

Do contextual factors, tournament level, and location affect external match load in elite Brazilian youth soccer players?

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Abstract

Objective: The present study compares the external load of a Brazilian first-division U-20 team match between the tournament level (regional vs. national) and the match's location (home or away). **Methods:** Thirty-five athletes from a U-20 team belonging to the same Brazilian first-division team participated in the study (age=19.1 ±0.58 years; body mass=70.1 ±7.64 kg; height=176.1 ±6.28 cm). Twenty-eight games belonging to the national championship (14 Brasileirão matches) and regional championship (14 Carioca state matches) were analyzed, following these external load variables through a global positioning system: total distance traveled (TD), player load (PL), distance traveled >20 km/h, distance traveled >25km/h, the number of accelerations and decelerations > 2 m/s² (AD2) and >3 m/s² (AD3) and the number of Repeat High-Intensity Efforts (RHIE). A two-factor ANOVA compared the tournament level and the match's location, and the effect size (ES) was verified, considering p≤0.05. **Results:** Significant differences were found in TD (F=3.42 and ES=0.7), PL (F=4.2 and ES=0.8), D20 (F=2.87 and ES=0.67), AD3 (F=6.49 and ES=0.97), RHIE (F=14.6 and ES=1.18) and in AD2 (F=10.1 and ES=1.24). No effects were found according to location or interaction effects (p>0.1). **Conclusion:** Findings indicated that the tournament type impacts the external match load - with higher effort values in the national tournament. The location did not affect the external load, but further studies are required to corroborate these results due to the lack of public presence because of the COVID-19 pandemic. The following data may be helpful for the coaching staff to consider this factor when planning and programming the training load concerning the tournament in which they are participating.

Keywords: Football, Youth Sports, Physiology, Biomechanics, Match Running performance, Athletic Performance.

Introduction

Soccer is a sport of an intermittent nature, where players alternate high-intensity actions with brief periods of rest (Dolci et al., 2020). It has become common and **advantageous** to monitor external load (Weston, 2018)-defined as a measurable aspect that is occurring externally to the athlete (Impellizzeri et al., 2018)-during training and matches for coaches, as it can be used for weekly training planning (Malone et al., 2015) for the player to arrive in an optimal condition at match time and during the match to analyze fatigue on subsequent days (Freire et al., 2021). In team sports, the external load is usually described through the total distance covered, the distance covered in different speed bands, and the number of explosive actions, such as accelerations, decelerations, and jumps (Freire et al., 2022; Pérez-Contreras et al., 2022). The external match load has been influenced by contextual factors, such as match location, opponent quality, and tactical formation, among others (Aquino et al., 2020; Freire et al., 2022; Gonçalves et al., 2021).

Monitoring **the running performance of a young soccer player** using a global positioning system is essential to current youth soccer players' progress (Palucci Vieira et al., 2018). This **fact** is revealed by a remarkable change in knowledge over the last decade when findings showed a lack of information on running performance in youth soccer players (Gastin et al., 2017; Haycraft et al., 2019; Kobal et al., 2016; Nikolaidis et al., 2016). Several additional studies have collected and evaluated the running performance in soccer adult athletes, observing total distance during matches and training (Gimenez et al., 2018), player loads (Sangnier et al., 2019), sprints distances (Naser & Ali, 2016), accelerations and decelerations (Ingebrigtsen et al., 2015), as repeat high-intensity efforts, and others GPS variables (Kempton et al., 2015; Morin et al., 2021; Reinhardt et al., 2019; Shearer et al., 2017; Trewin et al., 2018). Most external load studies that have described the contextual factors affecting external match load have been **on** adult players, with fewer published on young players (Palucci Vieira et al., 2019). In fact, in a recent systematic review on match running performance in players, it is

suggested to analyze contextual factors due to the scarce literature on this population (Palucci Vieira et al., 2019). The literature on external match load differences according to tournament type and location is very scarce, and most only with adult teams (Augusto et al., 2021; Freire et al., 2022; Gonçalves et al., 2021). To date, only one study **analyzed** match load according to **the** type of tournament in adult professional players, where higher values **were** found in **the** national tournament than **in the** regional tournament in **the** relative distance and sprint frequency >24 km/h (Freire et al., 2022). **Concerning the** location effect, controversial results are found in the literature, possibly by the difference between **the** public in the different leagues and the effect of **long-distance** travel in the visit games versus without travel (Augusto et al., 2021).

