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SINTOMAS DE CONCUSSÃO AUTORRELATADOS E LACUNAS DIAGNÓSTICAS EM UMA AMOSTRA EXPLORATÓRIA DE JOGADORES DE FUTEBOL AMADOR BRASILEIROS

SELF-REPORTED CONCUSSION SYMPTOMS AND DIAGNOSTIC GAPS IN AN EXPLORATORY SAMPLE OF BRAZILIAN AMATEUR SOCCER PLAYERS

SÍNTOMAS DE CONMOCIÓN CEREBRAL AUTOINFORMADOS Y LAGUNAS EN EL DIAGNÓSTICO EN UNA MUESTRA EXPLORATORIA DE JUGADORES DE FÚTBOL AMATEUR BRASILEÑOS

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Resumo

Introdução: As concussões relacionadas ao esporte são frequentemente subdiagnosticadas no futebol, apesar de seus significativos riscos neurológicos. Essa questão é particularmente relevante em ambientes amadores, onde protocolos diagnósticos estruturados são frequentemente ausentes. Este estudo teve como objetivo investigar a prevalência de sintomas de concussão autorrelatados entre jogadores de futebol amadores brasileiros e analisar associações com características do atleta,

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características do impacto e contexto de prática. **Métodos:** Um estudo transversal foi conduzido com 58 jogadores de futebol amadores (idade média de 25,4 ± 9,2 anos; 93,1% do sexo masculino) utilizando um questionário estruturado baseado na Ferramenta de Avaliação de Concussão no Esporte – 3ª edição (SCAT3), adaptada para autorrelato. Foram coletados dados sobre impactos na cabeça nas 12 semanas anteriores, sintomas, características da lesão e manejo pós-impacto. As associações entre variáveis categóricas foram analisadas usando os testes qui-quadrado de Pearson ou exato de Fisher, com os tamanhos do efeito estimados por Phi (φ) e V de Cramér. **Resultados:** Os sintomas autorrelatados foram relativamente frequentes, porém apenas 3,4% (n = 2) dos participantes relataram um diagnóstico formal de concussão e 5,2% (n = 3) necessitaram de atendimento hospitalar, indicando um subdiagnóstico substancial. Observou-se uma associação significativa entre forte impacto percebido e desorientação (p = 0,007; φ = 0,352). Lesões visíveis foram significativamente associadas ao diagnóstico formal (p = 0,007; V = 0,412), sugerindo um viés diagnóstico em relação a traumas externamente evidentes. O contexto da prática influenciou o manejo pós-impacto: jogadores de futsal apresentaram taxas mais altas de desistência da partida (60% vs. 22,4%; p = 0,034) e menor retorno imediato ao jogo. A maioria dos atletas (75,9%) relatou retorno imediato ao jogo após impactos na cabeça. **Conclusões:** Há uma subnotificação substancial e um manejo heterogêneo de eventos concussivos no futebol amador brasileiro. Os processos diagnósticos parecem enviesados em relação a lesões visíveis, levando à subnotificação de concussões "invisíveis", particularmente na ausência de lesões visíveis e de avaliação estruturada à beira do campo. Esses achados destacam a necessidade de protocolos obrigatórios de avaliação pós-impacto, melhor capacitação de atletas e comissão técnica e implementação de ferramentas de triagem padronizadas para aumentar a segurança dos atletas.
Palavras-chave: Futebol; Concussão; Atletas amadores; Subdiagnóstico; Lesão cerebral; Epidemiologia de lesões esportivas.

