Article

It is high time to increase elite soccer substitutions permanently

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Abstract: The soccer injury rate is distinctly higher during matches than the training sessions. Rules determine how to play, generating specific kinds of fatigue which is associated with the injury incidence. No research has evaluated the impact of potential rule-induced physical demands in soccer, or comparing sports. Understanding the differences might be useful for enhancing rules (e.g., safer sport). Therefore, the aims of this study were: a) to described the differences in the rule-induced physical demands of soccer, futsal, basketball, and handball; and b) to evaluate whether soccer rule-induced physical demands are different than the other invasion intermittent team sports, focusing the impact of the substitutions rules. Data were collected from different sports rules (i.e., soccer, futsal, basketball, and handball), and performed hypothetical corrections to equate the other team sports to the soccer (i.e., court dimensions/number of players). The data showed that soccer has higher rule-induced physical demands: lower substitutions, higher dimensions in absolute (eight to 15 times), and relative (four to eight times) values. Hypothetical corrections showed that soccer has remarkably large differences. Therefore, we conclude that soccer has remarkably higher rule-induced physical demands than other team sports, and allowing unlimited substitutions in soccer is a must.

Keywords: coronavirus; football; rules; sports medicine; prophylaxis

1. Introduction

The overall load of soccer matches (i.e., cognitive decision making, tactical and technical proficiency inside a set of well-advanced physical capacities) results in post-match fatigue which is associated with high match-induced muscle damage and inflammatory responses, dehydration, and glycogen depletion [1–3]. A systematic review concluded that a period of ~3 days post-match, for example, is insufficient to fully recover homeostatic balance caused by a soccer match load [1]. Compared to basketball, volleyball, and handball, soccer is the most demanding sport with much higher muscle damage and inflammatory markers than the other sports [4]. Indeed, another systematic review showed that soccer has the largest total running distances, including high-intensity running and sprinting in comparison with futsal, basketball, and handball [5], and increments in soccer demands has been recognized through the years [6]. Barnes et al. investigated physical and technical soccer performance across a 7-season period in the English Premier League. Their data confirmed an increment of ‘only’ ~2% in total distance covered during a match, however they reported impressive increments in distances covered in high-intensity running distance (~30%),

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actions (~50%), sprint distance (~35%), and the number of sprints (~85%) [6]. This high-intensity increment may be a concern because there is a strong association between high-speed running and injuries [7,8]. Additionally, due to commitments for economic and entertainment reasons, soccer has presented congested schedules (i.e., multiple games within 72-96-h), which is a relevant issue for medical staff [9,10]. For instance, data over 11 seasons (from 27 teams) exhibited that matches with short recovery (≤ four days) were related to augmented muscle injury rates when compared with longer recovery periods (≥ six days) [11], generating the average cost of an elite player injured of ~ €500.000 (~1 month) [12]. Also, soccer is associated with long-term sequelae due to the high loading on hip and knee joints [13], early osteoarthritis and poor quality of life after retirement [14]. Additionally, soccer injuries may produce a meaningful loss of time from participation, or even an early retirement [15].

To confront the issues aforementioned, several studies have investigated strategies to improve recovery, and to minimize soccer-induced muscle damage and fatigue [2]. For example, compression garments [16,17], cold water immersion [2], myofascial release [18], etc. Also, the literature has a myriad of studies seeking to find smarter training programs or better control of the training load [8], nutritional aids [19], sleep hygiene [20], and other strategies. Surprisingly, however, there is no scientific study investigating the potential issues caused by the rules of the game itself. Reasoning scientifically, the rules of any sport are the 'cause', and the 'way to play' is the effect. The injury rate is noticeably higher (~ 10 times) during the soccer matches than during the training sessions [21]. Therefore, the rule evaluation to manage the main cause of issues (i.e., match) is necessary, once rules should often be updated to enhance any sport for better safety (e.g., shin guards), prevention (e.g., time for hydration), entertainment, cleaner (e.g., video referee), etc.

On 11 March 2020, the World Health Organization announced the coronavirus disease (COVID-19) outbreak as a pandemic, and the regular sports season worldwide was interrupted. After months of interruption (~3 or 4 months), most sports leagues have resumed the seasons. Due to the overlap of schedules competitions caused by COVID-19 interruption, most soccer teams will face very congested schedules on returning (e.g., games every Sunday and Wednesday), which potentially increases the risk of injuries (e.g., muscle and ligament injuries) [10,11]. Thus, The Fédération Internationale de Football Association (FIFA) has changed the substitution rule (temporarily) increasing from three substitutions to up to five each team (each match), aiming to minimize the impact on player welfare [22]. There is no research regarding a deep investigation on the impact of potential rule-induced physical demands in soccer (e.g., area per player and fewer substitutes forced by the law of the game), and none comparing different sports in this context. Understanding the potential differences among the rules, which may impact the sport-specific fatigue and eventually the injury risk [10], might be useful for practical applications (e.g., updating and enhancing rules for a safer/healthier sport). Therefore, the aims of this study were: a) to described the differences in the rule-induced physical demands of soccer, futsal, basketball, and handball; and b) to evaluate whether soccer rule-induced physical demands are different than the other invasion intermittent team sports, focusing the impact of the substitutions rules (including changes due to COVID-19). We hypothesized that soccer would have potentially higher rule-induced physical demands than other team sports, even considering the changes due to COVID-19.