On the other hand, it has been found that there is a relationship between the external training load with the match load (Silva et al., 2021). Knowing whether these factors **influence the external match load could be helpful to the base categories' technical team in planning the training weeks' loads**. Thus, the objective of the present study is to compare the external match load of a Brazilian **first-division** U-20 team between tournament levels (national vs. regional) and locations (home vs. away). It is hypothesized that in the national tournament, players should have higher external load values due to **the tournament's importance and the opponents' quality** (Gonçalves et al., 2021; Link & De Lorenzo, 2016).

Methods

Design

The present exploratory-descriptive study was conducted with a cross-sectional descriptive design. During each match, participants' running performance was monitored using a GPS device; the statistical analysis compared the external load between tournaments (national vs. regional) and location (home vs. away).

Sample

A non-random convenience sample was used. Twenty-eight games belonging to the national championship (n=14 Brasileiro games, with 95 running performances, separated by seven home, vs. seven away, with 91 running performances) and regional championship (14 carioca state games with 98 running performances, vs. seven away, with 96 running performances) were analyzed from thirty-five athletes from a U-20 team belonging to the first division of Brazil who participated in the study (age=19.1 $\pm$ 0.58 years; body mass=70.1 $\pm$ 7.64 kg; height=176.1 $\pm$ 6.28 cm). These performances were collected from **younger professional** athletes who competed in national and state representative championships **once** or twice per week and were regularly training (technical and tactical) 5 times a week during the evaluation period. To be included in the study, the athletes had to participate in at least one game, aged over 18 years, without injuries, and with more than **one year** at the professional soccer level.

Procedures

The games of the year 2020 were analyzed. That year, due to the coronavirus pandemic (COVID-19), the presence of the public was not allowed in the matches. Before each match, the athletes performed the same standardized warm-up conducted by the physical trainer before a substitute player entered. The external load of the match was collected from all the players who participated and normalized by the minutes played (intensity of the load).

Match External Load

To analyze the external load of the matches, a global positioning system (GPS) X7 - Catapult Sports, Melbourne, Australia; version firmware 7.27) was used, which has a sampling frequency of 10 hertz (Johnston et al., 2014), an accelerometer and gyroscope 3D with a sampling frequency of 100Hz. The GPS device was positioned using an elastic shoulder harness to be placed between the bowler's shoulder blades at the base of the cervical spine (Akyildiz et al., 2022). The following variables were analyzed: total distance traveled (TD), player load (PL), distance traveled >20 km/h, distance traveled >25 km/h, the number of accelerations and decelerations > 2 m/s² (AD2), and >3 m/s² (AD3) and the number of Repeat High-Intensity Efforts (RHIE) - 3 high-intensity efforts with an interval of up to 21 seconds between actions. All variables were normalized by the time the player participated during the match and have been commonly reported in other soccer studies (Freire et al., 2021; Freire et al., 2020; Pérez-Contreras et al., 2022).

Statistical analysis

The normality of the variables was analyzed through the Shapiro-Wilk test, where a normal distribution was assumed, and descriptive statistics were presented through the mean and standard deviation (SD). The influence of external load was analyzed with the factors through a two-factor ANOVA (type of tournament and place).

For the interaction effect, the effect size was expressed as partial eta squared (η^2p) and for the main effects as Cohen's d (mean difference/SD pooled), since in posterior ANOVA analysis, only one main factor was found to have an effect. The following thresholds were used to indicate Cohen's d categorically: 0 to 0.19 trivial, 0.2 to 0.59 small, 0.6 to 1.19 moderate, 1.2 to 1.99 large, 2 to 4.0 very large (Hopkins et al., 2009). The statistics were carried out with SPSS version 25 software. Due to the superiority hypothesis, an alpha of 0.1 was established for the main effects.

Results

Table 1 shows the external load's descriptive statistics according to the tournament type and location.
Table 1. Description of external load between tournaments and location of elite Brazilian youth soccer players.