Abstract

Introduction: Sport-related concussions are frequently underdiagnosed in soccer, despite their significant neurological risks. This issue is particularly relevant in amateur settings, where structured diagnostic protocols are often absent. This study aimed to investigate the prevalence of self-reported concussion symptoms among Brazilian amateur soccer players and analyze associations with athlete characteristics, impact characteristics, and practice context. **Methods:** An exploratory cross-sectional study with convenience sampling was conducted with 58 amateur soccer players (mean age 25.4 ± 9.2 years; 93.1% male) using a structured questionnaire based on the Sport Concussion Assessment Tool – 3rd edition (SCAT3), adapted for self-report. Data were collected on head impacts within the previous 12 weeks, symptoms, injury characteristics, and post-impact management. Associations between categorical variables were analyzed using Pearson's chi-square or Fisher's exact tests, with effect sizes estimated by Phi (φ) and Cramér's V. **Results:** Self-reported symptoms were relatively frequent; however, only 3.4% (n = 2) of participants reported a formal concussion diagnosis and 5.2% (n = 3) required hospital care, indicating a potential diagnostic gap. A significant association was observed between perceived strong impact and disorientation (p = 0.007; φ = 0.352). Visible injuries were significantly associated with formal diagnosis (p = 0.007; V = 0.412), suggesting a pattern suggestive of reliance on visible injury relative to externally evident traumas. Practice context influenced post-impact management: futsal players showed higher rates of match withdrawal (60% vs. 22.4%; p = 0.034) and lower immediate return to play. The majority of athletes (75.9%) reported an immediate return to play following head impacts. **Conclusions:** It was observed in this exploratory sample of Brazilian amateur soccer players that diagnostic processes appear biased toward visible injuries, leading to the underreporting of "invisible" concussions, particularly in the absence of visible lesions and structured sideline assessment. These findings highlight the need for post-impact assessment protocols in exploratory samples, improved education for athletes and technical staff, and the implementation of standardized screening tools to enhance athlete safety.
Keywords: Soccer; Concussion; Amateur athletes; Underdiagnosis; Brain injury; Sports injury epidemiology

Resumen

Introducción: Las conmociones cerebrales relacionadas con el deporte suelen estar

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infradiagnosticadas en el fútbol, a pesar de sus importantes riesgos neurológicos. Este problema es particularmente relevante en el ámbito amateur, donde a menudo no existen protocolos de diagnóstico estructurados. Este estudio tuvo como objetivo investigar la prevalencia de síntomas de conmoción cerebral autoinformados entre futbolistas amateurs brasileños y analizar su asociación con las características del atleta, las características del impacto y el contexto de la práctica. **Métodos**: Se realizó un estudio transversal exploratorio con muestreo por conveniencia con 58 futbolistas amateurs (edad media 25,4 ± 9,2 años; 93,1 % hombres) mediante un cuestionario estructurado basado en la Herramienta de Evaluación de Conmociones Cerebrales Deportivas – 3.ª edición (SCAT3), adaptada para autoinforme. Se recopilaron datos sobre impactos en la cabeza durante las 12 semanas previas, síntomas, características de la lesión y manejo posterior al impacto. Se analizaron las asociaciones entre variables categóricas mediante la prueba de chi-cuadrado de Pearson o la prueba exacta de Fisher, y se estimaron los tamaños del efecto mediante el coeficiente phi (φ) y la V de Cramér. **Resultados**: Los síntomas autoinformados fueron relativamente frecuentes; sin embargo, solo el 3,4 % (n = 2) de los participantes reportaron un diagnóstico formal de conmoción cerebral, y el 5,2 % (n = 3) requirieron atención hospitalaria, lo que indica una posible brecha diagnóstica. Se observó una asociación significativa entre el impacto percibido fuerte y la desorientación (p = 0,007; φ = 0,352). La lesión visible se asoció significativamente con el diagnóstico formal (p = 0,007; V = 0,412), lo que sugiere un patrón que indica una mayor dependencia de la lesión visible en relación con el traumatismo externamente evidente. El contexto de la práctica influyó en el manejo posterior al impacto: los jugadores de fútbol sala mostraron mayores tasas de abandono de partidos (60 % frente a 22,4 %; p = 0,034) y menor retorno inmediato al juego. La mayoría de los atletas (75,9 %) reportaron un regreso inmediato al juego tras los impactos en la cabeza. **Conclusiones**: Observado en esta muestra exploratoria de futbolistas amateurs brasileños. Los procesos de diagnóstico parecen estar sesgados hacia las lesiones visibles, lo que conlleva una subestimación de las conmociones cerebrales "invisibles", particularmente en ausencia de lesiones visibles y una evaluación estructurada en el campo. Estos hallazgos resaltan la necesidad de protocolos de evaluación posterior al impacto en muestras exploratorias, una mejor formación de los atletas y el personal, y la implementación de herramientas de detección estandarizadas para mejorar la seguridad de los atletas.
Palabras clave: Fútbol; Conmoción cerebral; Atletas amateurs; Subdiagnóstico; Lesión cerebral; Epidemiología de las lesiones deportivas