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2. Materials and Methods

2.1. Experimental design

In order to meet the aims of this study, first rule-specific information for the international top men was obtained from each team sport selected. Two authors independently highlighted which rules (in each sport) may have an impact on the physical demands of the players (e.g., total distance covered). For example, the size of the goal (or basket) has a minimal potential effect on physical demands. On the other hand, the dimensions of the court/field (absolute area and relative area per player), time of playing, and the absolute and relative number of substitutes logically impact the demands of the sport. After a consensus between the two authors, the data were collected in detail. Then, data were organized in Excel sheets for calculations (e.g., percentage of players - relative substitutions allowed/total players available) , and quantitative and qualitative analyses were performed and confronted with the literature already existent on physiological (e.g., muscle damage and inflammatory markers) and time-motion (e.g., number of sprints, jumps, distances covered in several speed zones) sport demands.

2.2. Rules of the team sports

Four invasive team sports (i.e., soccer, futsal, handball, and basketball)l were selected because these sports have several similarities, and are popular worldwide. All are invasive intermittent team sports, have body contact, require quick (and accurate) decision making and optimum scanning (reading the game), and the purpose is to score a goal or a basket on the opponent territory [23,24].

The specific rule information of each team sport were obtained from official websites in July of 2020: soccer, futsal [25], basketball [26], and handball [27]. To meet the current research aims, specific information from the rules which may impact the physical demand of the players were collected. For instance, information about the number of players inside the field (soccer) or court (other team sports), availability of substitutes in the bench area and when they are allowed to play (including the substitutions changes due to COVID-19), time load of each team sport, time-outs, field/court dimensions and the relation between and among that information.

2.3. Number of games per season

The number of games per season (2018-2019) from top four teams (international, men, elite) of each sport were obtained from websites of each team or official federation. The teams for each sport are presented as a table in the supplementary document.

2.4 Data analysis

This study developed a descriptive, cross-sectional design, therefore quantitative data presentation is essentially descriptive in nature. Due to the nature of this study (i.e., there is only one rule for each sport), the data were not judged from a traditional statistical point of view (e.g., p value, mean values and standard deviation). Alternatively, a qualitative analysis was performed, conducted by two authors focusing on the potential practical implications. All other authors read this analysis carefully, and edits have been combined. Such kind of data analysis (e.g., progressive statistics and case research) has been used in the Sports Medicine and Sports Science fields [28,29].

3. Results

3.1. Rules of the team sports

Data about the number of players, substitutions, time (total, breaks, time-outs), and dimensions of the field/court are presented in Table 1. Overall, soccer rules demand higher dimensions of the field and lower substitutions, both in absolute and relative values.

Soccer has no time-out during the game, but the others (i.e., futsal, basketball and handball) have (range from 4 to 10 per game). Another distinction is that soccer has the offside rule, but all other team sports here evaluated no.

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Table 1. Description of the rules and mathematical outcomes obtained of each team sport, focusing on the substitutions.

Variables		soccer	futsal	basketball	handball
players inside field/court	A	11	5	5	7
available substitutes *	B	12	9	7	9
total players available	C (A + B)	23	14	12	16
substitutions allowed	**D**	**3**	**unlimited*** **	**unlimited*** **	**unlimited*** **
maximum players involved in a game (all substitutions allowed)	E	14 (A + D)	14 (C)	12 (C)	16 (C)
**COVID-19: substitutions allowed ** **	**F**	**5**	**unlimited*** **	**unlimited*** **	**unlimited*** **
COVID-19: maximum players involved (all substitutions allowed)	G (A + F)	16	14	12	16
relative substitutions allowed/total players available	H (D / C)	13%	100%	100%	100%
relative COVID-19: substitutions allowed/total players available	I (F / C)	21.7%	100%	100%	100%
a substituted player can return to the game?	J	No	Yes	Yes	Yes
total game time and [half-time] (min)	K	90 [15]	40 [15]	40 [19]	60 [10]
total time load (A*K; min)	L	990	200	200	420
L/E (min/player)	M	70.7	14.3	16.7	26.3
COVID-19: L/G (min/player)	N	61.9	14.3	16.7	26.3
L/C* if soccer could use all players available (min/player)**	**O**	**43**	**14.3**	**16.7**	**26.3**
mitigation using COVID-19 substitutions allowed (from M to N)	P	- 12.4%	- 0%	- 0%	- 0%
mitigation using all substitutions allowed (from M to O)	Q	-39.2%	- 0%	- 0%	- 0%

* international and official competitions – minimum dimensions (for soccer); maximum allowed by rules; ** soccer has changed number of maximum substitutions allowed from 3 to 5, due to postponing the regular calendar caused by the COVID-19 pandemic; *** unlimited, using total players available (C).

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Table 2 shows hypothetical corrections to equate the soccer dimension, changing the current court dimensions.

Table 2 – Hypothetical 'corrections' to equate soccer dimensions (6400 m^2/22 players = ~291 m^2/players), changing the current court dimensions.

