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Effects of numerical unbalance constraints on workload and tactical individual actions during ball possession small-sided soccer games across different age groups

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ABSTRACT

This study aimed to examine the effects of age group (under-11, under-15, and under-23) on the external, internal workloads, and tactical individual actions when playing 4v2, 4v4, and 4v6 ball possession small-sided soccer games. Data were analysed separately under the opponent perspective (4vX) and by the cooperation perspective, according to teammates (4v2+X). For all opponent formats, statistical differences were found for walking, with older age groups covering longer distances. Higher running distances were found in 4v4 game format for U11s, while U23s reported higher RPE scores in 4v4 and 4v6 formats. More passes were performed in 4v2 and 4v4 game formats for U11s and a higher maximum passing speed in 4v6 format for U15s and U23s. In the cooperation perspective, statistical differences were found for all external workload variables: U11s covered more distances while sprinting, whereas U23s walked more, perceiving the task as more intense. Similarly, U11s performed a higher amount of tactical individual actions also in every format. Younger players seem to benefit from a lower level of opposition to mature tactical individual actions, while older players can develop fast ball circulation in numerical inferiority.

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Team sports; task constraints; skill acquisition; practice design

1. Introduction

Soccer training moved in the last decades from an analytical methodology to a more holistic approach, where coaches usually manipulate constraints on tasks to achieve certain intended outcomes and improve the transfer to the practice (Sarmento et al., 2018; Travassos et al., 2014). The "constraints-led" approach (CLA) provides a reliable framework to understand the process of manipulating constraints for creating effective

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learning environments (Davids et al., 2013). According to this approach, players and teams' behaviours emerge from the interaction between players, the task, and the environment constraints (Davids et al., 2016; Travassos et al., 2017). Effective manipulation of these constraints in small-sided games (SSGs), particularly the individual and task constraints, ensures the creation of specific contexts of play and highlights functional movement solutions required to perform successfully in competitive match-play (Miller et al., 2017; Roca & Ford, 2020). This process of manipulating individual and task constraints should be tailored to players' age and individual capabilities to ensure an adjusted learning process (Travassos et al., 2017, 2014).

The continuous manipulation of task constraints, such as the adaptation of space and number of players, according to a specific age and individuals' capabilities, allows for more effective development of individual and collective tactical, physical and technical skills (Gonçalves et al., 2017; Sampaio et al., 2014; Silva et al., 2015). For example, Sangnier et al. (2019) showed that the manipulation of playing dimensions in balanced game formats constrains the intensity of the game, players' actions and energy sources. Similarly, Olthof et al. (2018) demonstrated that different age groups deal differently with space available, revealing that the distance between players tends to increase as older the player becomes (Olthof et al., 2018). Furthermore, older players revealed greater physical and physiological capabilities when practising the same SSGs due to their advanced maturity (Buchheit & Mendez-Villanueva, 2013). That is, players' capabilities clearly constrain the identification of possibilities for action, and perceptive capabilities allow exploring the performance environment (Castelão et al., 2017; Travassos et al., 2018).

Also, previous research demonstrated that the variation of the numerical relation triggered significant changes in players' behaviours while in ball possession leading to more offensive movement opportunities and passes (Vilar et al., 2014). Moreover, Travassos et al. (2014) demonstrated that the defensive team in numerical inferiority tend to decrease the distance between players, while the attacking team in superiority seeks to disperse in the playing area. Previous research also reported a greater impact on players' external workload and rating of perceived exertion (RPE) (Hill-Haas et al., 2010). Different numerical relations between players allow for highlighting the exploration of individual and collective possibilities of play that could temporarily occur over the game when numerical unbalance is created (Torres-Ronda et al., 2015). In this specific scenario, more experienced players seem better to explore the space, facilitated by team play, identifying a greater number of possibilities for actions and solving performance issues more successfully and competently (Gonçalves et al., 2016; Ric et al., 2016). Thus, when working with different age groups, coaches should manipulate the numerical balance of SSGs to encourage players to explore new individual and collective actions when facing different spatial-temporal relations between opponents and teammates (Castelão et al., 2017; Silva et al., 2015; Travassos et al., 2018).