Introduction

Soccer is the most widely practiced team sport worldwide, with an estimated 250 million participants distributed across more than 200 countries (A. de A. Fernandes et al., 2015). Its global reach extends beyond professional competition, playing a central role in physical education, recreational sport, and community-based activities. Despite its recognized health benefits, soccer is characterized by intermittent high-intensity actions, including accelerations, jumps, rapid changes of direction, and frequent physical contact, which substantially increase the risk of traumatic injuries, particularly traumatic brain injury (TBI) (Bunc et al., 2017; Levy et al., 2012; Pedrinelli et al., 2013).

Among these injuries, sport-related concussion has emerged as a major concern due to its potential acute and long-term neurological consequences. According to the most recent international consensus (Patricios et al., 2023), concussion is defined as a complex pathophysiological process induced by biomechanical forces transmitted directly or indirectly to the brain, typically resulting in transient neurological dysfunction without detectable structural abnormalities on conventional neuroimaging (Chancellor et al., 2019; Kazl & Torres, 2019). In soccer, head impacts may occur through player-to-player collisions, contact with the ground, or intentional heading, exposing athletes to both concussive and subconcussive events (Auger et al., 2020).

Beyond clinically diagnosed concussion, increasing attention has been directed toward subconcussive impacts, defined as head impacts that do not produce immediate clinical symptoms but may contribute to cumulative neurological burden over time (Bunc et al., 2017). Repeated exposure to such impacts has been associated with alterations in brain function, neuroinflammatory processes, and potential long-term cognitive consequences, even in the absence of formally diagnosed concussion (Talavage et al., 2014). This further complicates clinical detection in sports such as soccer, where symptom presentation may be subtle, transient, or underreported.

Epidemiological studies in professional soccer report that TBI accounts for approximately 4% to 22% of all injuries, with concussion incidence ranging from 0.03 to 0.07 per 1,000 hours of exposure,

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corresponding to roughly two cases per team per season (Ekstrand et al., 2011; Waldén et al., 2013). However, these figures likely underestimate the true burden of injury, as up to 75% of concussive events occur during matches and may go unrecognized or unreported (Auger et al., 2020). This underestimation is further compounded by the predominantly functional nature of concussion, which often lacks visible signs and depends on symptom recognition and clinical judgment(Guskiewicz et al., 2005).

While concussion research has advanced considerably in professional and elite settings, there remains a critical gap in understanding its occurrence and management in amateur populations. From a public health perspective, amateur soccer players represent a substantially larger and more heterogeneous group than professional athletes yet receive considerably less medical oversight. In these settings, the absence of healthcare professionals during training and matches limits the application of standardized diagnostic tools and structured return-to-play protocols. Furthermore, educational gaps among athletes, coaches, and staff contribute to misinterpretation or normalization of concussion symptoms, often leading to continued participation despite neurological impairment (De Araújo et al., 2021; Wilke et al., 2025).

In Brazil, where soccer is deeply embedded in both cultural and educational contexts, this issue is particularly relevant. Informal and recreational play constitutes a significant proportion of total exposure, frequently occurring in environments without medical supervision or institutional regulation. Recent evidence suggests that both athletes and technical staff demonstrate insufficient knowledge regarding concussion recognition and management, and that clinical decision-making often relies on subjective or visibly evident signs rather than structured assessment protocols (G. C. de A. M. Fernandes et al., 2025). Consequently, concussive events without external manifestations may be systematically overlooked, reinforcing patterns of potential diagnostic gap and unsafe return to play.