Variables		**soccer**	**futsal**	**basketball**	**handball**
field/court dimension length x width (m) *	A	100 x 64	38 x 20	28 x 15	40 x 20
total field/court dimension (m^2) *	B	6400	760	420	800
normalized total dimension (% of soccer)	C	100%	11.9%	6.6%	12.5%
number of players inside field or court	D	**22** (11 vs 11)	**10** (5 vs 5)	**10** (5 vs 5)	**14** (7 vs 7)
number of players inside field or court (% of soccer)	E	100%	45.4%	45.4%	63.6%
area per player (B / D) (m^2/player)	F	**291**	76	42	57
area per player (B / D) (% of soccer)	**G**	**100%**	**26%**	**14.4%**	**19.6%**
"increasing A" (m) to equalize soccer (F)	**H**	-	**74 x 39**	**74 x 39**	**90 x 45**
"increased B" from H (m^2)	**I**	-	**2886**	**2886**	**4050**
"equalized area per player (I / D) (m^2/player)	**J**	**291**	**289**	**289**	**289**

Hypothetical corrections to equate soccer to other team sports by decreasing the number of players of the other team sports, or increasing the number of soccer players are shown in Figures 1 and 2.

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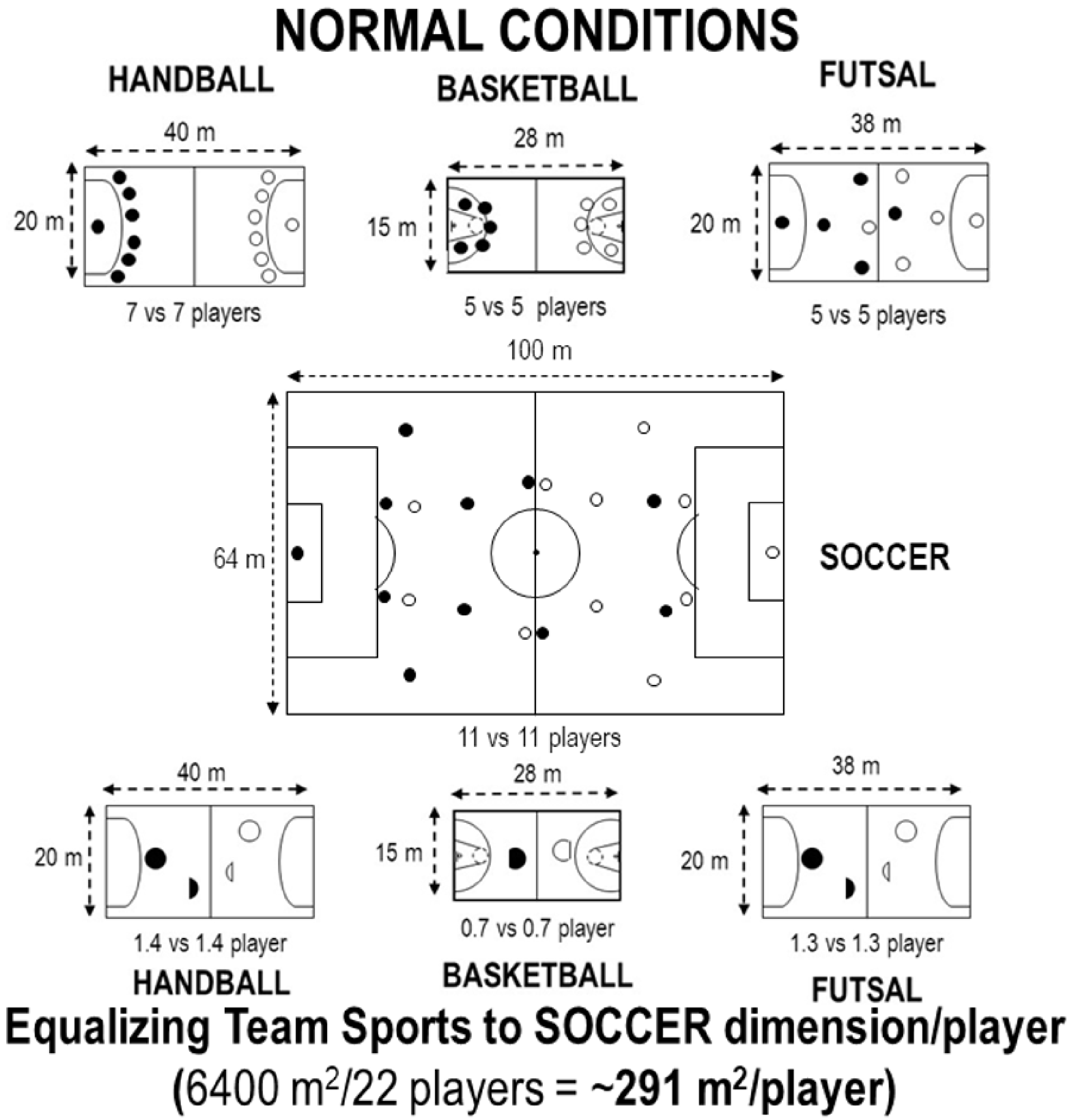

Figure 1. Regular dimensions and number of players inside the field/court (top). On the bottom, hypothetical corrections to equate soccer (~291 m^2/player) to other team sports dimensions by decreasing the number of players.

