ORIGINAL ARTICLE

Impact of game format and age group on technical performance in youth football: A comprehensive analysis

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ABSTRACT

This study aimed to analyse technical action variations among 5, 7, 9, and 11-a-side game formats and investigate the effects of age groups (U8, U10, U12, and U14) on these actions. A total of 197 soccer players aged between 6.94 ± 0.7 and 13.46 ± 0.5 years participated, with three matches conducted weekly, totalling 48 matches. Two-way ANOVA was employed to analyse age group and game format as independent factors. The study revealed the influence of age group on players' technical actions variability: front pass success $p < .001$; side pass success $p < .001$; back pass success $p < .001$; short pass success $p < .001$; reception success $p < .001$; goal $p < .002$; unsuccessful short pass $p < .001$; unsuccessful long pass $p < .001$; ball contacts $p < .001$. Additionally, the study highlighted the impact of game format on success rates: front pass success $p < .001$; side pass success $p < .001$; back pass success $p < .001$; short pass success $p < .001$; reception success $p < .001$; goal $p < .036$; shot on target $p < .001$; ball contacts $p < .001$; interception $p < .001$. These findings enhance understanding of how game format and age group affect technical performance in youth soccer, emphasizing the need for interventions that optimize players' development trajectories.

Keywords: Performance analysis, Youth football, Game formats, Technical actions, Age groups, Player development.

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INTRODUCTION

Football is a phenomenon with a widespread impact on society. Consequently, interest in developing the sport has increased over the years, seeking to improve collective and individual performance. One of the most significant axes of strategic growth in football is the development of young players. This is because it can lead to higher levels of sports performance and increase the profitability of player transactions.

However, during football matches, various constraints can influence sports performance, including environmental, structural, and functional constraints (Coutinho, Gonçalves, Travassos, Folgado, Figueira, & Sampaio, 2020; Heuvelmans, Di Paolo, Benjaminse, Bragonzoni, & Gokeler, 2024; Joode, 2023; Teune, Woods, Sweeting, Inness, & Robertson, 2022). In this context, it becomes crucial to provide appropriate match-play conditions for young players, ensuring that variables such as field size, number of players, and match durations are effectively adapted to the age and characteristics of the participants (Castellano, Puente, Echeazarra, Usabiaga, & Casamichana, 2016; Serra-Olivares, García-López & Gonçalves, 2019; García-Angulo, Palao, Giménez-Egido, García-Angulo, & Ortega-Toro, 2020). This is essential for contributing to the development of their physical, tactical, technical, and psychological demands (Brito, Roriz, Duarte, & Garganta, 2018).

Previous studies suggest that the number of technical actions is greater in the 8-a-side game format compared to 11-a-side (Joo, Hwang-Bo, & Jee, 2016); the chance of a shot on goal is greater in 5-a-side game format compared to 7-a-side and 8-a-side game formats in U10 age-group (Lapresa, Arana, Amatria, Fernández, & Anguera, 2017); and there are more technical actions in the 4-a-side game format compared to 8-a-side (Fenoglio, 2004). In summary, comparisons between formats suggest that individual frequencies of technical actions tend to increase in formats with fewer players (Clemente, Chen, Bezerra, Guiomar, & Lima, 2018; Bergmann, Braksiek, & Meier, 2022; Clemente & Sarmento 2020).

Despite these pedagogical insights, uncertainties persist regarding the variability of young players' technical actions between different game formats (Bergmann et al., 2022) and the effects of different age-groups on their respective technical actions. Assessing the technical performance of young players in different game formats can be relevant for developing and optimizing match-play conditions, ultimately enhancing player involvement, enjoyment, and satisfaction, leading to continued participation (Machado, Ribeiro, Palheta, Alcântara, Barreira, Guilherme, Garganta, & Scaglia, 2019; Hill, & Green, 2008). To observe and analyse technical performance patterns, such as the predominant technical actions during soccer games, notational analysis (James, 2006; Clemente, Couceiro, Martins, & Mendes, 2012) and/or observational analysis (Martone, Giacobbe, Capobianco, Imperlini, Mancini, Capasso, Buono, & Orrù, 2017; Lemes, Luchesi, Diniz, Bredt, Chagas, & Praça, 2020) are considered valuable and widely used tools. Manipulating game variables such as pitch size and player numbers to align with specific age-groups becomes pivotal for optimizing player development trajectories (Brito et al., 2018).

Research in this area has primarily focused on older age groups and elite levels of performance, emphasizing physical or time-motion variables. Studying the impact of game format becomes even more significant when considering the long-term development plan for younger players, highlighting the importance of understanding the effects of game format on technical actions across different age-groups.