Variables	National				Regional				Interaction		
	Home		Away		Home		Away				
	M	±SD	M	±SD	M	±SD	M	±SD	F	p	η ² p
TD (m/min)	103	4.08	106	2.03	102	4.54	102	5.06	1.00	0.33	0.04
PL (count/min)	9.84	0.48	10	0.33	9.54	0.49	9.58	0.52	0.14	0.71	0.01
D20 (m/min)	7.16	0.39	7.06	0.66	6.73	0.84	6.41	1.22	0.12	0.73	0.01
D25 (m/min)	1.56	0.19	1.36	0.32	1.49	0.3	1.48	0.40	0.66	0.43	0.03
AD2 (count/min)	6.14	0.34	6.01	0.42	5.33	0.99	5.15	0.83	0.01	0.92	0.00
AD3 (count/min)	1.36	0.10	1.27	0.13	1.12	0.35	1.02	0.33	0.01	0.93	0.00
RHIE (count/min)	0.22	0.02	0.21	0.02	0.18	0.03	0.17	0.02	0.21	0.65	0.01

M mean; ±SD standard deviation; η²p partial eta squared; TD total distance; PL player load; D20 distance >20km/h; D25 distance >25 km/h; AD2 number of accelerations and decelerations >2m/s²; AD3 number of accelerations and decelerations >3m/s²; RHIE Repeat High-Intensity Efforts.

No differences were found in the external load according to the interaction between tournaments and locations (p>0.1, Table 1).

Table 2 shows the descriptive statistics of the external load according to the tournament of elite Brazilian youth soccer players.

Table 2. Description of external load between tournament levels of elite Brazilian youth soccer players.

Variables	National		Regional		Tournament		
	M	±SD	M	±SD	F	p	ES
TD (m/min)	105	3.5	102	4.62	3.42	0.08	0.70
PL (count/min)	9.92	0.4	9.56	0.49	4.20	0.05	0.80
D20 (m/min)	7.11	0.52	6.57	1.02	2.87	0.10	0.67
D25 (m/min)	1.46	0.28	1.48	0.34	0.05	0.82	-0.06
AD2 (count/min)	6.08	0.37	5.24	0.88	10.1	≤0.01	1.24
AD3 (count/min)	1.31	0.12	1.07	0.33	6.49	0.02	0.97
RHIE (count/min)	0.21	0.02	0.18	0.03	14.6	≤0.01	1.18

M mean; ±SD standard deviation; ES d Cohen effect size; TD total distance; PL player load; D20 distance >20km/h; D25 distance >25 km/h; AD2 number of accelerations and decelerations >2m/s²; AD3 number of accelerations and decelerations >3m/s²; RHIE Repeat High-Intensity Efforts.

Table 2 demonstrated significant differences comparing national and regional tournaments (p≤0.01) in TD (F=3.42 and ES=0.7 - moderate), PL (F=4.2 and ES=0.8 - moderate), D20 (F=2.87 and ES=0.67 - moderate), AD3 (F=6.49 and ES=0.97 - moderate), RHIE (F=14.6 and ES=1.18 - moderate) and in AD2 (F=10.1 and ES=1.24 - large).

Table 3 demonstrates the descriptive statistics of the external load according to the tournament of elite Brazilian youth soccer players.

Table 3. Description of external load between home vs. away location of elite Brazilian youth soccer players.

Variables	Home		Away		Location		
	M	±SD	M	±SD	F	p	ES
TD (m/min)	102	4.2	104	4.35	1.06	0.31	-0.37
PL (count/min)	9.69	0.49	9.8	0.47	0.37	0.55	-0.23
D20 (m/min)	6.95	0.66	6.74	1.00	0.45	0.51	0.25
D25 (m/min)	1.52	0.24	1.42	0.36	0.78	0.39	0.33
AD2 (count/min)	5.74	0.83	5.58	0.78	0.34	0.57	0.20
AD3 (count/min)	1.24	0.28	1.15	0.27	0.94	0.34	0.33
RHIE (count/min)	0.20	0.03	0.19	0.03	0.59	0.45	0.33

M mean; ±SD standard deviation; ES d Cohen effect size; TD total distance; PL player load; D20 distance >20km/h; D25 distance >25 km/h; AD2 number of accelerations and decelerations >2m/s²; AD3 number of accelerations and decelerations >3m/s²; RHIE Repeat High-Intensity Efforts.