However, to the best of our knowledge, no studies have been conducted to understand how players of different ages perform in SSGs with an unbalanced number of players. This lack of research is surprising since the scenario of an unbalanced number of players is the main cause of game disturbances and opportunities to score goals (Torres-Ronda et al., 2015). This is particularly valid for ball possession games that have been widely used to improve passing actions and creation of space in young and to develop ball circulation and team organisation in older players (Castellano et al., 2013). It was

observed that ball possession tasks induce an increase in exercise intensity and the number of tactical individual actions, as players need to continually create passing lines or block opponents, thereby increasing the number of moves to keep or recover ball possession (Castellano et al., 2013). Nevertheless, it is essential to analyse the interactive effects of unbalance number of players in ball possession scenarios to understand the emergent behaviours in soccer SSGs at different ages or levels of expertise.

This study aims to investigate the effects of different soccer unbalanced ball possession SSGs (4v2, 4v4 and 4v6) across three different age groups (under-11, under-15 and under-23) on the external workload, the internal load of perceptions and tactical individual actions, under opposition- and cooperation-based perspectives. Considering the opposition- and cooperation-based perspectives, we aim to be able to explore the effects of the variation of external and internal loads, and tactical individual actions across different age groups.

2. Materials and methods

2.1. Participants

Fifty-two academy level soccer players from under-11, under-15 and under-23 age groups participated in this study (under-11: U11, n = 16, age: 10.0 ± 0.7 years, body mass: 33.0 ± 2.34 kg, height: 141.0 ± 4.6 cm, years of experience: 1.0 ± 1.1 years; under-15: U15, n = 18, age: 14.0 ± 1.3 years, body mass: 58.0 ± 13.4 kg, height: 169.0 ± 10.1 cm, years of experience: 3.0 ± 1.2; under-23: U23, n = 18, age: 21 ± 1.60 years, body mass: 66.5 ± 10.1 kg, height: 174.5 ± 4.3 cm, years of experience: 6.5 ± 1.6 years). All participants experienced three weekly 90-min training sessions, plus one game on weekends at a regional playing standard in a regular turf soccer pitch. Players have around 40 weeks of training per season and goalkeepers were not included in data collection. The experimental protocol and investigation were approved by the local Institutional Research Ethics Committee and performed according to the Helsinki Declaration's ethical standards.

2.2. Procedures

Participants performed in a 4-series of 4vX (2, 4 and 6) SSGs for ball possession on a 30x25m playing area in an artificial turf pitch (Sarmento et al., 2018). Due to the exercise's purpose (maintaining and recovering ball possession), no goalkeeper or any type of goal or target was used. Data were collected in a single session for all age categories during the season's competitive period. The total duration of the session was approximately 1 h and 35 min. For the opposition-based perspective, variables were analysed by fixing the same four players and compared them against 2 (High Superiority; High-Sup, 4v2), 4 (Balanced, 4v4) and 6 (High Inferiority; High-Inf, 4v6) players. For the cooperation-based perspective, variables were analysed by comparing performances from the same 2 players when counting with none (Very Low; VLow-Coop, 4v2+0), 2 (Balanced, 4v2+2) and 4 (Very High: VHigh-Coop, 4v2+4) teammates (Gonçalves et al., 2016; Torres-Ronda et al., 2015) (see Figure 1). Each SSG format was performed for four sets of 4 min each (in a total of 16 min of intermittent exercise for

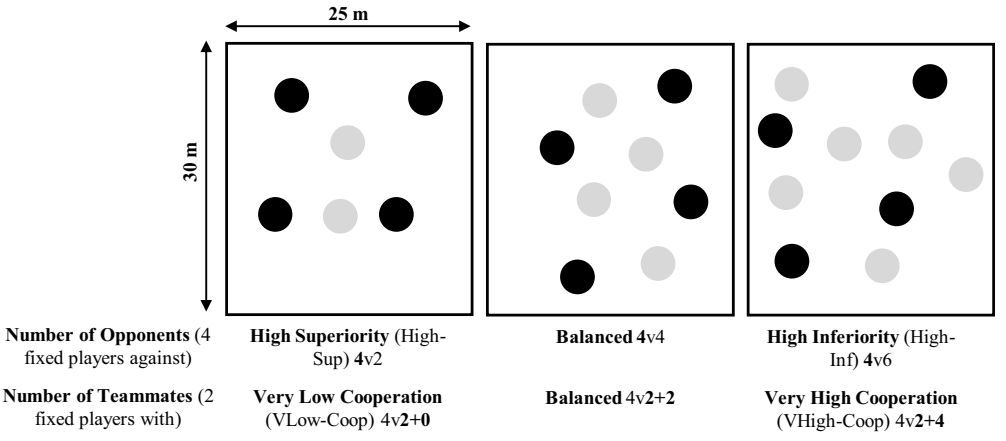

Figure 1. Small-sided games and analysis format.