Regarding younger age-groups, participation in adult versions of the game can hinder player development due to individual participation limitations. Authors have shown that skill development was greater in adapted game conditions with smaller areas and fewer players (Amatria, Lapresa, Arana, Anguera, & Garzón, 2016;

García-Angulo, Ortega-Toro, Giménez-Egido, Olmedilla, García-Mas, & Manuel Palao, 2021). Furthermore, comparing different match formats within the same age-group revealed significant differences in attacking plays and chances created, emphasizing the need to tailor match formats to specific developmental needs. Bergmann et al. (2022) compared 5-a-side and 7-a-side formats and found that U9 players perform more tactical decisions and technical actions in the smaller match format, with greater levels of effectiveness. Such findings underscore the importance of adapting match formats to optimize player engagement and development.

Therefore, this study aimed (1) to analyse the variations of technical actions between 5-a-side, 7-a-side, 9-a-side, and 11-a-side game formats; and; (2) to investigate the effects of different age-groups (U8, U10, U12, and U14) in technical actions. It was hypothesized that the different game formats and age-groups would induce differences in the success rates of technical actions of the young football players. By exploring variations in technical performance patterns, we aim to inform practical decisions for coaches and administrators, ultimately fostering an environment conducive to player development and enjoyment. Specifically, we hypothesize that both game formats and age-groups will exert discernible effects on success rates in the technical performance of young soccer players.

METHODS

Participants

One hundred and ninety-seven Portuguese youth football players from the U8, U10, U12, and U14 age-groups, participated in this study (Table 1). Participant selection, both teams and individual players, adhered to the following criteria: (1) teams and players registered at the Porto Football Association championship and (2) teams and players with similar competitive level.

Participants and their tutors were fully informed about the study's objectives, design, procedures, requirements, implications, benefits, and risks prior to their involvement. Given that participants were minors, written consent was obtained from their respective tutors. The study protocol adhered to the guidelines outlined in the Declaration of Helsinki and received approval from the Ethics Committee of the Faculty of Sport at Porto University.

Table 1. Description of player subsamples.

	U8 (*n* = 53)	U10 (*n* = 44)	U12 (*n* = 41)	U14 (*n* = 59)	*F*	*p*	Post hoc (Bonferroni)
Age (Y)	6.94±0.72	8.52±0.66	11.24±0.44	13.46±0.50	1282.65	<.001	a,b,c,d
Height (cm)	125.36±6.04	134.57±6.85	146.80±6.49	159.16±7.78	250.13	<.001	a,b,c,d
Weight (Kg)	27.16±5.75	34.70±7.49	41.57±7.47	49.89±8.89	91.02	<.001	a,b,c,d
Body-mass (Kg/m^2)	17.37±3.92	18.93±2.87	19.11±1.78	19.51±1.68	6.33	<.001	a
Soccer practice (h/week)	2.18±0.28	2.38±0.31	3.09±0.38	3.38±0.12	26.17	<.001	a,b,c,d
Soccer experience (years)	2.06±0.86	3.04±0.91	3.58±1.46	3.68±1.19	23.01	<.001	a,e

Note. Significant differences are identified as (a) U8 vs U10; U8 vs U12; U8 vs U14, (b) U10 vs U8; U10 vs U12; U10 vs U14, (c) U12 vs U8; U12 vs U10; U12 vs U14, (d) U14 vs U8; U14 vs U10; U14 vs U12, (e) U10 vs U14.

Methodological procedures

This observational analytic study was conducted during sixteen consecutive weeks and aimed to analyse the variability of four game formats (5-a-side; 7-a-side; 9-a-side; and 11-a-side) to assess technical actions performed by young soccer players across four age-groups (U8, U10, U12, and U14). Three soccer matches

were conducted weekly, consistently on Sundays, totalling 48 matches. Matches were organized in a triangular tournament setup (e.g., match 1: team A vs. team B; match 2: team A vs. team C; match 3: team B vs. team C), in accordance with the football rules, except match duration (30 minutes, without breaks) and player substitutions (not allowed). Each week, an age group was tested in a game format following a progressive sequence (e.g., 1st week U8 in 5-a-side format; 2nd week U8 in 7-a-side format; …).

