15x15}	186 ± 5	178	193
$HR_{mean}TL_1$(%maxFIET)	$IT_{7,5x7,5}$	94,7 ± 1,6	93,0	98,0
	IT_{15x15}	94,8 ± 1,3	92,7	97,0

* Significant difference ($p < 0.019$).

Descriptive data relating to the characteristics of the sample for the group that performed the $TL_{PS100\%FIET}$, were for the M2 group (n=20): age: 17.5 ± 1.2, body mass: 71.6 ± 7.6, height: 175.4 ± 4.3, fat percentage: 10.5 ± 0.9, peak speed: 16.9 ± 0.7 and $HR_{maxFIET}$: 198±6. Finally, for the F1 group, the descriptive data was: age 20.0* ± 2.2, body mass 59.8 ± 5.7*, height: 164.8 ± 7.0, fat percentage: 14.1 ± 1.9*, peak speed: 15.4* ± 0.9, $HR_{MAXFIET}$: 195 ± 6*. There was demonstrated a significant difference between M2 and F1 groups at the age, where women were older ($p \leq 0.001$). The body mass and fat percentage of the women were higher than the men ($p \leq 0.001$). $HR_{MAXFIET}$ was lower for the F1 group when compared to the M2 group ($p \leq 0.001$).
Table III shows the time limit at 100%PSFIET for the M2 and F1 teams during the $IT_{7.5x7.5}$ and IT_{15x15}. It was shown that the time limit was shorter for IT_{15x15} ($p = 0.014$).

Table III. Descriptive results of the TL100%$_{PSFIET}$ for the M2 under-20 men's team (n = 9) and an F1 under-20 team (n = 8) who performed the tests in both training models ($IT_{7.5x7.5}$ and IT_{15x15}).

Variables			Values	Values	
			Mean ± SD	Minimum	Maximum
$TL_{100\%PSFIET}$ (min)	n=17	$IT_{7,5x7,5}$	2,91 ± 0,96 15	1,00	4,42
	n=17	IT_{15x15}	2,29 ± 0,57*	1,25	3,75

* Significant difference (p = 0.014).

Following the results presented in the descriptive data, for the group that performed the TL_2, the following values were found respectively: age: 18.3 ± 1.9, body mass: 58.9 ± 6.6, height: 163 ± 4.4, fat percentage 15.6 ± 2.3, BW: 15.7 ± 1.0 and $HR_{maxFIET}$: 195 ± 9.

Table IX shows the descriptive data of TL_2, perceived, and physiological variables for the F2 team at the $IT_{7.5x7.5}$ and IT_{15x15} models. Significant differences were found in the IT model only in the HR_{max} responses for the group that performed the IT in the IT_{15x15} model (p = 0.002). On the other hand, there were no found significant differences TL_2, RPE, HR_{mean} and heart rate mean in $HR_{mean}TL_1$ (%HR_{max}).

Tabela IX Descriptive results of the variables (TL_2, RPE, HR_{maxTL2}, $HR_{meanTL2}$, $HR_{mean}TL_1$ (%HR_{max})) determined in the female F2 under-20/adult team (n = 12) that performed the TL_2 in the models ($IT_{7.5x7.5}$ and IT_{15x15}) respectively:

Variables	Models	Median	Mod	Minimum	Maximum
TL_2	$IT_{7,5x7,5}$	8,5	8,0	5,0	10,0
	IT_{15x15}	9,0	9,0	5,0	10,0
RPE (u.a.)	IT $I_{7,5x7,5}$	6,4	5,5	4,2	8,6
	IT_{15x15}	6,7	6,4	5,1	7,9
Variables	Models	Median		Mod	Minimum
$HR_{max}TL_2$ (bpm)	$IT_{7,5x7,5}$	191 ± 8		177	201
	IT_{15x15}	193 ± 8*		177	205
$HR_{mean}TL_2$ (bpm)	$IT_{7,5x7,5}$	189 ± 7		176	200
	IT_{15x15}	189 ± 7		176	199
$HR_{mean}TL_1$ (%HR_{max})	$IT_{7,5x7,5}$	96,9 ± 2,2		91,9	99,0
	IT_{15x15}	97,1 ± 1,7		94,3	98,9

* Significant difference (p = 0.002)

Discussion

This study aimed to compare the physiological responses and TL in two interval training models based on FIET at different intensities, one with one change of direction ($TI_{7.5X7.5}$ = 86-91% of PS_{FIET}) and the other with three changes in direction (TI_{15X15} = 83-88% of PS_{FIET}) in male and female futsal players. The main findings of the present investigation show that interval training with three changes of direction has a shorter time limit when compared to training with only one change of direction. The findings of this study support one of our hypotheses. In this sense, it was shown that some differences were found between the male and female sex, It is important to highlight the following results: a longer time limit for the male participants when compared to the female and a higher percentage of body fat for the female group. Finally, heart rate did not differ between the two interval training models.