each SSG format; 4 × 4 min + 4 min recovery time). These procedures allowed to collect data on a total of 12 SSGs, from which each player took part in around six of them. Team head coaches were present during data collection and assigned players into balanced teams based on their perceptions of players' physical, technical, and tactical abilities. Between bouts, players performed some lower limb stretching exercises according to their individual preference. The different SSG formats followed a random order. Before the beginning of each session, players performed a general warm-up that included running at various intensities, joint mobilisation and stretching for 20-min duration. The coach did not intervene during the SSG with any encouragement. If the ball went out of play, other strategically placed balls allowed an immediate restart from a pass.

2.3. Data collection

Data on the external workload variables were collected through a Global Position System (GPS) included in the ZEPP Play Soccer system (ZEPP Labs, San Jose, United States), which uses 2 Micro Electromechanical Systems (MEMS) sensors and Bluetooth 4.0 Low Energy (LE) connectivity. Each player had a microchip (each with two internal sensors: 3-Axis Accelerometer + 3-Axis Gyroscope) attached to each of their gastrocnemius to record displacement data (Aroganam et al., 2019). Later, Zepp's computer software (version 1.6.0) was used to compute the values of external load: total distance covered (m), distance differentiated by walking (≤9 km/h), running (9–18 km/h) and sprinting (>18 km/h), number of sprints (n), maximum sprint speed (km/h); and tactical individual actions: number of passing with the dominant and non-dominant foot (n), and maximum passing speed (km/h). The passing actions were registered when the force applied to the ball allowed it to travel a distance of at least 5 m (ZEPP Play Soccer system). The internal load perceptions were measured using a Borg Scale CR10. It was presented to participants after the end of each SSG bout to ensure that the perceived effort was referred to that specific game condition (Coutts et al., 2009).

2.4. Statistical analysis

The descriptive analysis is presented as means and standard deviations (mean ± SD). The normality and homogeneity of the variances were tested, and the sample met the requirements for the assumption of normality. A one-way analysis of variance (ANOVA) was conducted to evaluate differences in performance variables for each game format according to age group factor (U11, U15, and U23) and analysed under two perspectives (opposition and cooperation). Effect size (ES) was presented as partial eta-squared (η_p^2) and interpreted by the following criteria: small (ES ≤ 0.06), medium (0.06 < ES ≤ 0.14) and large (ES > 0.14) (Cohen, 1988). The opposition-based perspective analysed the effects of the age group when manipulating the number of opponents. The cooperation-based perspective analysed the effects of the age group when manipulating the number of teammates. Pairwise differences were assessed with the Bonferroni post hoc test. The statistical analysis was completed using Jamovi Project (jamovi, 2020), and the alpha level of statistical significance for all tests was set at .05

3. Results

3.1. Opposition-based perspective

On High-Superiority (4v2), statistical differences were found for walking ($p < .001$, $\eta_p^2 = 0.48$), RPE ($p < .001$, $\eta_p^2 = 0.24$), passing number ($p < .05$, $\eta_p^2 = 0.16$) and non-dominant foot ($p < .05$, $\eta_p^2 = 0.19$). Post-hoc showed statistical differences when comparing U11 vs U15 and U11 vs U23 for walking ($p < .001$), RPE ($p < .01$) and non-dominant foot ($p < .05$), and specifically for passing number ($p < .05$) when only comparing U11 vs U15. No differences were depicted when comparing U15 vs U23 age groups.

On Balanced (4v4) formats, statistical differences were noted for walking ($p < .001$, $\eta_p^2 = 0.52$), sprinting ($p < .01$, $\eta_p^2 = 0.25$), sprint number ($p < .01$, $\eta_p^2 = 0.24$), RPE $p < .001$, $\eta_p^2 = 0.28$), passing number and with dominant foot (both $p < .05$, $\eta_p^2 = 013$). When comparing U11 vs U15 age groups, differences were observed for walking ($p < .001$), sprinting ($p < .01$), sprint number, passing number and with dominant foot (all $p < .05$). Likewise, statistical differences were found for walking, RPE (both $p < .001$), sprinting ($p < .05$) and sprint number ($p < .01$) when analysing U11 vs U23. No differences were depicted when comparing U15 vs U23 age groups.