All matches were conducted on the same artificial third-generation pitch surface with official dimensions (length: 100 m, width: 64 m). The field size was adjusted for each game format using the relative space per player, i.e., reducing the length and width proportionally to accommodate the number of players (Silva, 2014). A detailed description of match conditions is presented in Table 2. Matches commenced with a planned, standardized warm-up lasting fifteen minutes, comprising running activities, small-sided games, and stretching. Subsequently, players engaged in a simulated match comprising two periods of two minutes each, separated by one minute of passive recovery. Coaches utilized subjective skill assessments to distribute players into balanced teams. All football matches were conducted between 9 and 11 a.m. under an average temperature of 13°C, with a relative humidity of 56%, and no precipitation. To maintain consistency between repeated measures, the same players were assigned to balanced teams based on recommendations from the head coach and playing positions. Matches were recorded using a digital camera, and technical actions were compared across sessions, age-groups, and game formats. This protocol was disseminated to the teams one month prior to commencement to ensure players, coaches, and directors were familiar with the procedures to be adopted before, during, and after the matches.

Table 2. Match conditions.

	Match configuration			
Game formats	5-a-side	7-a-side	9-a-side	11-a-side
Game duration (min)	30 min	30 min	30 min	30 min
Pitch size (length x width)	45.5 x 29 m	64 x 41 m	82 x 52 m	100 x 64 m
Pitch ratio per player (m^2)	1:132	1:187	1:237	1:291
Tactical structure	1-1-2-1	1-2-3-1	1-3-4-1	1-4-3-3
Playing positions	1GK+1DF+2MD+1FW	1GK+2DF+3MD+1FW	1GK+3DF+4MD+1FW	1GK+4DF+3MD+3FW
Goals size (height x width)	2 x 6 m	2 x 6 m	2 x 6 m	2.44 x 7.32 m

Note: Playing positions categories: GK = Goalkeeper; DF = Defender; MD = Midfielder; FW = Forward.

Data collection

Match recordings and corresponding technical actions were captured using a digital camera (Sony Handycam DCR-SR210). The camera was securely mounted on a tripod (Sony VCT-R6400) positioned at the centre of the pitch, elevated at distances of 6 and 20 meters from the pitch surface. Recorded footage was transferred to a computer via USB and analysed using Windows Media Player (Microsoft Corporation, USA). All data were recorded in Microsoft Office Excel (Microsoft Corporation, USA) and subsequently exported to SPSS Statistics, version 32.0 (SPSS Inc., Chicago, USA), for further analysis.

Data analysis

The technical actions analysed were categorized as follows:

Successful technical actions

Front pass: precise transfer of possession from one player to a teammate positioned forward on the field, effectively advancing the team's offensive play;

Side pass: accurate transfer of possession from one player to a teammate positioned to the side on the field, facilitating ball circulation and maintaining control of the game's tempo;
Back pass: precise transfer of possession from one player to a teammate positioned behind them on the field to maintain possession or relieve pressure;
Short pass: accurate transfer of possession to a nearby teammate to maintain ball control, build up play, or evade opponents in close quarters on the field;
Long pass: accurate transfer of possession to a teammate located at a considerable distance away on the field to bypass opponents or switch play;
Reception: skilful and controlled act of receiving the ball from a teammate to maintain possession and enable offensive play;
Dribble: proficient manoeuvring of the ball past opponents while maintaining control to advance up the field and potentially creating goal-scoring opportunities;
Goal: ultimate objective in football, where a player successfully propels the ball into the opposing team's net, resulting in a score for their own team.

Unsuccessful technical actions
Front pass: attempted transfer of possession forward on the field that does not result in successful completion;
Side pass: attempted transfer of possession to a teammate positioned laterally on the field that does not result in successful completion;
Back pass: attempted transfer of possession to a teammate positioned behind on the field that does not result in successful completion;
Short pass: attempted transfer of possession to a nearby teammate that does not result in successful completion;
Long pass: attempted transfer of possession to a teammate located at a considerable distance away on the field that does not result in successful completion;
Reception: inability to successfully control and gain possession of a passed ball from a teammate;
Dribble: attempt to manoeuvre the ball past opponents while maintaining control that does not result in successful execution.

Technical actions of variable impact
Shot: attempt to strike the ball towards the opponent's goal with the intention of scoring;
Shot on target: shot attempt accurately directed towards the goal and would result in a goal if not blocked or saved by the goalkeeper;
Goal assists: providing a pass or set-up play that directly leading to a goal being scored by a teammate;
Ball contacts: number of times a player touches or interacts with the ball during a game or a specific period of play;
Crossing: delivery of the ball from the flanks or wings into the opposition's penalty area;
Turnover: loss of possession of the ball by one team to the other team;
Interception: successful gain of possession after an opponent’s pass;
Clearance: Defensive action to remove the ball from a dangerous area in or around the team's penalty area;
Foul: Infringement of the rules as defined by the laws of the game.

The observations and notifications were executed by the same observer, who had more than 12 years of experience in match analysis. The observer was tested for his reliability level. 12.5 percent of the full data was analysed twice, interspaced by a period of 15 days. An intra-class correlation of .88 was achieved, what ensured good reliability of the analysis.