Additionally, contextual factors related to the mode of practice may influence both injury occurrence and management. Differences between field soccer and futsal—including playing surface characteristics, spatial constraints, intensity of play, and level of supervision—may affect exposure to head impacts, perception of injury severity, and decisions regarding removal from play (Ekstrand et al., 2011) However, these aspects remain insufficiently explored in literature, particularly in amateur settings, where variability in organizational structure and technical support is preliminary.

Given the potential cumulative effects of repeated concussive and subconcussive impacts, including associations with long-term cognitive impairment and neurodegenerative outcomes (Guskiewicz et al., 2005), improving early recognition and management is essential. Nevertheless, the extent to which concussive symptoms are recognized, reported, and clinically addressed in amateur soccer remains unclear, particularly in contexts lacking standardized evaluation protocols. In this context, the present study aimed to:(i) assess the frequency of self-reported concussions among Brazilian amateur soccer players;(ii) analyze differences in post-impact management according to the practice context (field vs. indoor/futsal) ;(iii) identify factors associated with the occurrence of concussive symptoms; and(iv) investigate potential pattern suggestive of reliance on visible injury in the identification of injuries without visible manifestations.

Material & methods

This was an exploratory cross-sectional study with convenience sampling between August and November 2024 through the application of an online questionnaire. The target population comprised amateur soccer players of both sexes, aged 18 years, residing in Brazil.

The sample was obtained by convenience, through dissemination of the instrument (Google Forms questionnaire) on social networks such as WhatsApp and Instagram, using a direct access link. Of the 142 recorded access, 58 questionnaires obtained the minimum permitted attendance (three sessions per week) and were considered valid (response rate of 40.8%), constituting the final sample. Individuals with a previous diagnosis of degenerative neurological diseases, severe traumatic brain injury or reported less than three sessions per week were excluded (n=84). as shown in Figure 1. Our sample was heavily skewed toward male athletes (93.1%) and residents of São Paulo (87.9%), limiting generalizability to female players and other Brazilian regions. Additionally, online recruitment excludes athletes without internet access or social media presence, potentially underrepresenting lower socioeconomic groups. The small sample size (n=58), particularly the indoor-only subgroup (n=10), limited statistical power to detect small-to-moderate effect sizes and resulted in low cell frequencies in several analyses.

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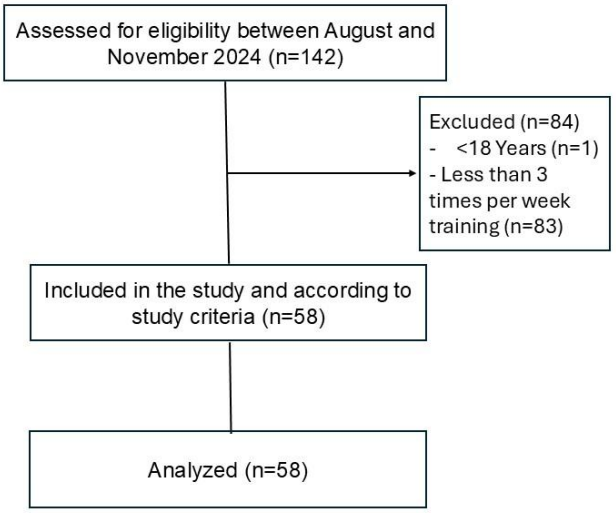

Figure 1: Participant flow diagram showing participant selection and follow-up.