On High-Inferiority (4v6), statistical differences were observed for walking ($p < .001$, $\eta_p^2 = 0.31$), max speed ($p < .001$, $\eta_p^2 = 0.41$), RPE ($p < .05$, $\eta_p^2 = 0.14$) and max passing speed ($p < .01$, $\eta_p^2 = 0.19$). Comparing age groups, differences were found for walking (U11 vs U15: $p < .01$; U11 vs U23: $p < .001$), max speed (U11 vs U15: $p < .01$; U11 vs U23: $p < .001$), RPE (U15 vs U23: $p < .05$) and max passing speed (U11 vs U15: $p < .05$; U11 vs U23: $p < .01$) (see Table 1).

3.2. Cooperation-based perspective

A higher number of statistical differences was found for the cooperation-based perspective. For very-low cooperation (4v2+0), statistical differences were found for walking ($p < .001$, $\eta_p^2 = 0.51$), sprinting ($p < .001$, $\eta_p^2 = 0.68$), sprint number ($p < .001$, $\eta_p^2 = 0.71$), passing number ($p < .01$, $\eta_p^2 = 0.45$) and with dominant foot ($p < .001$, $\eta_p^2 = 0.50$). When

Table 1. Descriptive analysis with mean ± SD and post hoc analysis for opposition-based perspective.

Variables	4v2 High-Superiority			4v4 Balanced			4v6 High-Inferiority		
	U11	U15	U23	U11	U15	U23	U11	U15	U23
External workload									
Walking (m)	144.0 ± 27.5[a, b]	193.0 ± 21.4	201.0 ± 31.8	125.0 ± 28.4[a, b]	188.0 ± 31.8	183.0 ± 22.8	139.0 ± 34.0[a, b]	185.0 ± 39.9	189.0 ± 29.5
Running (m)	96.8 ± 50.1	128.0 ± 43.7	107.0 ± 79.9	172.0 ± 66.1	156.0 ± 63.4	177.0 ± 57.4	164.0 ± 50.5	143.0 ± 60.6	162.0 ± 63.3
Sprinting (m)	6.2 ± 7.4	5.1 ± 5.2	3.0 ± 3.3	30.6 ± 28.4[a, b]	10.7 ± 13.1	7.4 ± 6.1	18.2 ± 19.3	13.6 ± 10.1	12.1 ± 10.5
Max speed (km/h)	14.3 ± 2.8	15.8 ± 2.8	15.6 ± 3.2	15.8 ± 2.3	17.5 ± 3.0	17.3 ± 1.4	14.4 ± 1.9[a, b]	17.0 ± 2.1	18.7 ± 2.5
Sprint number (counts)	0.8 ± 0.8	0.8 ± 0.8	0.4 ± 0.6	3.2 ± 2.5[a, b]	1.5 ± 1.3	1.0 ± 0.8	2.3 ± 2.0	1.4 ± 1.0	1.5 ± 1.2
Internal load of perceptions									
RPE (a.u.)	1.3 ± 1.35[a, b]	2.9 ± 1.1	2.8 ± 1.5	3.6 ± 0.8[a, b]	4.4 ± 0.9	5.0 ± 1.1	4.6 ± 1.1	4.4 ± 1.2[c]	5.4 ± 1.3
Tactical individual actions									
Max passing speed (km/h)	40.7 ± 2.7	40.6 ± 7.4	37.5 ± 12.3	34.9 ± 8.4	38.1 ± 8.7	39.6 ± 15.3	29.5 ± 7.0[a, b]	38.8 ± 7.0	40.9 ± 15.2
Passing number (counts)	13.8 ± 4.2[a]	9.4 ± 4.0	10.6 ± 5.1	11.0 ± 6.5[a]	6.9 ± 2.4	7.8 ± 4.1	7.8 ± 3.9	8.2 ± 3.1	6.5 ± 3.7
Dominant foot (counts)	10.9 ± 3.6	8 ± 3.6	9.0 ± 4.9	8.8 ± 5.7[a]	5.2 ± 2.0	6.1 ± 3.2	6.0 ± 3.5	6.7 ± 2.4	4.3 ± 2.6
Non-dominant foot (counts)	2.9 ± 1.7[a, b]	1.4 ± 1.2	1.6 ± 1.5	2.3 ± 2.1	1.7 ± 1.4	1.7 ± 1.4	1.7 ± 1.1	1.5 ± 1.4	2.1 ± 1.7