Statistical analysis

Results are presented as means ± standard deviations (SD). Normality of the data was assessed using the Kolmogorov-Smirnov test, along with coefficients of skewness and kurtosis, and through visual inspection of box plots, normal quantile-quantile (q-q) plots, and histograms.

Dependent variables, including game formats and age-groups, were analysed using a 2-factor repeated-measures analysis of variance (ANOVA). This approach was chosen for its effectiveness in evaluating the interaction effects of two categorical independent variables (game formats and age-groups) on the dependent variables, while also considering potential within-subject correlations.

Effect sizes (Cohen's d) were calculated to assess the magnitude of differences observed. Effect sizes were interpreted according to established guidelines: <0.20 = denoted trivial effect sizes; 0.20–0.59 = indicated small effects; 0.60–1.19 = suggested moderate effects; 1.20–1.99 = signified large effects; and ≥2.0 = represented very large effects (Hopkins, Marshall, Batterham, & Hanin, 2009). To ensure methodological rigor and reliability, all statistical analyses were performed using SPSS Statistical Analysis Software (SPSS Inc., Chicago, USA) version 32.0 for Windows. Significance was defined as $p \leq .05$, consistent with conventional thresholds for statistical significance.

RESULTS

The findings of this investigation reveal a influence of age-group on the variability of young players' technical actions. Age-group exerted a more significant impact on the variability of technical actions under specific conditions, including:

Successful technical actions

[front pass success $F(3.611) = 11.604$, $p < .001$, $\eta^2 = 4.511$]; [side pass success $F(3.610) = 8.181$, $p < .001$, $\eta^2 = 3.032$]; [back pass success $F(3.457) = 6.265$, $p < .001$, $\eta^2 = 3.176$]; [short pass success $F(3.731) = 18.547$, $p < .001$, $\eta^2 = 13.501$]; [Reception success $F(3.690) = 13.395$, $p < .001$, $\eta^2 = 9.785$]; [Goal $F(3.139) = 5.181$, $p < .002$, $\eta^2 = .498$].

Unsuccessful technical actions

[Unsuccessful front pass $F(3.549) = 4.721$, $p < .003$, $\eta^2 = 1.699$]; [Unsuccessful side pass $F(3.277) = 4.132$, $p < .007$, $\eta^2 = .384$]; [Unsuccessful short pass $F(3.831) = 17.374$, $p < .001$, $\eta^2 = 11.901$]; [Unsuccessful long pass $F(3.335) = 5.272$, $p < .001$, $\eta^2 = .948$].

Technical actions of variable impact

[Shot on target $F(3.227) = 3.505$, $p < .016$, $\eta^2 = 1.474$]; [Ball contacts $F(3.749) = 20.738$, $p < .001$, $\eta^2 = 74.485$]; [Turnover $F(3.465) = 4.722$, $p < .003$, $\eta^2 = 1.401$].

Moreover, as illustrated in Table 3, there was a trend for the success rate to be significantly higher in the U14 compared to the younger age-groups (U8; U10; and U12) across several actions, such as: front pass; side pass; back pass; short pass; and reception. Conversely, the rate of goals scored was significantly higher more in the U8 age-group.

Furthermore, the U14 exhibited elevated rates of unsuccessful technical actions, particularly in front pass; side pass; short pass; and long pass, as depicted in Table 4.

Finally, the technical actions of variable impact (Table 5) indicated that the U14 age-group achieved higher rates of shot on target; ball contacts; and turnovers compared to younger age-groups.

In summary, older players demonstrated increased involvement in technical actions of the game and exhibited greater proficiency in executing said actions.

Concomitantly, the outcomes of this study underscore the influence of game format on the success rates of young players' technical actions. The impact of game format on success rates was more pronounced in various conditions, including:

Table 3. Successful technical actions of young players of four age-group (U8; U10; U12; and U14) in different game formats (5-a-side; 7-a-side; 9-a-side; and 11-a-side).

