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Load Variability According to Specificity of Exercises. Analysis in Youth Futsal

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A young sprinter prepares herself with a track series to work on her explosiveness. @Jérome Aufort/Adobestock

Abstract

In order to determine whether the specificity of the technical-tactical tasks in training sessions affects the external load (EL) experienced by players, data were recorded for 11 players aged 15-16 years (15.55 ± 0.52) from a male futsal team during 10 training sessions using Polar Team Pro® accelerometers, analysing low-intensity accelerations (A) and decelerations (D) (m/s^2): A-1 [0.50 to 0.99], A-2 [1.00 to 1.99], D-1 [–0.50 to –0.99], D-2 [–1.00 to –1.99]; as well as high intensity ones (m/s^2): A-3 [2.00 to 2.99], A-4 [3.00 to 50.00], D-3 [–2.00 to –2.99] and D-4 [–3.00 to –50.00]. Possible relationships between the EL and approximation level III (special orientation) exercises were obtained in D-3 (r = .85; p = .03), D-4 (r = .98; p = <.01), A-3 (r = 1.00; p = <.01), TOTAL A-D 3 (r = .96; p = <.01) and TOTAL A-D 3-4 (r = .97; p = <.01). Linear regression analysis demonstrated possible causalities between EL and Level III exercises at D-3 (R^2 = .73), D-4 (R^2 = .97), A-3 (R^2 = .99), TOTAL A-D 3 (R^2 = .93) and TOTAL A-D 3-4 (R^2 = .95). The results suggested that, in this specific context, Level III exercises lead to an increase in high-intensity EL. Monitoring these aspects can be useful in programming the load according to competitive demands and squad characteristics.

Keywords: accelerometry, intensity, physical demands, RPE, volume.

Introduction

External load (EL) and internal load (IL) have been presented as parameters that allow the independent assessment of competitive demands and the effect of training on athletes (Barbero-Álvarez et al., 2008; Foster et al., 2017). It is possible to assess the physical and neuromuscular demands of exercises through the EL, while the IL reflects the player's biological response to the EL (Halson, 2014). Accelerations and decelerations, assessed using accelerometry, have been identified as parameters for the measurement of EL, as they allow its quantification and control (Caparrós et al., 2018), and from them it is possible to adjust the loads of each training session through objective data (Foster et al., 2017), thus facilitating the reduction of the possible risk of injury (Caparrós et al., 2018). In order to facilitate the programming of the load based on the objectives set, these parameters can be divided into high intensity or qualitative accelerations and decelerations ($\geq \pm 2$ m/s^2), and low intensity or quantitative accelerations and decelerations ($< \pm 2$ m/s^2) (Sánchez-Ballesta et al., 2019). On the other hand, the perceived exertion index, also known as range of perceived exertion (RPE), has been established as a useful tool for the subjective monitoring of IL in futsal (Freitas et al., 2012; Haddad et al., 2017), facilitating understanding of the response of each player in relation to the applied load (Moreira et al., 2013).

Task specificity is a fundamental principle of training (Reilly et al., 2009) that allows for the control of the athlete's adaptive responses to competition and promotes the attainment of good sporting results (Moras, 2000; Vilar et al., 2014). In order to adapt the task to the skills to be worked on, it is possible to condition the game by varying the space, the rules and/or the technical-tactical aspects (López, 2017). The exercises present in a training session can be differentiated according to their similarity to competition (Moras, 2000). In this sense, there are generic orientation exercises (Level 0 and I), which do not involve cognitive demands; directed orientation exercises (Level II), which are based on movement exercises with dynamic correspondence to the sporting movement carried out using low external resistance; special orientation exercises performed with one's own body weight (Level III and IV), where Level III exercises offer reduced but decontextualised exercises of the sport itself, and Level IV exercises are simplified situations from the real game; and, finally, competitive orientation exercises (Level V), which are exercises in which the different components of performance, such as technical, tactical, physical and psychological aspects, are combined (Moras, 2000; Vizuete, 2017).

In view of these factors, it is vitally important that coaching staff adjust the planning and design of training sessions to promote the necessary adaptations so that players can successfully cope with the demands encountered during competition (Casamichana et al., 2018). In order to achieve maximum control of these adaptations, it is necessary to understand how the EL and IL of a training session of a team interact, according to the exercises performed in that session. For this reason, the aim of the present study was based on observing the possible existence of relationships between exercise approximation levels and training load. Based on the stated objective, the main hypothesis of the research has supported the idea that a higher load will be obtained in exercises with a greater similarity to that of a competition.

Methodology

Participants

The present observational and longitudinal analytical study consisted of a sample of 11 players (age: 15.55 ± 0.52) from a boys' futsal team in the first division of the Catalan Football Federation's cadet category during the competitive period of the 2019-2020 season.