The structured questionnaire was developed using the Google Forms platform and divided into three modules:(i) eligibility and exclusion criteria (two screening questions, age and training frequency) ;(ii) sociodemographic and sports characterization (age, sex, location, professional status, training frequency, and playing context); and(iii) assessment of concussive events based on the Sport Concussion Assessment Tool – 3rd edition (SCAT3), adapted for self-report (Downey et al., 2018), our specific adaptation has not been independently validated against clinical assessments. Furthermore, we did not obtain clinical confirmation of reported concussions, and the absence of data on prior concussion history prevented control for this potentially confounding variable, as previous concussions may influence symptom recognition and reporting behavior.
The concussion module investigated impacts occurring within the previous 12 weeks, post-traumatic symptoms (disorientation, headache, memory loss), impact severity (self-perceived on a dichotomous scale: strong/not strong), presence of visible injuries (abrasions or lacerations), withdrawal protocols, and time to return to play, Although more recent versions of the instrument (SCAT5 and SCAT6) are available. SCAT3 was selected for compatibility with the project's initial development phase and its greater suitability for self-reported symptoms data.
Participants received detailed information regarding the nature of the research, potential risks, and benefits. The Informed Consent Form was presented on the first page of the questionnaire, Confidentiality was guaranteed through anonymous data collection, with no IP address or identifying data stored. The study was approved by the Research Ethics Committee of the University of Mogi das Cruzes (CAAE: 83978724.5.0000.5497), in accordance with Resolution 466/2012 of the Brazilian National Health Council.
Data was exported to SPSS software version 25.0. Descriptive analysis was performed using absolute and relative frequencies. Associations between categorical variables were assessed using Pearson's chi-square test when at least 80% of the cells had expected frequencies ≥ 5; otherwise, Fisher's exact test was applied. Effect size was calculated using the Phi coefficient (φ) for 2×2 tables and Cramér's V for larger tables. A significant level of 5% was adopted ($\alpha = 0.05$). Importantly, all associations reported are bivariate and unadjusted; therefore, the current cross-sectional design does not permit causal inference regarding the identified relationships

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This study was exploratory in nature, and no formal sample size calculation was performed a priori. The sample size (n=58) was limited by the convenience sampling approach and represents a preliminary investigation requiring confirmation in larger samples.

Results

While the study targeted players across Brazil, the resulting sample is primarily representative of amateur players in the state of São Paulo, and findings should not be used to estimate national population prevalence. The final sample (n = 58) was predominantly male (93.1%), aged between 18 and 22 years (51.7%) and mostly residing in the state of São Paulo (87.9%). The majority of participants played soccer recreationally (81.0%). Regarding the playing context, 32.8% played exclusively on field, 17.2% exclusively on indoor court (futsal), 19.0% played in both contexts with predominance of field, and 31.0% played in both with predominance of court.

Table 1: Descriptive Summary of Head Impacts, Symptoms, and Management

Variable Category		% of Total Sample (n=58)	% of Impact Sub-sample (n=32) *
Head Impact Occurrence			
Reported Strong Impact (12-week window)	32	55.2%	—
Symptom Prevalence			
Disorientation	17	29.3%	53.1%
Headache	13	22.4%	40.6%
Memory Loss	6	10.3%	18.8%
Injury Characteristics			
Visible Injury (abrasions/lacerations)	23	39.7%	71.9%
Management & Diagnosis			
Withdrawn from Match/Training	13	22.4%	40.6%
Required Hospital Care	3	5.2%	9.4%
Formal Concussion Diagnosis	2	3.4%	6.3%
Return to Play Timing			
Immediate Return (Stayed in match)	44	75.9%	—
Delayed Return (10–30+ minutes)	11	18.9%	34.4%
Return in Next Match or later	3	5.2%	9.4%

Source: Data compiled from Damianovich et al. (2026) and the Statistical Report provided. *Note: Percentages in this column are recalculated based on the 32 athletes who reported strong impacts.

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Table 2: Contingency table: Practice context vs. Memory loss. Chi-square test: χ2(3) = 8.235. p = 0. 041; Cramér's V: V = 0.377.

Practice context	No	Yes	Total
Field	16	3	19 (32.8%)
Both. more in field	11	0	11 (19%)
Both. more in indoor	18	0	18 (31.0%)
Indoor	7	3	10 (17.2%)
Total	52 (89.7%)	6 (10.3%)	58 (100%)

Source: DAMIANOVICH. L.C. et al., 2026

Table 3: Contingency table: Practice context vs. Match withdrawal. Chi-square test: χ2(3) = 8.668. p = 0.034; Cramér's V: V = 0.386.