Age Group	M ± SD	Between Age-Groups	Technical Actions	Game Format	M ± SD	Between Game Formats
U8	2.89±0.192			5-a-side	3.83±0.256	
U10	2.15±0.121	*U8>U10**		7-a-side	2.98±0.195	*5-a-side>7-a-side**
U12	2.39±0.138	*U10<U14***	Successful front pass	9-a-side	2.18±0.131	*5-a-side>9-a-side***
U14	3.45±0.208	*U12<U14***		11-a-side	2.44±0.129	*5-a-side>11-a-side***
Total	2.74±0.088			Total	1.13±0.044	*7-a-side>9-a-side**
U8	2.58±0.129			5-a-side	3.59±0.194	*5-a-side>7-a-side**
U10	2.15±0.113	*U8<U14**		7-a-side	2.89±0.169	*5-a-side>9-a-side***
U12	2.70±0.115	*U10<U12**	Successful side pass	9-a-side	2.22±0.084	*5-a-side>11-a-side***
U14	3.13±0.187	*U10<U14***		11-a-side	2.26±0.117	*7-a-side>9-a-side**
Total	2.65±0.071			Total	2.65±0.071	*7-a-side>11-a-side**
U8	2.80±0.219			5-a-side	3.26±0.246	
U10	2.15±0.116	*U8>U10**		7-a-side	2.96±0.203	*5-a-side>9-a-side**
U12	2.16±0.107	*U8>U12**	Successful back pass	9-a-side	2.40±0.152	*5-a-side>11-a-side***
U14	2.94±0.188	*U10<U14**		11-a-side	1.88±0.083	*7-a-side<11-a-side***
Total	2.52±0.084	*U12<U14**		Total	2.52±0.084	
U8	5.96±0.314	*U8>U10***		5-a-side	8.62±0.397	*5-a-side>7-a-side***
U10	4.32±0.206	*U8<U14**		7-a-side	6.96±0.329	*5-a-side>9-a-side***
U12	5.50±0.191	*U10<U12**	Successful short pass	9-a-side	4.82±0.197	*5-a-side>11-a-side***
U14	7.13±0.340	*U10<U14***		11-a-side	4.28±0179	*7-a-side>9-a-side***
Total	5.74±0.140	*U14>U12***		Total	5.74±0.140	*7-a-side>11-a-side***
U8	1.23±0.093			5-a-side	6.40±0.347	
U10	1.20±0.064			7-a-side	5.15±0.337	
U12	1.29±0.084		Successful long pass	9-a-side	3.63±0.157	
U14	1.39±0.081			11-a-side	3.54±0.155	
Total	1.29±0.041			Total	4.39±0.122	
U8	4.50±0.267			5-a-side	6.40±0.347	*5-a-side>7-a-side**
U10	3.55±0.173	*U8>U10**		7-a-side	5.15±0.337	*5-a-side>9-a-side***
U12	3.90±0.170	*U8<U14**	Successful reception	9-a-side	3.63±0.157	*5-a-side>11-a-side***
U14	5.52±0.305	*U10<U14***		11-a-side	3.54±0.155	*7-a-side>9-a-side***
Total	4.39±0.122	*U12<14***		Total	4.39±0.122	*7-a-side>11-a-side***
U8	1.86±0.182			5-a-side	1.77±0.096	
U10	1.68±0.110			7-a-side	1.93±0.163	
U12	1.71±0.100		Successful dribble	9-a-side	1.53±0.132	
U14	1.66±0.117			11-a-side	1.60±0.112	
Total	1.73±0.066			Total	1.73±0.066	
U8	1.82±0.177			5-a-side	1.62±0.110	
U10	1.23±0.078			7-a-side	1.46±0.121	
U12	1.26±0.088	*U8>U10** *U8>U12**	Goals	9-a-side	1.17±0.084	*5-a-side>9-a-side**
U14	1.47±0.127			11-a-side	1.25±0.160	
Total	1.43±0.062			Total	1.43±0.062	

Note: Significant difference across successful technical of players (p ≤ .05); and (p ≤ .001)**.*

Table 4. Unsuccessful technical actions of young players of four age-group (U8; U10; U12; and U14) in different game formats (5-a-side; 7-a-side; 9-a-side; and 11-a-side).