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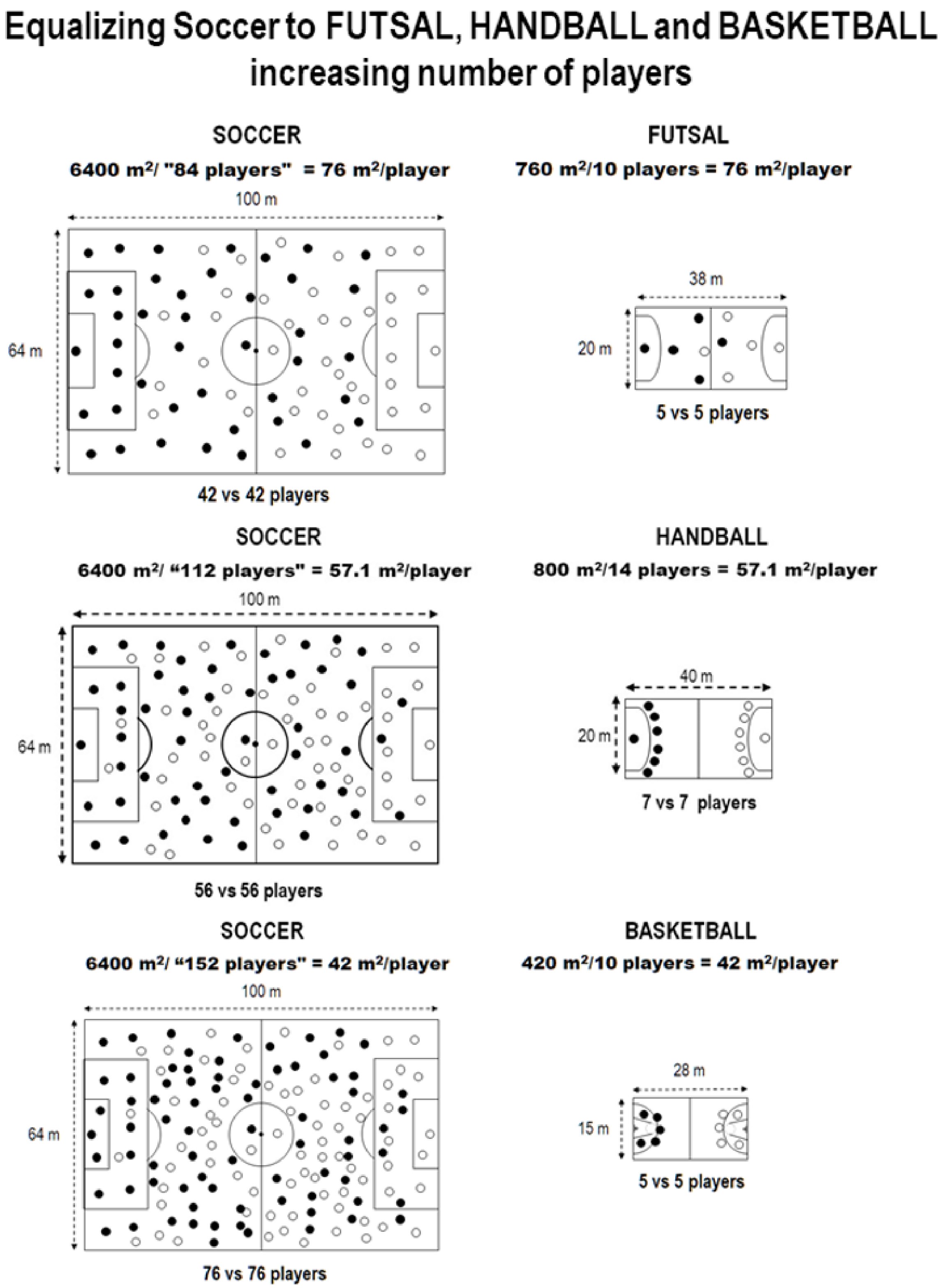

Figure 2. Hypothetical corrections to equate soccer (i.e., to have similar m²/player) to other team sports relative dimensions, by increasing the number of soccer players.

3.2. Number of games per season

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Basketball presented the highest number of matches per season, followed by soccer and futsal (similar), and lately handball in top clubs (Table 3).

Table 3 – Number of matches of the season 2018-2019 for all team sports evaluated (men, elite teams).

soccer	**futsal**	**basketball**	**handball**
Liverpool (62)	Magnus (57)	CSKA Moscow (71)	Vardar Skopje (50)
Tottenham Hotspur (62)	Sporting Lisboa (58)	Real Madrid (86)	Barcelona Lassa (53)
Flamengo (76)	Corinthians (74)	Barcelona Lassa (84)	MVM Veszprém (51)
River Plate (50)	Barcelona (62)	Anadolu Efes (77)	Vive Targi Kielce (52)
62.5*	**62.8***	**79.5***	**51.5***

* mean

The proportion between dimensions of the field/courts, number of players, the ratio between total match time and number of matches/season and substitutions corrections are shown in Figure 3.