[a]Statistical differences for U11 vs U15; [b]Statistical differences for U11 vs U23; [c]Statistical differences for U15 vs U23

comparing age groups on the post hoc, statistical differences were found for walking (U11 vs U15: $p < .01$; U11 vs U23: $p < .001$), sprinting (U11 vs U15 and U15 vs U23: $p < .05$; U11 vs U23: $p < .001$), sprint number (U11 vs U15 and U11 vs U23: $p < .001$; U15 vs U23: $p < .05$), passing number (U11 vs U23: $p < .001$) and with dominant foot (U11 vs U15: $p < .05$; U11 vs U23: $p < .001$).

On Balanced formats (4v2+2), statistical differences were observed for walking ($p < .001$, $\eta_p^2 = 0.54$), sprinting ($p < .001$, $\eta_p^2 = 0.42$), sprint number ($p < .001$, $\eta_p^2 = 0.53$), RPE ($p < .001$, $\eta_p^2 = 0.29$), passing number $p < .01$, $\eta_p^2 = 0.24$), with dominant foot ($p < .01$, $\eta_p^2 = 0.21$) and non-dominant foot ($p < .01$, $\eta_p^2 = 0.20$). When analysing the age groups, statistical differences were observed for walking, sprinting, sprint number and RPE (all $p < .001$, and RPE: U11 vs U15 $p < .05$) when comparing U11 vs U15 and U11 vs U23. Passing number ($p < .001$), with dominant foot ($p < .01$) and non-dominant ($p < .001$) foot also revealed statistical differences when comparing U11 vs U23. No differences were depicted when comparing U15 vs U23 age groups.

For the Very-High Cooperation (4v2+6) format, statistical differences were found for walking ($p < .001$, $\eta_p^2 = 0.47$), sprinting ($p < .01$, $\eta_p^2 = 0.17$), sprint number ($p < .01$, $\eta_p^2 = 0.17$), RPE ($p < .001$, $\eta_p^2 = 0.62$), passing number ($p < .001$, $\eta_p^2 = 0.32$), dominant-foot ($p < .001$, $\eta_p^2 = 0.34$) and non-dominant foot ($p < .05$, $\eta_p^2 = 0.09$). Comparing U11 vs U15, statistical differences were found for walking, RPE, passing number, with dominant foot (all $p < .001$), and with non-dominant foot ($p < .05$). For U11 vs U23, statistical differences were found for walking, sprint number, RPE, passing number, with dominant foot (all $p < .001$) and sprinting ($p < .01$), while walking ($p < .01$), sprinting ($p < .05$) and RPE ($p < .001$) revealed differences for U15 vs U23 (see Table 2).

4. Discussion

This study aimed to examine the effects of age group (under-11, under-15, and under-23) on the external, internal workloads, and tactical individual actions when playing 4v2, 4v4, and 4v6 ball possession small-sided soccer games. For the opposition-based perspective, all game formats promoted less walking for U11s, and higher sprinting distance covered and number of sprints during the Balanced (4v4) format. High-Sup (4v2) and Balanced (4v4) formats promoted a lower RPE for U11s compared with the older age groups. Additionally, the same formats (4v2 and 4v4) promoted more tactical individual actions, mostly for U11s and with the non-dominant foot, whereas the High-Inf (4v6) promoted a higher passing speed and max speed sprint for the U23s. On the cooperation-based perspective, all game formats and especially VLow-Coop (4v2+0) and Balanced (4v2+2), promoted higher walking and lower sprint and sprint numbers for U23s than younger age groups. Variations on RPE were observed for each players' age according to different game formats. However, U15s indicated higher scores for VLow-Coop (4v2+0) and VHigh-Coop (4v2+4). Surprisingly, U11s revealed a higher number of tactical individual actions across all game formats.

4.1. Opponent-based perspective

All opponent-game formats, particularly Balanced (4v4) scenarios, constrained U11s to cover more distances while sprinting and perform a higher number of sprints when

Table 2. Descriptive analysis with mean ± SD and post hoc analysis for cooperation-based perspective.