Age Group	M ± SD	Between Age-Groups	Technical Actions	Game Format	M ± SD	Between Game Formats
U8	2.19±0.126			5-a-side	2.58±0.141	
U10	2.15±0.096			7-a-side	2.30±0.127	
U12	1.82±0.082	*U12<U14**	Unsuccessful front pass	9-a-side	2.01±0.098	*5-a-side>9-a-side**
U14	2.40±0.126			11-a-side	1.90±0.090	*5-a-side>11-a-side***
Total	2.15±0.056			Total	2.15±0.056	
U8	1.26±0.070			5-a-side	1.45±0.087	
U10	1.25±0.053	*U14>U10**		7-a-side	1.48±0.101	
U12	1.23±0.052	*U14>12**	Unsuccessful side pass	9-a-side	1.25±0.065	*11-a-side<5-a-side**
U14	1.55±0.113			11-a-side	1.17±0.047	*11-a-side<7-a-side**
Total	1.32±0.038			Total	1.32±0.038	
U8	1.10±0.069			5-a-side	1.18±0.122	
U10	1.11±0.111			7-a-side	1.06±0.062	
U12	1.22±0.147		Unsuccessful back pass	9-a-side	1.16±0.095	
U14	1.20±0.117			11-a-side	1.20±0.145	
Total	1.15±0.053			Total	1.15±0.053	
U8	4.76±0.214			5-a-side	7.62±0.297	*5-a-side>7-a-side**
U10	3.12±0.218	*U8>U10**		7-a-side	5.96±0.229	*5-a-side>9-a-side***
U12	4.30±0.161	*U10<U14***	Unsuccessful short pass	9-a-side	3.82±0.097	*5-a-side>11-a-side***
U14	6.11±0.240	*U12<U14***		11-a-side	3.28±079	*7-a-side>9-a-side***
Total	4.57±0.170			Total	5.17±0.040	*7-a-side>11-a-side***
U8	1.59±0.117			5-a-side	1.94±0.140	
U10	1.63±0.074			7-a-side	1.62±0.099	
U12	1.29±0.072	*U14>U12***	Unsuccessful long pass	9-a-side	1.60±0.116	*5-a-side>11-a-side**
U14	1.91±0.138			11-a-side	1.48±0.081	
Total	1.63±0.054			Total	1.63±0.054	
U8	1.39±0.087			5-a-side	1.39±0.073	
U10	1.30±0.066			7-a-side	1.31±0.081	
U12	1.18±0.066		Unsuccessful reception	9-a-side	1.39±0.094	
U14	1.44±0.073			11-a-side	1.30±0.060	
Total	1.34±0.038			Total	1.34±0.038	
U8	1.33±0.091			5-a-side	1.33±0.71	
U10	1.38±0.086			7-a-side	1.44±0.086	
U12	1.29±0.063		Unsuccessful dribble	9-a-side	1.131±0.083	
U14	1.38±0.085			11-a-side	1.30±0.086	
Total	1.34±0.041			Total	1.34±0.041	

Note: Significant difference across successful technical actions of players (p ≤ .05); and (p ≤ .001)**.*

Successful technical actions

[front pass success $F(3.611) = 15.957$, $p < .001$, $\eta^2 = 4.422$]; [side pass success $F(3.610) = 19.413$, $p < .001$, $\eta^2 = 2.879$]; [back pass success $F(3.457) = 14.016$, $p < .001$, $\eta^2 = 3.028$]; [short pass success $F(3.731) = 53.779$, $p < .001$, $\eta^2 = 11.902$]; [Reception success $F(3.690) = 30.714$, $p < .001$, $\eta^2 = 9.135$]; [Goal $F(3.139) = 2.917$, $p < .036$, $\eta^2 = .521$].

Unsuccessful technical actions

[Unsuccessful front pass $F(3.549) = 7.111$, $p < .001$, $\eta^2 = 1.677$]; [Unsuccessful side pass $F(3.277) = 4.296$, $p < .006$, $\eta^2 = .384$]; [Unsuccessful short pass $F(3.335) = 5.272$, $p < .001$, $\eta^2 = 10.886$]; [Unsuccessful long pass $F(3.335) = 3.157$, $p < .025$, $\eta^2 = .966$].

Technical actions of variable impact

[Shot $F(3.145) = 4.902$, $p < .003$, $\eta^2 = .378$]; [Shot on target $F(3.227) = 21.965$, $p < .001$, $\eta^2 = 1.195$]; Ball contacts $F(3.749) = 61.311$, $p < .001$, $\eta^2 = 64.767$]; [Crossing $F(3.171) = 2.916$, $p < .036$, $\eta^2 = .807$]; [Turnover $F(3.465) = 5.002$, $p < .002$, $\eta^2 = 1.399$]; [Interception $F(3.589) = 28.627$, $p < .001$, $\eta^2 = 3.611$].

Table5. Technical actions of variable impact of young players of four age-group (U8; U10; U12; and U14) in different game formats (5-a-side; 7-a-side; 9-a-side; and 11-a-side).