All research procedures followed the standards of the Declaration of Helsinki, as revised in Fortaleza (World Medical Association, 2013). The data were collected during the daily activity of the team, and the athletes, tutors and managers were informed that they were being used for sporting purposes and also in a scientific context. Due to the young age of the sample, the legal guardians of the players signed the corresponding informed consent form. Players were assigned an individual identification code in order to conceal their identity, thereby guaranteeing the protection of personal data in accordance with the Organic Law on Data Protection 15/1999 and the General Data Protection Regulation (GDPR) of the European Parliament (14/04/2016).

Materials and Resources

EL was measured through player accelerations and decelerations using Polar Team Pro® devices, which have an integrated MEMS (accelerometer, gyroscope and digital compass) motion sensor and 10 Hz GPS, and which have proven to be valid and reliable at measuring EL in team sports (Fox et al., 2019). Each player was assigned the same sensor (Polar Team Pro Sensor®) throughout the data collection period, with the sensor positioned on the chest using the brand's own elastic bands (Sánchez-Ballesta et al., 2019). The collected data was sent via bluetooth to a mobile device (iPad) and stored in the brand's own app for further analysis using the Polar Team Pro® software (https://teampro.polar.com; Kempele, Finland). Four levels of accelerations were recorded with these sensors (A-1 encompassed accelerations from 0.50 m/^{2} o 0.99 m/s^2; A-2 from 1 m/s^2 to 1.99 m/s^2; A-3 those from 2 m/s^2 to 2.99 m/s^2, and A-4 those from 3 m/s^2 to 50 m/s^2) and four decelerations (D-1 included those from –0.50 m/s^2 to –0.99 m/s^2; D-2 those from –1 m/s^2 to –1.99 m/s^2; D-3 those from –2 m/s^2 to –2.99m/s^2, and D-4 those from –3m/s^2 to –50m/s^2). This EL was categorised according to intensity, with level one and two (1-2) as low intensity, and level three and four (3-4) as high intensity. From these levels, the values were grouped as follows: total accelerations (Total A, sum of A-1, A-2, A-3 and A-4); total decelerations (Total D, sum of D-1, D-2, D-3 and D-4); total accelerations and decelerations (Total A-D, sum of Total A and Total D); total accelerations and decelerations level three (Total A-D 3, sum of A-3 and D-3); total accelerations and decelerations level three and four (Total A-D 3-4, sum of A-3, A-4, D-3 and D-4), and total accelerations and decelerations level one and two (Total A-D 1-2, sum of A-1, A-2, D-1 and D-2) (Sánchez-Ballesta et al. , 2019).

IL was measured using the RPE subjective rating system, which has demonstrated high validity and reliability in relation to perceived exertion (Haddad et al., 2017). The results were recorded on a record sheet and players scored according to the RPE following Borg's CR-10 scale of 0-10, where zero (0) was considered "none at all" and ten (10), "extremely high" (Borg, 1990).

Based on the adaptation of the classification of approximation levels provided by Moras (2000) and Vizuete (2017), the specificity of the exercises was determined starting from Level III, Level IV and Level V. The space used varied according to the exercise, and was performed on a 40 x 20 m (1/1), 30 x 20 m (2/3) or 20 x 20 m (1/2) track.

Procedure

Data recording was carried out over 7 consecutive weeks, during the competitive period (October-December). Within this recording period, during which the players had a training schedule of 3 hours per week, 10 training sessions were analysed, resulting in a total of 550 minutes recorded and an average time per exercise of 12 minutes. All sessions started and ended with standardised off-court actions, which have been excluded from the analysis.

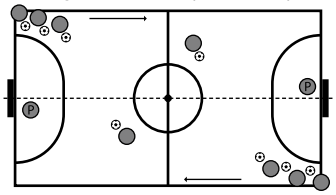
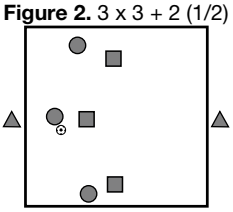
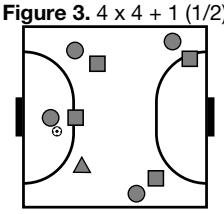
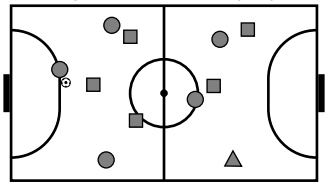
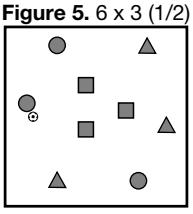
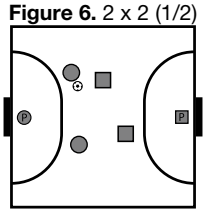
The recording of the EL started at the beginning of the on-track training and ended at the end of the training, enabling the recording of all tasks. IL, which was recorded with the RPE system, was observed 20 minutes before the start of training (Pre-RPE) and 10 minutes after the end of training (Post-RPE) (Bickelhaupt et al., 2018). In order to familiarise the players with the RPE system, they were instructed by professionals used to working with this recording system, who explained each section of the system in detail and provided support in the event that a player requested it, during four training sessions (Borg, 1990).