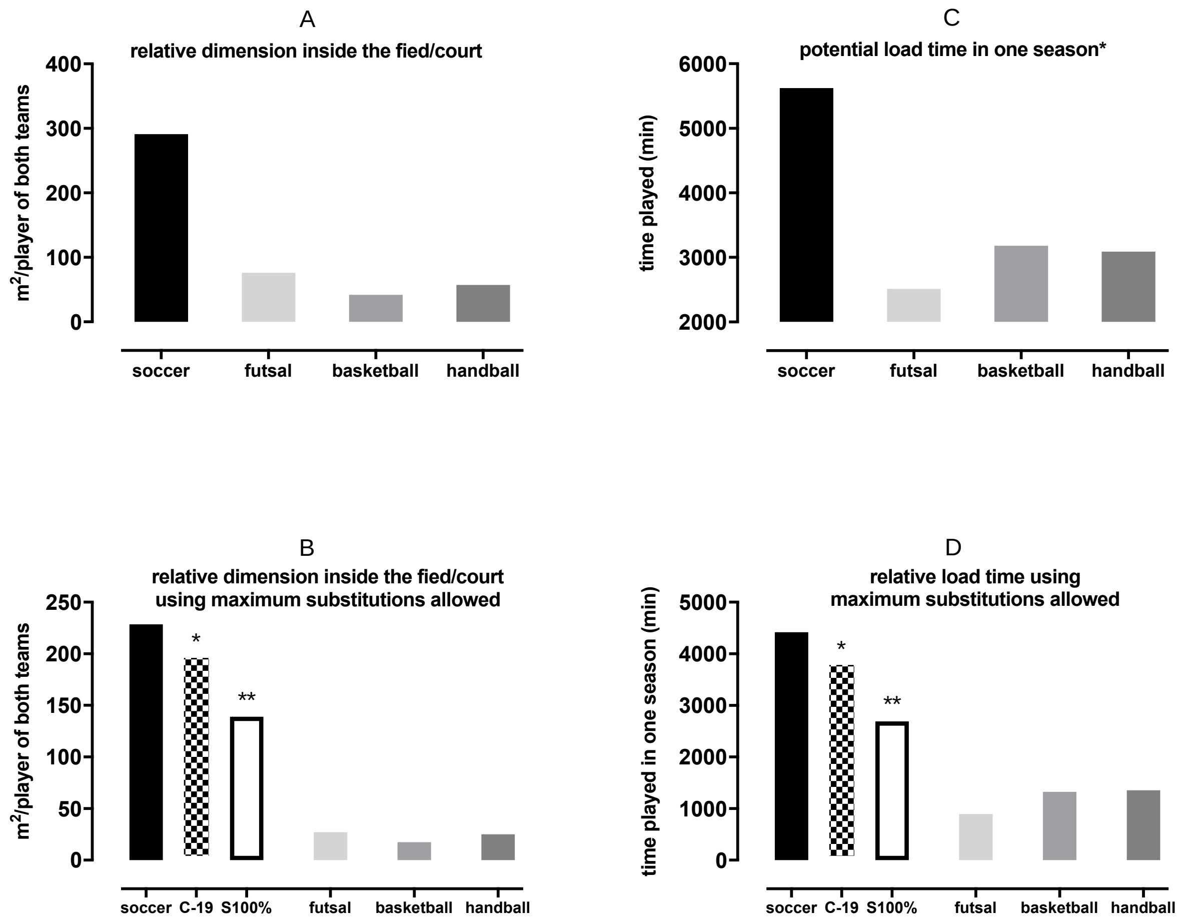

Figure 3. Proportion between dimensions of the fields/courts (A and B), considering two opposing teams (e.g., soccer 11 vs. 11 = 22 total). Panel A shows values related to the regular number of players inside the field/court. Panel B shows the values using the maximal players involved in a game according to the rules for substitutes (see Table 1 "E"); *C-19 means the increased maximum substitutions allowed for soccer (from 3 to 5), due to postponing the calendar caused by the COVID-

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19 pandemic; **S100% represents a hypothetical simulation if soccer could make unlimited substitutions (i.e., using total players available in a game (i.e., 23 each team). So, 6400 m^2 (soccer area) / 46 players (23 x 2 teams) = 139 m^2/player. Panel C shows a ratio between total game time X number of matches (e.g., soccer 90 min X 62.5 matches/season [Table 3] = ~5625 min/season). Panel D presents the load time using the maximum substitutions allowed in each sport. Note that for soccer we added the C-19* and S100%** corrections to equate (similar to panel B explanation).

4. Discussion

This study shows for the first time a comparison of the rules which may impact the physical demands of popular team sports and that soccer has an enormous discrepancy, eventually needing to update the rules. Our main findings show that soccer presents remarkably higher rule-induced physical demands than futsal, basketball, and handball, corroborating studies related with time-motion and physiological demands [4,5]. A capital reason is the higher surface area of the soccer field, in both absolute (eight to fifteen times) and relative terms (per player; four to eight times), than in the other sports. Also, the restricted possibility to replace players during the games (i.e., only three substitutions according to the regular rule) is crucial; the other team sports can limitlessly replace players. Even considering the possibility to increase the number of substitutions during the match, due to the COVID-19 changes, the discrepancy in the soccer rule-induced physical demands is still too big (Figure 3). The current data (Table 1 H, I, N, O, P and Q and Figure 3B and D) support that soccer rule-induced physical demands causes an overload on the players compared with other team sports. Once the injury rate is clearly higher (~ 10 times) during the matches than during the training sessions [21], the changes due to the COVID-19 (i.e., up to five substitutions) seem not to be enough.