Age Group	*M ± SD*	*Between Age-Groups*	*Technical Actions*	*Game Format*	*M ± SD*	*Between Game Formats*
U8	1.35±0.123			5-a-side	1.65±0.137	
U10	1.27±0.092			7-a-side	1.32±0.078	
U12	1.32±0.085		Shot	9-a-side	1.24±0.076	*5-a-side>9-a-side**
U14	1.48±0.111			11-a-side	1.14±0.067	*5-a-side>11-a-side**
Total	1.36±0.052			Total	1.36±0.052	
U8	1.73±0.243			5-a-side	2.68±0.169	
U10	1.67±0.125			7-a-side	1.76±0.131	*5-a-side>7-a-side***
U12	1.84±0.145	*U14>U8**	Shot on target	9-a-side	1.31±0.098	*5-a-side>9-a-side***
U14	2.40±0.149	*U14>U10**		11-a-side	1.29±0.119	*5-a-side>11-a-side***
Total	1.87±0.081			Total	1.87±0.081	
U8	1.29±0.127			5-a-side	1.14±0.067	
U10	1.10±0.066			7-a-side	1.16±0.091	
U12	1.05±0.050		Goal assists	9-a-side	1.07±0.067	
U14	1.05±0.050			11-a-side	1.10±0.100	
Total	1.13±0.044			Total	1.13±0.044	
U8	15.92±0.784	*U8>U10***		5-a-side	22.25±0.883	*5-a-side>7-a-side***
U10	11.43±0.455	*U8<U14**		7-a-side	18.54±0.846	*5-a-side>9-a-side***
U12	14.46±0.494	*U10<U12**	Ball contacts	9-a-side	12.38±0.452	*5-a-side>11-a-side***
U14	18.35±0.701	*U10<U14***		11-a-side	12.11±0.402	*7-a-side>9-a-side***
Total	15.11±0.327	*U12<U14***		Total	15.11±0.327	*7-a-side>11-a-side***
U8	1.52±0.131			5-a-side	1.68±0.125	
U10	1.40±0.113			7-a-side	1.88±0.180	
U12	1.61±0.108		Crossing	9-a-side	1.59±0.116	*7-a-side>11-a-side**
U14	1.83±0.161			11-a-side	1.30±0.109	
Total	1.62±0.069			Total	1.62±0.069	
U8	2.10±0.150			5-a-side	2.38±0.150	
U10	1.87±0.085			7-a-side	2.06±0.127	
U12	1.63±0.091	*U8>U12**	Turnover	9-a-side	1.81±0.085	*5-a-side>9-a-side**
U14	2.18±0.098	*U12<U14**		11-a-side	1.81±0.094	*5-a-side>11-a-side**
Total	1.96±0.055			Total	1.96±0.055	
U8	3.20±0.168			5-a-side	4.65±0.271	
U10	3.11±0.154			7-a-side	3.01±0.180	*5-a-side>7-a-side***
U12	3.00±0.176		Intersection	9-a-side	2.55±0.105	*5-a-side>9-a-side***
U14	2.93±0.169			11-a-side	2.74±0.123	*5-a-side>11-a-side***
Total	3.06±0.083			Total	3.06±0.083	
U8	1.44±0.119			5-a-side	1.28±0.080	
U10	1.45±0.095			7-a-side	1.46±0.115	
U12	1.33±0.082		Clearance	9-a-side	1.46±0.102	
U14	1.54±0.101			11-a-side	1.53±0.095	
Total	1.45±0.050			Total	1.45±0.050	
U8	1.06±0.059			5-a-side	1.20±0.082	
U10	1.07±0.046			7-a-side	1.08±0.058	
U12	1.19±0.065		Foul	9-a-side	1.04±0.040	
U14	1.10±0.069			11-a-side	1.13±0.063	
Total	1.12±0.031			Total	1.12±0.031	

Note: Significant difference across successful technical actions of players (p ≤ .05); and (p ≤ .001)**.*

The study findings reveal a consistent pattern indicating higher success rates of technical actions in smaller game formats (5-a-side and 7-a-side) compared to larger formats (9-a-side and 11-a-side). Specifically, analysis of Table 3 underscores the significance of this trend, particularly in successful front pass, side pass, back pass, short pass, reception, and goal actions.

Furthermore, smaller game formats exhibit elevated rates of unsuccessful technical actions relative to larger formats, with the 5-a-side format demonstrating the highest rates. Table 4 illustrates this trend, highlighting increased occurrences of unsuccessful front pass, side pass, short pass, and long pass.

Examining technical actions of variable impact in Table 5, we can see that on average, actions such as shot, shot on target, ball contacts, crossings, turnovers, and interceptions decrease as game format increases. This implies that young players exhibit more technical actions of variable impact in smaller game formats (5-a-side and 7-a-side) compared to larger formats (9-a-side and 11-a-side).

DISCUSSION

The aim of this study was to analyse the variations of technical actions between different game formats, and to investigate the effects of different age-groups in technical actions.