During the training session exercises, the groupings of partners and opponents were randomly varied. These exercises have been organised according to the adaptation of the classifications of Moras (2000) and Vizuete (2017) according to the following levels: Level III (special orientation) exercises accounted for a total of six (1 x 0 1/1, 1 x 0 2/3, 3 x 3 + 2 1/2, 4 x 4 + 1 1/2, 5 x 5 + 1 1/1 and 6 x 3 1/2); four Level IV (special orientation) 2 x 2 1/2, 2 x 2 + 2 1/2, 3 x 3 2/3 and 3 x 3 + 1 1/2); and five Level V (competitive orientation) ((3 x 2 1/1, 4 x 4 1/1, 4 x 4 - E 1/1, 4 x 4 2/3 and 5 x 4 1/2) (Table 1).

Statistical Analysis

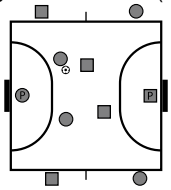
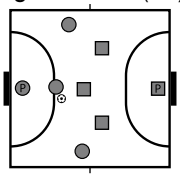
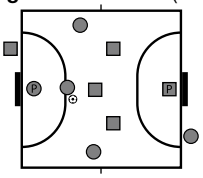
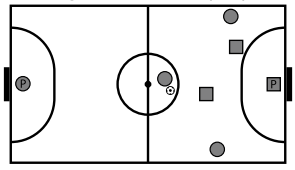
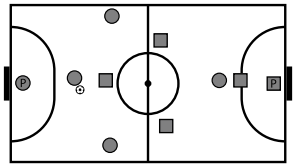
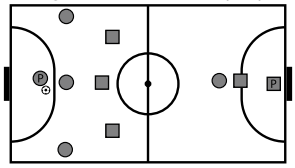
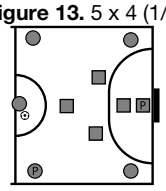
A descriptive analysis of general central tendency was performed. Subsequently, the normality of the variables studied was determined using the Shapiro-Wilk test, which revealed normal and non-normal distributions. The independence of the average values per session was analysed using the Kruskal-Wallis test for the set of variables relating to training sessions and exercises grouped according to their specificity. Independence between sessions was assessed with the Friedman test. Possible relationships among the mean values per minute per session or per exercise were determined with Pearson's r for normal data and Spearman's rho for non-normal data. Finally, multiple linear regression was used to determine the possible causality of the average values per minute per session or per exercise. The significance level in all cases was $p < .05$. Descriptive values are expressed as mean ± standard deviation. All statistical analyses were performed using JASP software (JASP Team, Amsterdam, 2019, version 0.11.1).

Table 1
Characteristics of exercises carried out during the study.

Exercise (Space)	Specificity	Description	Graphic representation
1 x 0 (1/1 or 2/3)	Level III (Directed orientation)	Drills for driving and striking the ball at goal.	**Figure 1.** 1 x 0 (1/1 or 2/3) 
3 x 3 + 2 (1/2)	Level III (Directed orientation)	Ball retention with outside support.	**Figure 2.** 3 x 3 + 2 (1/2) 
4 x 4 + 1 (1/2)	Level III (Directed orientation)	Offensive and defensive actions without goalkeepers. Scoring only permitted inside the penalty area.	**Figure 3.** 4 x 4 + 1 (1/2) 
5 x 5 + 1 (1/1)	Level III (Directed orientation)	Offensive and defensive actions without goalkeepers. Scoring only permitted inside the penalty area.	**Figure 4.** 5 x 5 + 1 (1/1) 
6 x 3 (1/2)	Level III (Directed orientation)	Retention. 2 offensive and 1 defensive team. Change of role after the ball is stolen.	**Figure 5.** 6 x 3 (1/2) 
2 x 2 (1/2)	Level IV (Directed orientation)	Simulated 2 x 2 game situation on 20 x 20 m.	**Figure 6.** 2 x 2 (1/2) 

Caption: 1/1 = 40 x 20 m; 2/3 = 30 x 20 m; 1/2 = 20 x 20 m; ● = Team 1; Ⓟ = Team 1 Goalkeeper; ■ = Team 2; Ⓟ = Team 2 Goalkeeper; ▲ = Joker (support player for both teams in the offensive phase)

Table 1 (Continued)
Characteristics of exercises carried out during the study.