The primary outcome of this study revealed that the interval training procedure of 7.5 seconds of exercise, followed by 7.5 seconds of rest, performed at an intensity of 86-91% of the PS_{FIET}, led to significantly longer time to exhaustion in both groups (M1, F1), when compared to the 15-second exercise to 15-second rest model, performed at 83-88% of PS_{FIET}. These findings provide support for the hypothesis that the time limit in the IT model utilizing one change of direction ($IT_{7.5s\ x7.5s}$), results in a significantly longer time to exhaustion compared to the procedure involving three changes of direction ($IT_{15sx15s}$), even when applying a higher percentage of the PS_{FIET}.

(Teixeira et al., 2019) aimed to analyze the effects of two training models based on $IT_{7.5x7.5}$ and IT_{15x15} on the performance of female futsal players using the PS_{FIET}, over a period of five weeks, the present study revealed that both training models resulted in improved performance of the athletes, however, the group that trained in the IT_{15X15} model obtained improvements in specific coordination skills and agility.

The disparity in time to exhaustion between models appears to be explained due to the greater number of changes of direction, resulting in more eccentric muscle contractions. (DELLAL & GROSGEORGE, 2006)have reported that changes in direction can influence the muscles involved and the type of muscle contraction. (A. R. Akenhead et al., 2015) demonstrated that the number of changes of direction made by an athlete increases the acceleration time, and it was also observed that the perception of effort, HR_{peak}, was a variable that increased with the number of changes of direction. Furthermore, (Allen, 2001) and (Byrne & Feston, 2002)have indicated that the eccentric component present in successive changes of direction reduces force production, leading to early fatigue and subsequently decreased performance. In this way, the $IT_{7.5sx7.5s}$ protocol was executed with four changes of direction of 180° every minute, whereas the $IT_{15sx15s}$ protocol involved six changes at the same amount of time. Consequently, the conclusion of the $IT_{15sx15s}$ model, an average of 21 (M1) and 25 (F1) more changes of direction were made when compared to the $IT_{7.5sx7.5s}$ model, which could explain the higher time to exhaustion found in the $IT_{15sx15s}$ model.

Regarding the heart rate results, no significant difference was found between the models in relation to HR responses to the Time to Exhaustion1, such as HR_{max}, mean heart rate, and mean $\%HR_{max}$. Our findings are in line with the study by (Teixeira et al., 2019), in which no statistically significant difference was found in HRmax in training sessions for futsal athletes in the $IT_{7.5x7.5}$ and IT_{15x15} models. In another study which included training sessions based on the PS_{FIET} percentage, two groups were assessed, one at 86% of PS_{FIET} and the other at 100% of PS_{FIET}, in this study, (Campos et al., 2021), found an improvement in heart rate variability, however, no differences were found between the sessions at 86% of PS_{FIET} and 100% of PS_{FIET}.

In this context, the findings in the present study concerning the heart rate response to different numbers of changes in direction, during intermittent efforts of short duration, specifically equal to or less than 15s and individualized by PS_{FIET}, did not result in significant changes in heart rate responses during time limit. Finally, our study had limitations that must be acknowledged.

Conclusion

In conclusion, the findings of this study indicate that although the training models have similar characteristics, differing only in the amount of change of direction and intensity. It was observed that the TL was higher for the TL_{15x15}, model when compared $TL_{7.5x7.5}$ to this difference found between the models seems to be related to a greater number of eccentric muscle actions due to the constant changes of direction and the number of accelerations and decelerations that are imposed on the athletes. To improve the performance of futsal players, physical trainers, coaches and other members of the technical staff should take into account the components they want to modulate when preparing training sessions. In this sense, training based on one or three changes of direction can be a viable alternative. Our results show that depending on the model used, the TL can alternate, which may be related to greater muscle demand due to the number of changes of direction. In addition, the IT_{15X15} model brings a greater number of acceleration and deceleration changes and movements close to those that occur during a futsal match. Therefore, when prescribing exercise, the objectives of the training session should be taken into account. Furthermore, we conclude that the PS_{FIET} is an important variable both for assessing futsal players and for prescribing the IT of teams using it, which helps coaches and other members of the technical committee in the decision-making process and physical preparation of players.

Conflicts of interest - The authors declare no conflict of interest.

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