The main findings of this study confirm the hypothesis that different game formats and age-groups would induce differences in the technical performance patterns of the young soccer players. Specifically, it was demonstrated a significant influence of age group on the technical performance of young soccer players. Older age groups, particularly U14, demonstrated higher success rates in various technical actions such as front pass, side pass, back pass, short pass, and reception, suggesting that as players mature, they tend to exhibit greater proficiency in executing fundamental technical actions. Our findings are consistent with previous research indicating the superiority of smaller-sided game formats in promoting skill development among youth soccer players (Hill-Haas, Rowsell, Coutts, & Dawson, 2008; Figueiredo, Coelho-e-Silva, Sarmento, Moya, & Malina, 2020). The observed higher success rates in technical actions among older players also align with studies by (Kelly, Wilson, Jackson, & Williams, 2020; Huijgen, Elferink-Gemser, Lemmink, & Visscher, 2014; Ford, Carling, Garces, Marques, Miguel, Farrant, Stenling, Moreno, Le Gall, Holmström, Salmela, & Williams, 2012), highlighting the developmental progression of technical abilities throughout adolescence. Additionally, Ford et al. (2012) suggests that skill acquisition follows a developmental trajectory, with older players showing more refined technical abilities compared to their younger counterparts. However, it's noteworthy that while older players showed increased involvement in technical actions, they also demonstrated higher rates of unsuccessful technical actions, indicating a need for continued skill development and refinement across all age groups.

The research also underscores the impact of game format on the success rates of technical actions among young players. Smaller game formats, such as 5-a-side and 7-a-side, consistently yielded higher success rates in technical actions compared to larger formats like 9-a-side and 11-a-side, contrasting with the data from (Clemente, Praça, Aquino, Castillo, Raya-González, Rico-González, Afonso, Sarmento, Ana Silva, Rui Silva, & Ramirez-Campillo, 2023). This finding can perhaps be explained by the conceptual approach of the studies, since the aforementioned study focuses on small-sided games while our study is contextualized in formal games. This suggests that smaller-sided games provide a more conducive environment for skill refinement and execution among youth players, which is also supported by your (Hintermann, Born, Fuchslocher, Kern, & Romann, 2021). Additionally, smaller formats exhibited elevated rates of unsuccessful technical actions, implying that players may face greater challenges or opportunities for error in tighter spaces. The superiority of smaller-sided game formats in facilitating skill development has been widely documented in the literature (Hill-Haas et al., 2008; Figueiredo et al., 2020; Bergmann et al., 2022). Hill-Haas et al. (2008) demonstrated that small-sided games enhance technical proficiency, decision-making, and physical conditioning among youth players. Similarly, Figueiredo et al. (2019) emphasized the benefits of smaller formats in promoting skill acquisition and tactical understanding, supporting our findings of higher success rates in technical actions in 5-a-side and 7-a-side games. However, it's important to note that smaller formats also resulted in higher rates of technical actions of variable impact, indicating increased player involvement and decision-making opportunities.

Finally, The interaction between age group and game format highlights the importance of context-specific interventions in youth soccer development. While older players generally exhibited higher success rates in technical actions, the influence of game format remained significant across all age groups. For instance, even within the U14 age group, smaller formats demonstrated advantages in terms of technical proficiency and player involvement. Research by Memmert and Roth (2007) suggests that the effectiveness of training interventions depends on the developmental stage of the players. Similarly, Williams and Hodges (2005) emphasize the need for tailored approaches to skill acquisition based on the cognitive and physical capabilities of the players. Our study's findings underscore the significance of aligning match formats with the developmental needs of players to optimize learning and performance outcomes. This suggests that tailoring match formats to specific developmental needs is crucial for optimizing player engagement and performance trajectories.

CONCLUSIONS

In summary, the present study underscores the significance of providing developmentally appropriate match formats for youth soccer players. It emphasizes the efficacy of smaller-sided games, such as 5-a-side and 7-a-side, in fostering skill refinement and player involvement across different age groups. Coaches and administrators are urged to tailor match formats based on player age and developmental stage to optimize learning and performance outcomes. Furthermore, the importance of continuous skill development is emphasized, irrespective of age group or game format. Strategic planning informed by developmental principles and empirical evidence is crucial for creating an environment conducive to player growth, enjoyment, and sustained participation in soccer. This study enriches our understanding of the influence of game format and age group on success rates of technical performance in youth soccer, highlighting the necessity of customized interventions to enhance player development trajectories. However, acknowledging limitations such as sample size and study design, future research incorporating diverse methodologies is advocated to further elucidate player development dynamics and foster innovation in youth soccer development.

AUTHOR CONTRIBUTIONS

Ângelo Brito is responsible for the conception and design of the study; he drafted and wrote the manuscript; participated in the literature review; operationalized data collection, as well as the respective processing and presentation of results. Luis Freitas participated in the conception and design of the study; writing the initial draft and reviewing the literature; as well as in the collection, processing and analysis of data. The authors contributed to the manuscript, approved the final version for submission and consent to its publication in JHSE.

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