Exercise (Space)	Specificity	Description	Graphic representation
2 x 2 + 2 (1/2)	Level IV (Directed orientation)	Simulated 2 x 2 situation with wing backs in the offensive zone.	**Figure 7.** 2 x 2 + 2 (1/2) 
3 x 3 (1/2)	Level IV (Directed orientation)	Simulated 3 x 3 situation.	**Figure 8.** 3 x 3 (1/2) 
3 x 3 + 1 (1/2)	Level IV (Directed orientation)	Simulated 3 x 3 situation with offensive support on the baseline.	**Figure 9.** 3 x 3 + 1 (1/2) 
3 x 2 (1/1)	Level V (Competitive orientation)	3 x 2 drills with a psychological component due to limited time for completion.	**Figure 10.** 3 x 2 (1/1) 
4 x 4 (1/1 or 2/3)	Level V (Competitive orientation)	Real-life game situation.	**Figure 11.** 4 x 4 (1/1 or 2/3) 
4 x 4 -E (1/1)	Level V (Competitive orientation)	Real life game situation with each action starting from a goal kick.	**Figure 12.** 4 x 4 - E (1/1) 
5 x 4 (1/2)	Level V (Competitive orientation)	Real-life "goalkeeper-player" game situation with time limitation.	**Figure 13.** 5 x 4 (1/2) 

Caption: 1/1 = 40 x 20 m; 2/3 = 30 x 20 m; 1/2 = 20 x 20 m; ● = Team 1; Ⓟ = Team 1 Goalkeeper; ■ = Team 2; Ⓟ = Team 2 Goalkeeper; ▲ = Joker (support player for both teams in the offensive phase)

Results

A total of 382 observations were obtained during the 10 recorded sessions. The EL, expressed as the average of the total accelerations and decelerations performed per player, was 1,004.52 ± 200 m/s²; and the IL, expressed as the average RPE exhibited by each player at the end of the training, was 7.58 ± 0.37. In terms of the specificity of the exercises, six Level III exercises were performed, resulting in 135 observations; four Level IV exercises were performed, resulting in 81 observations; and five Level V exercises were performed, resulting in a total of 166 observations. In the descriptive analysis of EL, the highest value per player of Total A-D was for the 6 x 3 1/2 (26.86 ± 1.15 m/s²) and the lowest for the 5 x 4 1/2 (16.44 ± 1.81 m/s²). For Total A-D 3-4, the highest value was shown for6 x 3 1/2 (3.85 ± 0.30 m/s²) and the lowest for 1 x 0 1/1 (0.61 ± 0.13 m/s²) (Figure 14). Finally, the highest value in Total A-D 1-2 was for 6 x 3 1/2 (23.02 ± 0.86 m/s²) and the lowest for 4 x 4 + 1 1/2 (14.57 ± 1.43 m/s²) (Table 2).

The independence of the variables was observed for the approximation levels (H = 36.32; $p < .01$); as well as for the EL of each player in D-2 (H = 19; $p = .40$), D-3 (H = 48.63; $p < .01$), D-4 (H = 62.51; $p < .01$), A-1 (H = 29.83; $p < .01$), A-2 (H = 29.77; $p < .01$), A-3 (H = 66.75; $p < .01$), A-4 (H = 23.32; $p = .01$), Total A-D 3 (H = 62.08; $p < .01$) and Total A-D 3-4 (H = 62.56; $p < .01$), and for each player's IL in Pre-RPE (H = 23.79; $p = .01$) and Post-RPE (H = 41.93; $p < .01$). Similarly, EL and IL behaved independently in each specific training session (F = 159.15; $p < .01$; $\eta^2 = .96$ $\varpi^2 = .94$).

Regarding the possible relationships between EL and approximation levels, relationships were observed for Level III in D-3 ($r = .85$; $p = .03$), D-4 ($r = .98$; $p < .01$), A-3 ($r = 1$; $p < .01$), Total A-D 3 ($r = .96$; $p < .01$) and Total A-D 3-4 ($r = .97$; $p < .01$); for Level IV at D-1 ($r = –.96$; $p = .04$); and for Level V at A-3 (*rho* = –1; $p = .02$) (Table 3).

Figure 14
Total accelerations and decelerations (Total A-D) and totals 3 and 4 (Total A-D 3-4) per minute of the exercises.