Recently a study concluded that non-starters (i.e., substitutes who played) had a lower internal and external load, considering matches and training sessions, during congested schedules [30], confirming that matches are a crucial training component (i.e., substitutes might be detrained). Allowing soccer to have unlimited substitutions across the games, would potentially be a "game changer". This would be easier to implement in comparison to other actions; e.g. reducing the number competitions since soccer has a huge economic impact [31]. Because the congested schedules in soccer are a relevant concern [9,11,32], and it is related to accumulated fatigue and higher risk of injuries [11], unlimited substitutions might be an intelligent decision. Allowing soccer unlimited substitutions, including turnover of players (e.g., only three opportunities to make substitutions to avoid disruption), would likely prevent the drop in the intensity of the matches, especially in the second half [1,33,34]. Evidence exists for improvement. For example, substitutes covered a greater high-intensity-running distance [35], and midfield substitutes covered a greater overall distance and distance at high-intensities compared to other midfield team-mates who remained on the pitch regarding the same period of the game [36]. Additionally, Hill et al. [37] concluded that substitutes may provide physical and/or tactical impetus, corroborating a basketball study that showed better scoring after substitutions [38].

Although a comparison among different sports is limited for obvious reasons (i.e., they "really" are different sports), the disparity among soccer and the others is enormous. It could be considered as "villain" the current rule of substitutions. For example, from all players available in a match (soccer 11 playing and 12 on the bench), the soccer coach can use only 13% or 21.7% (three players regular rules and five during COVID-19) against 100% in the other sports (Table 1). Besides, in all other sports, a replaced player is allowed to play again. A long time ago, a study compared the

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epidemiology of injuries between soccer and handball concluding that a modification in soccer rules concerning substitutions was a must [39]. The author showed that 80% of the soccer players had to wait in the field despite an injury because the substitute had already been done, probably worsening the injury [39]. If in 1984 it already was nonsensical, nowadays we cannot find an adjective to mention, once soccer matches are now much more demanding [1,4,6], and the number of games per season probably also. Unlimited substitutions potentially would reduce the injury risk during soccer matches/season, which can improve team performance since an 11-year follow-up of the UEFA Champions League concluded that injuries affect team performance negatively in soccer [40]. Recently due to the COVID-19 pandemic, two more substitutions per match were allowed (up to five total) in soccer. The contradiction is that the reason is to "protect" the physical integrity of the players. Why not release the substitutions regularly, if the reason is to prevent injuries? In the same way that coaches change the rules during small-sided games (e.g., different number of players, smaller area per player) during training to target specific effects [41], why not change the substitution rules in official matches to obtain benefits?

Besides the substitution limitations, soccer is the only sport (here investigated) which does not allow the substituted player to return to the same match, has no time-out (i.e., no chance for brief recovery), and has the offside rule (which obligates the players to move back and forth). Such conditions require even more physical efforts from soccer players. In this sense, it is interesting to note that the time load would be reduced by ~40% if soccer could use all players available (Table 1, Q). In our data, we performed corrections to equate soccer to other sports by increasing the court dimensions (Table 2, Figure 1 and Figure 2). It is relevant to realize the huge changes that are necessary to have similar conditions. It does not make sense a basketball match "1 vs. 1" (Figure 1). Or a soccer match with 76 players (Figure 2) inside the field.

Our data showed that basketball has a higher number of matches during a season while soccer and futsal are similar and handball a little behind (Table 3). Although soccer has fewer matches per season, when we investigated the ratio of matches and time load exposure, soccer shows around a two-fold greater time played (matches and season) than the other sports (Figure 3C and Figure 3D). Even assuming together (i.e., futsal plus basketball, plus handball) the soccer relative load time is higher (Figure 3D). When the COVID-19 changes in substitutions is considered, the scenario is better, but still, soccer alone is most demanding (i.e., higher time load per season). However, when allowing unlimited substitutions in soccer, then, soccer would have lower load time per season than the other three team sports 'together' (Figure 3D). Therefore, it seems crucial to increase the number of substitutions in soccer, beyond of COVID-19 changes. The same reasoning would apply to the dimension of each team sports (Figure 3A and Figure 3B). Although the field area would not be equal, the increment on substitutions would make soccer less physically stressful.

It has been shown that soccer promotes higher metabolic demands [1], and causes greater inflammatory responses and muscle damage, compared with handball, basketball and volleyball [4]. Lastly, but not least, besides the higher physical demand from soccer, especially on the lower limbs (to run, sprint, jump), all the technical skills are performed (e.g., passes) by the "same" lower limbs, which may impact the overall fatigue more seriously than the other team sports (i.e., basketball and handball). Indeed, lower extremities are more injured in soccer [42]. Those facts are additional points to suggest unlimited substitutions during the soccer games (forever) as a strategy to improve recovery, prevent injuries, and improve performance.