Variables	4v2+0 Very Low-Cooperation			4v2+2 Balanced			4v2+4 Very High-Cooperation		
	U11	U15	U23	U11	U15	U23	U11	U15	U23
External workload									
Walking (m)	96.5 ± 24.0[a, b]	161.0 ± 44.6	176.0 ± 37.2	125.0 ± 26.70[a, b]	179.0 ± 30.6	195.0 ± 28.1	147.0 ± 19.80[a, b]	186.0 ± 36.2[c]	212.0 ± 28.8
Running (m)	216.0 ± 46.7	183.0 ± 62.2	228.0 ± 80.8	179.0 ± 32.7	168.0 ± 70.8	172.0 ± 54.7	140.0 ± 54.3	103.0 ± 64.8	123.0 ± 70.5
Sprinting (m)	39.1 ± 7.10[a, b]	21.9 ± 15.1 [c]	4.6 ± 6.0	31.2 ± 23.70[a, b]	7.8 ± 6.7	4.1 ± 4.9	10.9 ± 9.9[b]	8.3 ± 9.5[c]	2.4 ± 3.1
Max speed (km/h)	15.9 ± 1.3	17.9 ± 1.3	16.9 ± 2.9	15.9 ± 1.7	16.8 ± 2.8	16.9 ± 2.3	14.8 ± 2.5	15.3 ± 3.5	15.6 ± 2.1
Sprint number (counts)	4.9 ± 1.10[a, b]	2.3 ± 1.5 [c]	0.6 ± 0.9	3.8 ± 2.20[a, b]	1.0 ± 0.6	0.6 ± 0.6	1.3 ± 1.0	0.8 ± 0.8[c]	0.5 ± 0.6
Internal load of perceptions									
RPE (a.u.)	6.1 ± 2.1	7.1 ± 1.4	5.5 ± 0.9	3.4 ± 1.20[a, b]	4.7 ± 1.1	4.8 ± 0.7	2.0 ± 1.10[a, b]	5.1 ± 1.1[c]	3.7 ± 0.8
Tactical individual actions									
Max passing speed (km/h)	36.4 ± 6.8	34.0 ± 16.6	32.1 ± 2.9	35.0 ± 6.2	37.0 ± 16.5	34.6 ± 7.3	38.3 ± 14.0	34.2 ± 7.7	34.8 ± 2.6
Passing number (counts)	10.5 ± 4.0[b]	6.8 ± 4.0	3.3 ± 1.9	11.6 ± 8.4[b]	7.3 ± 3.1	4.3 ± 8.5	9.6 ± 3.60[a, b]	4.5 ± 3.4	6.0 ± 6.8
Dominant foot (counts)	8.0 ± 2.90[a, b]	4.6 ± 2.8	2.4 ± 1.3	8.9 ± 7.3[b]	5.7 ± 2.3	3.3 ± 2.4	7.5 ± 2.60[a, b]	3.5 ± 2.7	4.7 ± 1.8
Non-dominant foot (counts)	2.5 ± 1.5	2.1 ± 1.8	0.9 ± 1.1	2.7 ± 1.6[b]	1.6 ± 1.5	1.0 ± 1.2	2.0 ± 1.70[a, b]	1.0 ± 1.2	1.3 ± 1.3

[a]Statistical differences for U11 vs U15; [b]Statistical differences for U11 vs U23; [c] Statistical differences for U15 vs U23

compared with the older age groups. For all game formats, U15s and U23s tend to achieve a higher speed. Usually, the game's absolute physical performance is better in older players due to age-related performance improvements and/or physical maturity (Mendez-Villanueva et al., 2011). However, when the individual or age-related speed thresholds are used, younger players tend to sprint more and run the same total distance as their older counterparts (Mendez-Villanueva et al., 2011). Consequently, younger players may find it difficult to explore the space to keep a balanced unit and tend to pursue the ball across the playing area (Brito et al., 2019). This results in the need to keep running at higher intensities.

Yet, this higher intensity run does not reflect the RPE, as U11s perceived the game-formats less intensely, even though these young players have walked less and sprinted more. The increase in the absolute physical capacity associated with the growth of players and their playing experience enables them to reduce their individual running demands. However, this decrease does not translate into a lower internal load, which may suggest that some movements related to the game which the GPS did not capture were conducted with low frequency and/or at a sufficiently high intensity to increase players' internal load (Casamichana & Castellano, 2010).