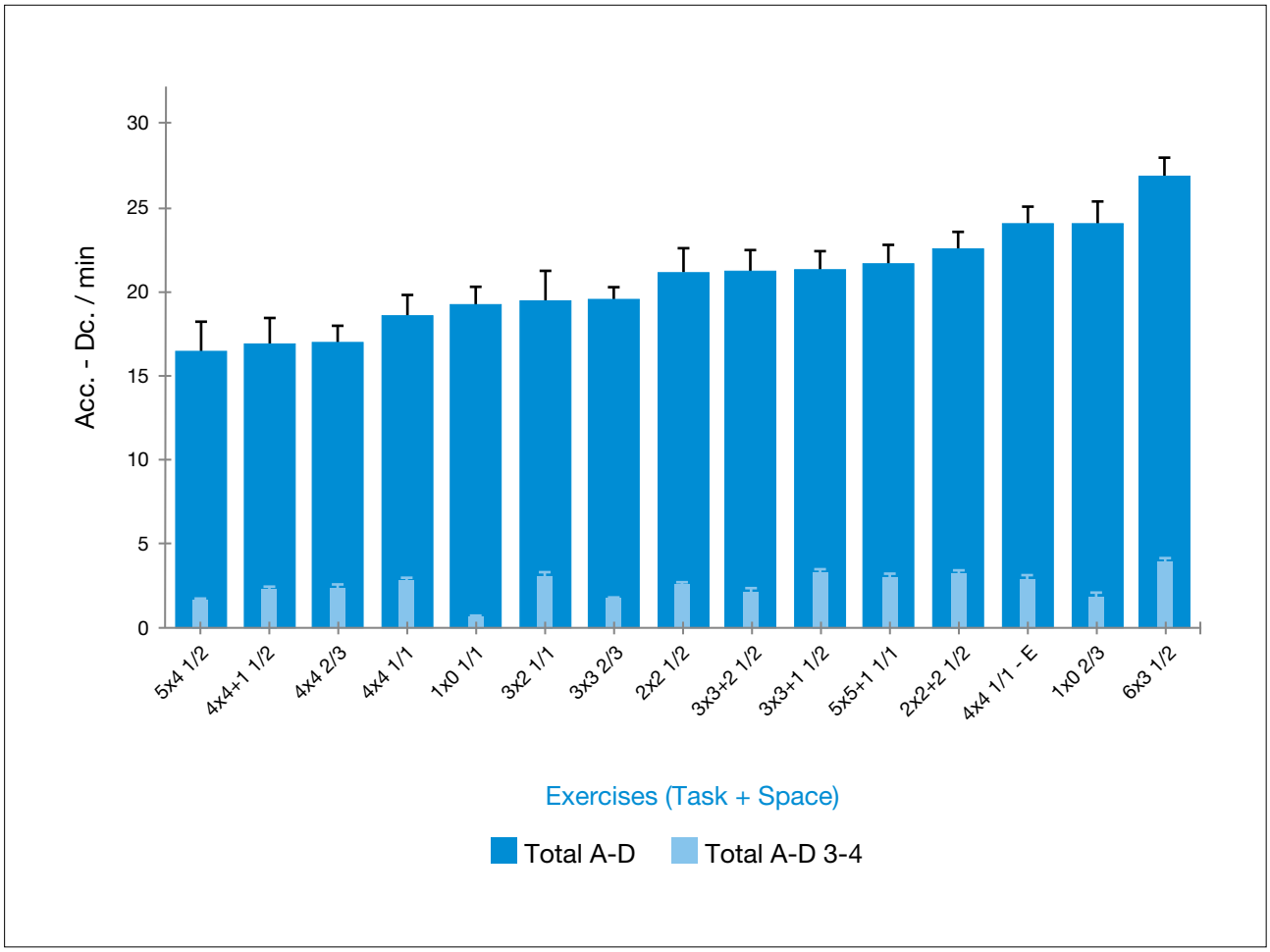


Table 2
*Total accelerations and decelerations (mean and SD) per player recorded in the training sessions, according to the level of approximation (adapted from Moras (2000) and Vizuete (2017)), intensity and exercise of the 11 training-age fustal players participating in the study (*n = 382*).*

Approximation levels	No. of observations	D-1	D-2	D-3	D-4	A-1	A-2
	n	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)
Level III (Specific orientation)							
1 x 0 1/1	17	4.65 ± 0.24	4.71 ± 0.08	0.40 ± 0.10	0 ± 0	5.25 ± 0.42	4.03 ± 0.24
1 x 0 2/3	21	5.41 ± 0.12	5.65 ± 0.29	1.21 ± 0.25	0.03 ± 0.01	5.70 ± 0.24	5.54 ± 0.37
3 x 3+2 1/2	21	4.57 ± 0.18	5.18 ± 0.28	1.10 ± 0.19	0.13 ± 0.03	4.63 ± 0.21	4.77 ± 0.29
4 x 4 + 1 1/2	32	3.43 ± 0.36	3.86 ± 0.29	0.99 ± 0.10	0.25 ± 0.02	3.94 ± 0.39	3.33 ± 0.39
5 x 5 + 1 1/1	33	4.41 ± 0.24	4.77 ± 0.19	1.37 ± 0.17	0.26 ± 0.04	5.07 ± 0.20	4.44 ± 0.22
6 x 3 1/2	11	5.41 ± 0.15	6.14 ± 0.26	1.79 ± 0.12	0.38 ± 0.04	5.20 ± 0.17	6.27 ± 0.27
Level IV (Specific orientation)							
2 x 2 1/2	19	4.84 ± 0.33	4.65 ± 0.25	1.19 ± 0.13	0.18 ± 0.02	5.12 ± 0.33	4.01 ± 0.36
2 x 2 + 2 1/2	10	4.61 ± 0.27	5.10 ± 0.29	1.42 ± 0.10	0.31 ± 0.04	4.65 ± 0.24	4.90 ± 0.24
3 x 3 2/3	21	4.33 ± 0.10	4.42 ± 0.10	0.84 ± 0.09	0.17 ± 0.01	4.84 ± 0.27	4.29 ± 0.17
3 x 3 + 1 1/2	31	4.30 ± 0.31	4.47 ± 0.17	1.41 ± 0.13	0.38 ± 0.04	4.86 ± 0.21	4.38 ± 0.24
Level V (Competitive orientation)							
3 x 2 1/1	11	4.29 ± 0.39	4.06 ± 0.40	1.43 ± 0.14	0.20 ± 0.01	4.44 ± 0.35	3.61 ± 0.42
4 x 4 1/1	82	4.00 ± 0.27	4.00 ± 0.29	1.18 ± 0.10	0.27 ± 0.03	4.13 ± 0.23	3.65 ± 0.29
4 x 4 - E 1/1	41	4.90 ± 0.16	5.28 ± 0.20	1.50 ± 0.18	0.18 ± 0.03	5.92 ± 0.18	5.06 ± 0.27
4 x 4 2/3	21	3.70 ± 0.19	3.64 ± 0.19	0.99 ± 0.14	0.20 ± 0.01	4.41 ± 0.23	2.93 ± 0.15
5 x 4 1/2	11	3.16 ± 0.35	4.02 ± 0.35	0.87 ± 0.11	0.10 ± 0.01	4.16 ± 0.34	3.49 ± 0.63

