Title: The influence of competition time in soccer players performance factors: A scoping review with evidence-gap map.

Short title: Performance factors in soccer.

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1. Results

1.1 Study identification and selection

The flowchart of the search and selection process of studies is presented in Figure 1. An initial search returned 32 613 results (2,750 in Cochrane Library, 5,869 in PubMed, 9,321 in Scopus, 9,170 in SPORTDiscus, and 5,503 in Web of Science). After removal of duplicates, a total of 8,819 studies remained, of which 8,467 were excluded based on title and abstract screening. Ninety-nine studies were eligible for full text analysis, of which thirty-eight did not characterize different groups of players (i.e., starters vs nonstarters) and were excluded [1-38]. Three studies were further excluded: one because it was not possible to access the full text [39] (the authors were contacted but no response was received) and two studies, because the data from others team sports were analyzed together (the authors responded that they did not have separate data sets). At this stage, fifty-eight studies were considered eligible for inclusion in our scoping review.

The reference lists of all studies were examined to identify further eligible studies and seven potential additional studies were identified, of which six did not characterize different groups of players (i.e., starter vs nonstarter) and were excluded [40-45]. One study was considered eligible for inclusion in our scoping review [46]. Snowball citation tracking was performed for the fifty-eight included studies and retrieved 1,158 records. After removal of duplicates, 764 records remained, of which 737 were excluded based on title and abstract screening. Twenty records were eligible for full text analysis, of which nine did not characterize different groups of players (i.e., starters vs nonstarters) and were excluded [47-55]. Eleven studies were considered eligible for inclusion in our scoping review [56-66]. We contacted sixteen external experts, and received no response after one month. No errata or retractions of the selected studies had been published by the time we finished the study selection process.

Twenty studies presented results from the same trial, and for this reason were considered as a single work [56, 61, 63, 65, 67-82]. Therefore, 57 independent trials corresponding to 70 publications were considered eligible for inclusion in our review [46, 56-124].

1.2 Study characteristics and context-related information

Concerning funding sources, twenty-nine studies received financial support [57-59, 63, 66-70, 72, 74-76, 78-81, 85, 90, 93, 96, 100, 110, 113-115, 122, 124], sixteen did not receive external funding [56, 60, 65, 71, 86, 88, 89, 92, 95, 97, 101, 104, 108, 109, 111, 118], and twenty-five did not report whether they

received financial support [46, 61, 62, 64, 73, 77, 82-84, 87, 94, 98, 99, 102, 103, 105-107, 112, 116, 117, 119-121, 123]. Regarding competing interests, forty-seven studies declared no conflict of interest [56-63, 65-76, 78-82, 86-88, 90-93, 95, 96, 98-101, 104, 109-111, 114, 118, 121-123], two declared conflict of interest [108, 113] and twenty-one studies did not provide information on this topic [46, 77, 83-85, 89, 94, 97, 102, 103, 105-107, 112, 115-117, 119, 120, 124].

1.3 Categorization of playing time

1.3.1 Acute approach

When assigning players according the acute exposure (twenty trials; 35.1%), other cut-offs were also applied: 100% vs. <100% [85, 96, 119], ≥50% vs. <50% [65, 77, 82], ≥44.4% vs <44.4% [102, 115], 100% vs. <50% [118], 75% to 100% vs. 0% to 37.5% [92], ≥72.2% vs. <72.2% [97] and ≥66.7% vs. ≤44.4% [117] for starters and nonstarters, respectively.

Other studies have categorized players into three (nine trials; 15.8%; starters vs. replaced/fringe vs. substitute/nonstarter, respectively) [59, 64, 72, 73, 87, 104, 106, 114, 121, 123] and four distinct profiles (four trials; 8.8%; starters vs. replaced vs. substitute vs. nonstarters, respectively) [60, 61, 84, 88, 90]. Concerning the former allocation, cut-offs of 100% vs. 77.8% to 100% vs. <77.8% [72], 100% vs. 83.3% vs. 16.7% [87], ≥66,7% vs. <66,7% vs. 0% [59], ≥50% vs. <50% vs. 33.3% [64], ≥50% vs. <50% vs. 0% [73], were respectively adopted. When assigning players in four categories, cut-offs of ≥77.8% vs. 77.8% to 50% vs. 50% to 22.2% vs. <22.2% [61, 84], 100% vs. ≥66.7% vs. <66.7% vs. 0% [90], 100% vs. ≥84.4 vs. 67.8% to 83.3% vs. 50% to 67.7% [60] and ≥50% vs. 33.3 to 50% vs. 16.7 to 33.3% vs. 16.7% to 6% [88] were correspondingly adopted.