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One limitation of the current study is that it is difficult to compare different sports, since they are naturally different. Also, we cannot confirm that all players participate in all the matches during a season. However, the same might happen for other sports too. Thus, such limitations do not obscure our conclusions. Another potential limitation of the current study is that we did not consider the surfaces. The playing surfaces of the field (soccer) and courts (futsal, basketball, and handball) of these sports are different and may generate diverse physical demands.

5. Conclusions

We conclude that elite soccer has remarkably higher rule-induced physical demands than futsal, basketball, and handball, even acknowledging the current changes in substitutions due to the COVID-19 pandemic. Changing the substitution rule of elite soccer, allowing unlimited substitutions across the game, is a simple way to mitigate the enormous physical demands differences among team sports. Once matches are crucial for injuries vs. training sessions [21], this rule change may help to solve relevant concerns of elite soccer: the congested schedules and the high injury rates.

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References

1. Silva JR, Rumpf MC, Hertzog M, Castagna C, Farooq A, Girard O, et al. Acute and residual soccer match-related fatigue: a systematic review and meta-analysis. Sports Med. 2018;48:539–583.

2. Nédélec M, McCall A, Carling C, Legall F, Berthoin S, Dupont G. Recovery in Soccer. Sports Med. 2013;43:9–22.

3. Russell M, Sparkes W, Northeast J, Cook CJ, Bracken RM, Kilduff LP. Relationships between match activities and peak power output and Creatine Kinase responses to professional reserve team soccer match-play. Hum Mov Sci. 2016;45:96–101.

4. Souglis A, Bogdanis GC, Giannopoulou I, Papadopoulos C, Apostolidis N. Comparison of inflammatory responses and muscle damage indices following a soccer, basketball, volleyball and handball game at an elite competitive level. Res Sports Med Print. 2015;23:59–72.

5. Taylor JB, Wright AA, Dischiavi SL, Townsend MA, Marmon AR. Activity Demands During Multi-Directional Team Sports: A Systematic Review. Sports Med. 2017;47:2533–51.

6. Barnes C, Archer DT, Hogg B, Bush M, Bradley PS. The evolution of physical and technical performance parameters in the English Premier League. Int J Sports Med. 2014;35:1095–100.

7. Buchheit M, Eirale C, Simpson BM, Lacome M. Injury rate and prevention in elite football: let us first search within our own hearts. Br J Sports Med. 2019;53:1327–8.

8. Gabbett TJ. The training-injury prevention paradox: should athletes be training smarter and harder? Br J Sports Med. 2016;50:273–80.

9. Dellal A, Lago-Peñas C, Rey E, Chamari K, Orhant E. The effects of a congested fixture period on physical performance, technical activity and injury rate during matches in a professional soccer team. Br J Sports Med. 2015;49:390–4.

10. Ekstrand J, Waldén M, Hägglund M. A congested football calendar and the wellbeing of players: correlation between match exposure of European footballers before the World Cup 2002 and their injuries and performances during that World Cup. Br J Sports Med. 2004;38:493–7.

11. Bengtsson H, Ekstrand J, Hägglund M. Muscle injury rates in professional football increase with fixture congestion: an 11-year follow-up of the UEFA Champions League injury study. Br J Sports Med. 2013;47:743–7.

12. Ekstrand J. Keeping your top players on the pitch: the key to football medicine at a professional level. Br J Sports Med. 2013;47:723–4.

13. Roos H. ARE THERE LONG-TERM SEQUELAE FROM SOCCER? Clin Sports Med. 1998;17:819–31.

14. Arliani GG, Astur DC, Yamada RKF, Yamada AF, Miyashita GK, Mandelbaum B, et al. Early osteoarthritis and reduced quality of life after retirement in former professional soccer players. Clinics. 2014;69:589–94.

15. Knapp TP, Mandelbaum BR, Garrett WE. WHY ARE STRESS INJURIES SO COMMON IN THE SOCCER PLAYER?*. Clin Sports Med. 1998;17:835–53.

16. Pavin LN, Leicht AS, Gimenes SV, da Silva BVC, Simim MA de M, Marocolo M, et al. Can compression stockings reduce the degree of soccer match-induced fatigue in females? Res Sports Med. 2019;27:351–64.

17. Gimenes SV, Marocolo M, Pavin LN, Spigolon LMP, Barbosa Neto O, da Silva BVC, et al. Compression Stockings Used During Two Soccer Matches Improve Perceived Muscle Soreness and High-Intensity Performance. J Strength Cond Res. 2019;

18. Rey E, Padrón-Cabo A, Costa PB, Barcala-Furelos R. Effects of Foam Rolling as a Recovery Tool in Professional Soccer Players. J Strength Cond Res. 2019;33:2194–201.

19. Russell M, Kingsley M. The efficacy of acute nutritional interventions on soccer skill performance. Sports Med. 2014;44:957–70.

20. Bonnar D, Bartel K, Kakoschke N, Lang C. Sleep Interventions Designed to Improve Athletic Performance and Recovery: A Systematic Review of Current Approaches. Sports Med. 2018;48:683–703.