Table 3 presented no effects between home and away locations (p>0.1).

Discussion

The main findings of the present study were effects on external match load in TD, PL, D20, AD2, AD3, and RHIE by tournament type, where higher values were found in national tournaments (NT) than in regional tournaments (RT). No effects of match location or interaction effects were found.

Concerning the differences according to the type of tournament, Freire et al. (2022) found in their **study conducted** in the same league but as an adult and comparing two other tournaments (cup and international), found that TD, number of sprints over 18 and 24 km/h, PL, and decelerations were higher in NT than in RT. Accelerations ($p=0.085$) and distance over 18 km/h ($p=0.067$), according to statistical significance (Wasserstein et al., 2019), could also be higher in NT than in RT. This result may be due to two other factors, the opponent's quality and the match's importance since the best regional teams participate in the national tournament. Aquino et al. (2021) found that when two Brazilian **second-division** teams faced teams of higher quality (place in the ranking), they had higher values of TD and **the** number of absolute accelerations. **In** agreement with our results, the location had no main effect on the external load and only had an interaction effect when the level factors of the team analyzed **were** included (a top team and a low-ranking team). In another study in the Brazilian first division of a tournament in 2017, effects on external load according to the location were found (Aquino et al., 2020). **When** the team played at home, it had higher values of external load (Aquino et al., 2020). Another study in **the** Brazilian regional first division tournament **in** 2018 (Gonçalves et al., 2021) found that location affected the distance at a high intensity (based on individual thresholds per player) and the opponent quality factor on TD. In these studies, when teams faced opponents of higher quality (according to ranking, i.e., place in the final table), they had higher values of external load. Augusto et al. (2021) only found a difference in total distance between local and visit games but are not relativized by match minutes, **which** can affect the analysis. **Other results found that distance travel was affected by high-intensity and sprint distance, indicating other factors to be analyzed during away games** (Fowler et al., 2015).

The type of tournament effect agrees with our hypothesis and results, possibly due to the quality factor of the opponents encountered in the national tournament as well as the importance of the tournament (Gonçalves et al., 2021; Link & De Lorenzo, 2016). Controversial results are found in the literature, according to location effect in external load could be due to the presence/absence of the public and, in the case of presence, the quantity (Carling et al., 2014; Palucci Vieira et al., 2019) and by the distance of travel in away games (Augusto et al., 2021). In the study by Aquino et al. (2021), the championship analyzed was **in** 2020, the pandemic of COVID-19. **During** that period, the teams had to play without the public, unlike the other studies analyzed (2017-2018). Although the presence of the public is allowed in youth soccer matches, in the year in which the matches were analyzed (2020), the presence of the public was not allowed due to the pandemic of COVID-19, which could explain **the** case that there were no differences.

Limitations and Future Research

One of the main limitations is the number of matches analyzed and the fact that only one team's load was analyzed. Further analyses are required to corroborate these results. Future research should continue to analyze these and other contextual factors such as team formation, other tournament systems (i.e., quarterfinals, semifinals, finals), and travel distance. Also, to corroborate these results in other cohorts, such as adult and female youth players (starters and substituted players). Other external load and internal load variables should also be analyzed. Finally, the public factor should be analyzed (absence or presence, and in case of presence, the quantity, i.e., a lot versus a small amount of public).

Conclusion

From the results, it can be concluded that the type of tournament influences the external match load in elite Brazilian youth soccer players, where higher total distance during the game, acceleration, and deceleration frequencies at the national level than in the regional championships. High-intensity efforts and increased distance could be associated with the opponent's quality, as the tournament's importance. The location did not affect the external load, but further studies are required to corroborate these results due to the lack of public presence because of the COVID-19 pandemic. The following data may be helpful for coaches to consider the championship level when planning and scheduling the training load concerning the tournament in which they are participating.

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

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