1.3.2 Chronic approach

Different cut-off values match participation volumes were used to define the group of players. Studies that examined the effect of chronic exposure divided players in starters and nonstarters based on number of matches where players acted as starters in the observation period, and accumulated playing time during the season minutes (three trials; 5.3%), such as, 1633.8 ± 478.2 vs. 158.2 ± 269.3, respectively [107], 531,6 ± 118,1 vs. 31,5 ± 42,8, respectively [46] and >60% vs. <60% [74, 75]. Other studies have categorized players only by amount of total playing time (five trials; 8.8%) ≥50% vs. <50% [57, 95, 101, 105] and 83.06% vs 16.95% [103] or by the percentage of matches started (two trials; 3.5%) >80% vs. <50% [111]

and ≥55% vs. <55% [122], for starters and nonstarters, respectively. Four trials (7.0%) have categorized players into three cut-offs. Concerning the amount of total playing time two trials presented cut-offs (3.5%), ≥75%, >25% to <75% and ≤25% [94] and ≥66,7% vs. <66,7% vs. 0% [66], while two trials showed players starting status cut-offs (3.5%), ≥60% vs. 30% to 60% vs. <30% [83] and ≥55% vs. 30% vs. 55% vs. <30% [86], for starters, substitutes and nonstarters, respectively.

1.4 Performance factors

1.4.1 Physical Factors

It should be noted that the study of Morgans et al. [112] performed an correlation of the effects of two standard deviations of within-player changes of total distance, and high intensity running on peak power and height of counter movement jump.

External absolute intensity indicators. Sixteen trials observed starters accumulated higher EAI compared to nonstarters, on several metrics such as, total distance, distance in a range of speed zones (2 to 7 m/s^{-2}), number of sprints, average of maximum velocity, peak velocity, number of accelerations and decelerations, player load, body load, metabolic power, high metabolic load events, energy expenditure, equivalent distance index, dynamic stress load, and average metabolic power, in a weekly microcycle and over the season [56, 59, 63, 67-71, 74-76, 78, 79, 83, 86, 90-93, 95, 98, 101, 112, 113, 118]. In addition, one trial determined that the nonstarters covered higher weekly training EAI in total distance, decelerations, high speed running (5.5 to 6.97 m/s^{-2}) and sprint distance (>6.97 m/s^{-2}) [122]. Thirteen trials demonstrated that substitute players covered greater total distance covered, distance in a range of speed zones (1.7 to 7 m/s^{-2}), number of sprints, fast runs, accelerations, peak of maximum velocity and average of maximum velocity, player load, body load, metabolic power, average metabolic power, high metabolic load distance high metabolic load events, energy expenditure, equivalent distance index and dynamic stress load, relative to playing time than the players who were replaced or completed the entire match [60, 64, 87, 88, 91, 95, 96, 104, 106, 114, 118, 121, 123]. One trial showed no decline in work-rate in substituted players was observed [89]. Starters obtained higher values, in total distance and individual very high-speed distance over 80% of maximum peak speed during congested fixture periods [98] and performed more peak total distance and peak high speed running distance [121].

Internal absolute intensity indicators. Regarding objective internal absolute intensity, one trial did not seem to differ between the starting status of youth players [122]. One trial did not provide information

on IAI objective between starters and nonstarters players [95]. Concerning, subjective internal absolute intensity. Four trials demonstrated no significant differences between playing status across the season [58, 81, 82, 110]. Furthermore, Azcárate et al. [72] trial showed the respiratory and muscular perceived effort was similar for both groups across the competition period. One trial did not provide information on IAI subjective between starters and nonstarters players [62].

Anthropometric measurements. Three trials observed no significant differences in body composition, maturity status and somatotype between starters and nonstarters [105, 119, 124].

Endurance performance measurements. Several trials presented, regardless of playing time no significant differences were found between starters and nonstarters in the performance tests [102, 116, 117, 119, 124].

Physiological determinants. One trial did not provide information on physiological determinants between starters and nonstarters players [103].

1.5 Risk of Bias in Individual Studies

Regarding to risk of bias, selection of participants was unclear in five trials (8.8%), as study provided subjective classifications (i.e., entire match, substitute, and replaced), not clearly specified and justified (i.e., sample size, age, gender, training status) with unclear inclusion/exclusion criteria. Moreover, the risk of bias in the selection of participants were high in twenty-two trials (38.6%), due to the study period and team was not similar for the groups evaluated (e.g., different teams and/or different seasons) and the inclusion/exclusion criteria was not provided.

The risk of bias in the existence of potential confounding variables was high in eighteen trials (31.6%), because were not adequately considered during the analysis phases (i.e., same season with different teams, different season with same teams, different teams and seasons or analysis with multiple ages in the same trials) and the groups are unbalanced and might bias the exposure and outcome association (e.g., 519 starters vs 212 substitutes vs 212 replaced players).

Measurement of exposure was unclear in twelve trials (21.1%) of the studies, due to the lack of information on important assessment methods (i.e., details regarding the GPS procedure protocol, metrics analyzed or physical testing procedures).

Blinding of outcome assessments was high in thirty-one trials (54.4%), because blinding was not performed or incomplete and is not taken into account, having a likely effect on outcome measures (i.e., linear sprint tests, maximum strength tests or subjective measures of energy, focus, alertness, and fatigue).

Incomplete outcome data was high in seven trials (12.3%), as missing data could affect the study outcome (i.e., injured players, player transfers, inadequate recording, players not completing a full microcycle or excluded due to a low number of substitutions). Moreover, incomplete outcome data was unclear in twenty-two trials (38.6%), due to missing data on the existence of participant dropouts and the outcome assessment reported as percentages without absolute values being presented, preventing assessment of completeness of outcome reporting.

Selective outcome reporting was unclear in forty-nine trials (86.0%), because not all details were presented for replication of the study.

2. References

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