Acceleration and deceleration data expressed in m/s². Legend: SD=Standard deviation; D-1=decelerations 1 (–-0.50 - –0.99 m/s²); D-2=decelerations 2 (–1 - –1.99 m/s²); D-3=decelerations 3 (–2 - –2.99 m/s²); D-4=decelerations 4 4 (–3 - –50 m/s²); A-1=accelerations 1 (0.50 - 0.99 m/s²); A-2 accelerations 2 (1 - 1.99 m/s²).

Table 2 (Continued)
*Total accelerations and decelerations (mean and SD) per player recorded in the training sessions, according to the level of approximation (adapted from Moras (2000) and Vizuete (2017)), intensity and exercise of the 11 training-age futsal players participating in the study (*n = 382*).*

Approximation levels	No. of observations	A-3	A-4	TOT A-D	TOT A-D 3	TOT A-D 3-4	TOT A-D 1-2
	n	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)	Mean ± SD (m/s²)
Level III (Specific orientation)							
1 x 0 1/1	17	0.21 ± 0.02	0 ± 0	19.24 ± 1.10	0.61 ± 0.13	0.61 ± 0.13	18.63 ± 0.97
1 x 0 2/3	21	0.51 ± 0.11	0 ± 0	24.05 ± 1.38	1.72 ± 0.36	1.74 ± 0.37	22.31 ± 1.02
3 x 3+2 1/2	21	0.84 ± 0.09	0 ± 0	21.21 ± 1.26	1.94 ± 0.28	2.07 ± 0.31	19.14 ± 0.96
4 x 4 + 1 1/2	32	1.05 ± 0.05	0 ± 0	16.85 ± 1.60	2.04 ± 0.16	2.29 ± 0.17	14.57 ± 1.43
5 x 5 + 1 1/1	33	1.30 ± 0.09	0 ± 0	21.63 ± 1.16	2.67 ± 0.26	2.93 ± 0.30	18.70 ± 0.86
6 x 3 1/2	11	1.68 ± 0.14	0 ± 0	26.86 ± 1.15	3.46 ± 0.26	3.85 ± 0.30	23.02 ± 0.86
Level IV (Specific orientation)							
2 x 2 1/2	19	1.12 ± 0.09	0 ± 0	21.12 ± 1.50	2.31 ± 0.21	2.49 ± 0.23	18.63 ± 1.27
2 x 2 + 2 1/2	10	1.43 ± 0.11	0 ± 0	22.43 ± 1.18	2.85 ± 0.20	3.17 ± 0.24	19.26 ± 0.94
3 x 3 2/3	21	0.65 ± 0.04	0 ± 0	19.54 ± 0.78	1.49 ± 0.13	1.66 ± 0.14	17.88 ± 0.65
3 x 3 + 1 1/2	31	1.48 ± 0.07	0 ± 0	21.27 ± 1.16	2.88 ± 0.20	3.26 ± 0.24	18.00 ± 0.93
Level V (Competitive orientation)							
3 x 2 1/1	11	1.40 ± 0.16	0 ± 0	19.41 ± 1.88	2.82 ± 0.30	3.02 ± 0.31	16.39 ± 1.56
4 x 4 1/1	82	1.29 ± 0.10	0 ± 0	18.52 ± 1.31	2.47 ± 0.20	2.74 ± 0.23	15.78 ± 1.08
4 x 4 - E 1/1	41	1.15 ± 0.08	0 ± 0	23.99 ± 1.11	2.65 ± 0.26	2.83 ± 0.29	21.16 ± 0.81
4 x 4 2/3	21	1.09 ± 0.13	0 ± 0	16.95 ± 1.04	2.08 ± 0.27	2.28 ± 0.28	14.67 ± 0.76
5 x 4 1/2	11	0.63 ± 0.02	0 ± 0	16.44 ± 1.81	1.50 ± 0.13	1.60 ± 0.14	14.84 ± 1.67