High-Sup (4v2) and Balanced (4v4) allowed U11s to perform a higher number of actions in tactical individual actions. According to Olthof et al. (2018), an increase in the number of players results in reduced tactical variability and individual actions, while a lower number of players promotes higher possibilities to contact with the ball. In this numerical superiority game format, with more space available and consequently more time for decision-making, younger players were able to perform more tactical actions and to explore the use of their non-dominant foot (particularly for 4v2), with less opponents' marking. Interestingly, High-Inf (4v6) game format revealed reduced passing speed for U11s, due likely to the higher pressing environment where the younger players may have been constrained to perform safer options of tactical actions to keep ball possession. Thus, it seems that players tend to explore the more evident passing lines decreasing the velocity and increasing the precision of the pass when under pressure.

4.2. Cooperation-based perspective

The most differences across the age groups were found for the cooperation-based perspective. The U23s covered more distance while walking and the U11s while sprinting, with a higher number of sprints. Hence, due to higher tactical individual capabilities to collectively perform and maintain the balance on the space occupation over the SSGs dynamics, older players tend to disperse in the playing area when in the possession and reduce interpersonal distances when they need to defend (Barnabe et al., 2016). On the opposite, younger players tend more often to solve game tasks individually by approaching the ball to perform tactical actions instead of looking for a collective solution, contributing to higher intensity movements (Folgado et al., 2014). So, different age groups have different demands for movement, with younger players travelling longer distances at higher intensities, and as age increases, it is followed by the ability to lower the pace and better control the game moments.

In unbalanced formats, especially in VHigh-Coop (4v2+4), U15s reported higher RPE. Players at this age group are usually in the middle of puberty, which affects their ability to

experience new game dynamics as their bodies are changing, and it is a time of adaptation to new environmental contexts (Malina et al., 2007). These physical asset changes may constrain behaviours to quickly recover ball possession or create new passing lines for teammates, consequently perceiving the task as more intense. The RPE results were opposite to the initial expectation since higher values were found on game formats with less players. With fewer teammates and cooperative options, players may need to increase the intensity of actions for longer.

U11s performed a higher number of tactical individual actions for every game format, especially using their dominant foot. Older players tend to adopt a wider dispersion on the pitch and explore the available playing area's limits, using the space more efficiently (Barnabe et al., 2016). This behaviour is probably facilitated by an increase in physical capacities, as older players can pass the ball over longer distances and discover a wider range of players for cooperation (Buchheit & Mendez-Villanueva, 2013). Therefore, due to young players random dispersion on the playing area, an emergent adaptation occurs resulting from the reduced available space. Players needed to promote a higher number of tactical individual actions under pressure due to shorter distances between teammates to keep ball possession.

5. Conclusion

A more physically developed player may produce more explosive movements and influence the data collection process on external workload when compared with an internal load and tactical individual actions (Malina et al., 2007). Therefore, more research is needed to understand the effects of players' maturation on their individual and collective performance (e.g. length and number of ball possessions) (Miller et al., 2017; Roca & Ford, 2020). This may be achieved by collecting data from other indicators of intensity, such as the heart rate. Further research should be conducted to investigate the effects of task constraints on different SSGs as a function of different age groups.

In summary, from an opposition-based perspective, older age groups covered longer distances while walking and perceived the task as more intense for all game formats, whereas the younger age groups did this while sprinting. The High-Sup (4v2) promoted more passes and the High-Inf (4v6) constrained speed of ball circulation for U11s. Coaches can use High-Sup (4v2) game format to develop passing skills, especially with the non-dominant foot, and to physically recover players in numerical superiority for all age groups. The balanced (4v4) format seems more suitable for younger age groups when looking to increase task intensity, while High-Inf (4v6) is more suitable for older players. From the cooperation-based perspective, older age groups also covered longer distances while walking, whereas youngsters did this while sprinting across all game formats. U11s sprinted more time, U15s perceived the task as more intense, and U23s walked more in all game formats. Likewise, all cooperation-game formats demonstrated higher number of tactical individual actions, particularly with the dominant foot for U11s. The manipulation of unbalanced scenarios may foster the technical development of young players. Moreover, a lower level of cooperation allows an increase in task intensity, whereas high cooperation may stimulate players' use of aerobic energy

sources.

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