21. López-Valenciano A, Ruiz-Pérez I, Garcia-Gómez A, Vera-Garcia FJ, De Ste Croix M, Myer GD, et al. Epidemiology of injuries in professional football: a systematic review and meta-analysis. Br J Sports Med. 2020;54:711–8.

22. FIFA.com. Who We Are - News - Five-substitute option extended into 2021 in response to COVID-19 pandemic - FIFA.com [Internet]. www.fifa.com. [cited 2020 Aug 29]. Available from: https://www.fifa.com/who-we-are/news/five-substitute-option-extended-into-2021-in-response-to-covid-19-pandemic

23. Costa LCA da, Nascimento JV do, Vieira LF, Costa LCA da, Nascimento JV do, Vieira LF. TEACHING INVASIVE TEAM SPORTS IN THE SCHOOL ENVIRONMENT: FROM THEORY TO PRACTICE FROM THE PERSPECTIVE OF A HYBRID MODEL. J Phys Educ [Internet]. Universidade Estadual de Maringá; 2016 [cited 2020 Aug 30];27. Available from: http://www.scielo.br/scielo.php?script=sci_abstract&pid=S2448-24552016000100109&lng=en&nrm=iso&tlng=en

24. da Mota GR, Thiengo CR, Gimenes SV, Bradley PS. The effects of ball possession status on physical and technical indicators during the 2014 FIFA World Cup Finals. J Sports Sci. Routledge; 2016;34:493–500.

25. Fédération Internationale de Football Association FIFA. FUTSAL Laws of the game [Internet]. [cited 2020 Jun 8]. Available from: https://football-technology.fifa.com/media/1022/footballs_futsal_laws_of_the_game.pdf

26. Fédération Internationale de Basketball FIBA. Official basketball rules 2018 [Internet]. [cited 2020 Jun 8]. Available from: https://www.fiba.basketball/documents/official-basketball-rules.pdf

27. International Handball Federation IHF. Rules of the game. [Internet]. [cited 2020 Jun 8]. Available from: https://www.ihf.info/sites/default/files/2019-07/New-Rules%20of%20the%20Game_GB.pdf

28. Hopkins WG, Marshall SW, Batterham AM, Hanin J. Progressive statistics for studies in sports medicine and exercise science. Med Sci Sports Exerc. 2009;41:3–13.

29. Kinugasa T. The Application of Single-Case Research Designs to Study Elite Athletes' Conditioning: An Update. J Appl Sport Psychol. Routledge; 2013;25:157–66.

30. Gualtieri A, Rampinini E, Sassi R, Beato M. Workload Monitoring in Top-level Soccer Players During Congested Fixture Periods. Int J Sports Med. 2020;

31. Ahlert G. The Economic Effects of the Soccer World Cup 2006 in Germany with Regard to Different Financing. Econ Syst Res. 2001;13:109–27.

32. Gualtieri A, Rampinini E, Sassi R, Beato M. Workload Monitoring in Top-level Soccer Players During Congested Fixture Periods. Int J Sports Med. 2020;

33. Bradley PS, Carling C, Gomez Diaz A, Hood P, Barnes C, Ade J, et al. Match performance and physical capacity of players in the top three competitive standards of English professional soccer. Hum Mov Sci. 2013;32:808–21.

34. Harper DJ, Carling C, Kiely J. High-Intensity Acceleration and Deceleration Demands in Elite Team Sports Competitive Match Play: A Systematic Review and Meta-Analysis of Observational Studies. Sports Med Auckl NZ. 2019;49:1923–47.

35. Bradley PS, Lago-Peñas C, Rey E. Evaluation of the match performances of substitution players in elite soccer. Int J Sports Physiol Perform. 2014;9:415–24.

36. Carling C, Espié V, Le Gall F, Bloomfield J, Jullien H. Work-rate of substitutes in elite soccer: a preliminary study. J Sci Med Sport. 2010;13:253–5.

37. Hills SP, Radcliffe JN, Barwood MJ, Arent SM, Cooke CB, Russell M. Practitioner perceptions regarding the practices of soccer substitutes. PLoS ONE [Internet]. 2020 [cited 2020 Jun 8];15. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7006909/

38. Gómez M-Á, Silva R, Lorenzo A, Kreivyte R, Sampaio J. Exploring the effects of substituting basketball players in high-level teams. J Sports Sci. 2017;35:247–54.

39. Jørgensen U. Epidemiology of injuries in typical Scandinavian team sports. Br J Sports Med. 1984;18:59–63.

40. Hägglund M, Waldén M, Magnusson H, Kristenson K, Bengtsson H, Ekstrand J. Injuries affect team performance negatively in professional football: an 11-year follow-up of the UEFA Champions League injury study. Br J Sports Med. 2013;47:738–42.

41. Hill-Haas SV, Dawson B, Impellizzeri FM, Coutts AJ. Physiology of small-sided games training in football: a systematic review. Sports Med. 2011;41:199–220.

42. Wong P, Hong Y. Soccer injury in the lower extremities. Br J Sports Med. 2005;39:473–82.