Acceleration and deceleration data expressed in m/s². Caption: SD=Standard deviation; A-3=accelerations 3 (2.00 – 2.99 m/s²); A-4=accelerations 4 (3.00 – 50.00 m/s²); TOT A-D 3=Total accelerations and decelerations 3 (±2.00 – ±2.99 m/s²); TOT A-D 3-4=Total accelerations and decelerations 3 and 4 (≥ ±2.00 m/s²); TOT A-D 1-2=Total accelerations and decelerations 1 and 2 (< 2.00 m/s²).

Table 3
Relationship of EL of the exercises (n = 382) with the level of approximation.

	Approximation levels					
	Level III (*n* = 13)		Level IV (*n* = 8)		Level V (*n* = 16)	
D-1	*r*	–.02	*r*	**–.96***	*rho*	–.70
D-2	*r*	.21	*r*	–.51	*rho*	–.30
D-3	*r*	**.85***	*r*	.04	*rho*	–.70
D-4	*r*	**.98****	*r*	.58	*rho*	–.67
A-1	*r*	–.25	*r*	–.39	*rho*	–.20
A-2	*r*	.33	*r*	.17	*rho*	–.50
A-3	*r*	**1.00****	*r*	.10	*rho*	**-1.00****
A-4	*r*	.00	*r*	.00	*rho*	.00
Total A	*r*	.43	*r*	.04	*rho*	–.70
Total D	*r*	.38	*r*	–.48	*rho*	–.70
Total A-D	*r*	.40	*r*	–.27	*rho*	–.70
Total A-D 3	*r*	**.96***	*r*	.10	*rho*	–.90
Total A-D 3-4	*r*	**.97***	*r*	.14	*rho*	–.90
Total A-D 1-2	*r*	.12	*r*	-.66	*rho*	–.60

* $p < .05$; ** $p < .01$
Caption: D-1=decelerations 1 (–0.50 - –0.99 m/s²); D-2=decelerations 2 (–1 - –1.99 m/s²); D-3=decelerations 3 (–2 - –2.99 m/s²); D-4=decelerations 4 (–3 - –50 m/s²); A-1=accelerations 1 (0.5z0 - 0.99 m/s²); A-2=accelerations 2 (1 - 1.99 m/s²); A-3=accelerations 3 (2 - 2.99 m/s²); A-4=accelerations 4 (3 - 50 m/s²); Total A=Total accelerations; Total D=Total decelerations; Total A-D=Total accelerations and decelerations; Total A-D 3=Total accelerations and decelerations 3 (±2 - ±2.99 m/s²); Total A-D 3-4=Total accelerations and decelerations 3 and 4 (±2 - ±50 m/s²); Total A-D 1-2=Total accelerations and decelerations 1 and 2 (±0.50 - ±1.99 m/s²).

Table 4
Relationship between IL and training EL (n = 10).

	Perceived Effort Index			
	Pre		Post	
D-1	*rho*	–.02	*rho*	**.70***
D-2	*rho*	–.15	*rho*	.30
D-3	*rho*	–.62	*rho*	.38
D-4	*rho*	–.38	*rho*	.44
A-1	*rho*	.16	*rho*	.48
A-2	*rho*	–.29	*rho*	.36
A-3	*rho*	**–.84***	*rho*	.23
A-4	*rho*	–.17	*rho*	–.24
Total A	*rho*	–.27	*rho*	.53
Total D	*rho*	–.26	*rho*	.57
Total A-D	*rho*	–.27	*rho*	.53
Total A-D 3	*rho*	**–.80***	*rho*	.23
Total A-D 3-4	*rho*	**–.74***	*rho*	.27
Total A-D 1-2	*rho*	–.20	*rho*	.42

* $p < .05$; ** $p < .01$
Caption: D-1=decelerations 1 (–0.50 - –0.99 m/s²); D-2=decelerations 2 (–1 - –1.99 m/s²); D-3=decelerations 3 (–2 - –2.99 m/s²); D-4=decelerations 4 (–3 - –50 m/s²); A-1=accelerations 1 (0.5z0 - 0.99 m/s²); A-2=accelerations 2 (1 - 1.99 m/s²); A-3=accelerations 3 (2 - 2.99 m/s²); A-4=accelerations 4 (3 - 50 m/s²); Total A=Total accelerations; Total D=Total decelerations; Total A-D=Total accelerations and decelerations; Total A-D 3=Total accelerations and decelerations 3 (±2 - ±2.99 m/s²); Total A-D 3-4=Total accelerations and decelerations 3 and 4 (±2 - ±50 m/s²); Total A-D 1-2=Total accelerations and decelerations 1 and 2 (±0.50 - ±1.99 m/s²).

On the other hand, the IL was associated with the EL of training sessions (n = 10). Regarding the relationships between IL and EL, relationships were observed in Pre-RPE-in A-3 (rho = –.84; p < .01), Total A-D 3 (rho = –.80; p < .01), Total A-D 3-4 (rho = –.74; p = .02), and in Post-RPE, a relationship was observed in D-1 (rho = .70; p = .03) (Table 4).

Finally, from the linear regression study, possible causalities were found between the EL of Level III exercises with D-3 (R^2 = .73), D-4 (R^2 = .97), A-3 (R^2 = .99), TOTAL A-D 3 (R^2 = .93), TOTAL A-D 3-4 (R^2 = .95), and those of Level IV with D-1 (R^2 = .93).

Discussion

The main finding of the present study is the causality found between high-intensity EL and Level III (special orientation) exercises, the qualitative and quantitative nature of the exercises analysed, and the limited relationship between IL and EL for this group of training-age players.

The multifactorial and complex nature of the adaptive processes of sportsmen and sportswomen generates the need for training with varying levels of approximation (Vizuete, 2017), which can be a useful tool for load programming (Colby et al., 2014). In this context, it has been observed that the relationships have been mainly qualitative (high intensity), with significant relationships (p < .05) between qualitative EL (high intensity accelerations and decelerations) and Level III and Level V exercises (Sánchez-Ballesta et al., 2019). Based on the results obtained in the Level III exercises, and taking into account the characteristics of the sample, in the present research it has been possible to demonstrate causality (R^2 > .70) of these data through linear regression. These results suggest that it would be possible to adjust the exercise programming of training sessions towards a qualitative (high intensity) approach through the application of approximation levels.

The identification of the qualitative or quantitative nature of the different exercises proposed has provided a more objective view of the EL according to their level of approximation. Based on the results obtained, it was found that there is no clear pattern in relation to the EL and the approximation level of the exercises (Sánchez-Ballesta et al., 2019). Despite this, the results have shown that the exercises most similar to those in competition are not the ones with the highest load quality or quantity. This finding may lead to a conceptual change and allow Level III exercises to be carried out with an intensive objective as well.

IL management based on the index of perceived exertion has been found to be an effective method for intensity quantification (Freitas et al., 2012). However, based on the results obtained in this study, the RPE does not appear to be a reliable method for IL management in training age groups in futsal due to the great variability presented by the players and the limited relationship found between IL and EL. Although this assessment system has shown its usefulness and effectiveness in the evaluation of the fitness of athletes in team and individual sports (Ibáñez et al., 2020), it has also been observed that type of training can influence individualised perception, independently of physiological perception, of intensity during training (Fox et al., 2017) and competition (Brito et al., 2016), demonstrating alterations in the reliability of this method, as well as in relation to gender and experience.

The possibility of revealing relationships between the variables of EL, IL and exercise approximation levels could facilitate the planning of training sessions (Colby et al., 2014) towards a qualitative (high intensity) or quantitative (low intensity) approach (Sánchez-Ballesta et al., 2019), taking into account the accumulated stress or fatigue that the player may present regarding the proposed EL (Sansone et al., 2019), which would allow for performance improvement and reduce the potential risk of injury (Soligard et al., 2016).

The present research allows us to assess data independently (Impellizzeri et al., 2019; San Román-Quintana et al., 2014), as these results (p < .05) could indicate that the variables do not follow any particular pattern with respect to the set of exercises, just as each level of approximation is also specific in its behaviour, both for EL and IL.

The limitations of this study are mainly focused on the impossibility of comparing the data extracted in training with that obtained in competition, due to the prohibition of using accelerometers during matches in training categories. In turn, players' unfamiliarity with the RPE system for recording IL may have conditioned the result of certain ranges. Finally, it would be necessary to analyse other samples of the same age in order to be able to affirm that the results apply to all players in the category.

Conclusions

Relationships and causality have been found between the EL and planning variables related to exercise specificity, especially at Level III. Another factor observed from the results is the variability between qualitative (high intensity accelerations and decelerations) and quantitative (low intensity accelerations and decelerations) EL in the same exercise. Finally, in the present study, it was not possible to establish relationships between the RPE, as an IL variable, and the EL or the specificity of the exercises.

Practical applications

Load control is a tool used in the field of performance, injury prevention and rehabilitation (Sánchez-Ballesta et al., 2019), enabling the design of tasks/exercises for training by applying qualitative and quantitative loads according to the characteristics of the competition and the squad. To regulate the adaptive responses of such a squad, the appropriate application of the Moras (2000) and Vizuete (2017) approximation levels can be an effective tool with which to condition the qualitative (high intensity) and quantitative (low intensity) load of the session.

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