Practice context	No	Yes	Total
Field	16	3	19 (32.8%)
Both, more in field	10	1	11 (19%)
Both, more in indoor	15	3	18 (31.0%)
Indoor	4	6	10 (17.2%)
Total	45 (77.6%)	13 (22.4%)	58 (100%)

Source: DAMIANOVICH. L.C. et al., 2026

Association analyses demonstrated statistically significant relationships between practice context and memory loss, match withdrawal, and time to return. However, given the small size of the indoor-only subgroup (n=10), these associations should be viewed as preliminary trends observed within this exploratory sample (Table 1), match withdrawal (Table 3) and time to return after impact (Table 4). It is worth noting, however, that some tables presented cells with low frequencies, which calls for caution in interpreting the findings, even when statistical significance was achieved.

Table 4: Contingency table: Practice context vs. Time to return. Chi-square test: $\chi^2(9) = 19.324$. p = 0. 023; Cramér's V: V = 0.333

Practice context	10 min	30 min	No withdrawal occurred	Next match	Total
Field	3	0	16	0	19 (32.8%)
Both, more in field	1	1	9	0	11 (19%)
Both, more in indoor	2	0	15	1	18 (31.0%)
Indoor	3	1	4	2	10 (17.2%)
Total	9 (15.5%)	2 (3.4%)	44 (75.9%)	3 (5.2%)	58 (100%)

Source: DAMIANOVICH. L.C. et al., 2026

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Table 5: Contingency table: Strong impact vs. Disorientation. Chi-square test: $\chi^2(1) = 7.187$. $p = 0.007$; Phi coefficient: $\phi = 0.352$

Strong impact	No	Yes	Total
No	23	3	26 (44.8%)
Yes	18	14	32 (55.2%)
Total	41 (70.7%)	17(29.3%)	58 (100%)

Source: DAMIANOVICH. L.C. et al., 2026

Table 6: Contingency table: Disorientation vs. Concussion diagnosis. Chi-square test: X^2 (2) = 7.159. $p = 0.028$; Cramér's V: V = 0.351.

disorientation	Never	No	Yes	Total
No	38	3	0	41 (70.7%)
Yes	13	2	2	17 (29.3%)
Total	51 (87.9%)	5(8.6%)	2(3.4%)	58 (100%)

Source: DAMIANOVICH. L.C. et al., 2026

Table 7: Contingency table: Visible injury vs. Concussion diagnosis. Chi-square test: X^2 (2) = 9.835. $p = 0.007$; Cramér's V: V = 0. 412

visible injury	Never	No	Yes	Total
No	34	1	0	35 (60.3%)
Yes	17	4	2	23 (39.7%)
Total	51 (87.9%)	5(8.6%)	2(3.4%)	58 (100%)

Source: DAMIANOVICH. L.C. et al., 2026

There was a statistically significant association between strong perceived impact and disorientation ($\varphi = 0.352$; $p = 0.007$), suggesting a relationship between the perceived intensity of the impact and occurrence of acute neurological symptoms (Table 5). Additional associations were identified between disorientation and formal concussion diagnosis (Table 6), as well as between visible injury and concussion diagnosis, with moderate effect sizes (Table 7). Considering these statistical significances, certain associations warrant cautious interpretation due to low expected frequencies in specific cells. Given the small subgroup sizes and the exploratory nature of this study, these findings should be interpreted as hypothesis-generating rather than definitive conclusions.

Discussion

The findings reveal notable epidemiological underreporting: only 10.3% of athletes reported memory loss and 3.4% indicated a formal concussion diagnosis. This prevalence, lower than that reported in prospective studies (Ekstrand et al., 2011) may be attributed to the cross-sectional design and self-report nature of data collection, both of which tend to underestimate lower-intensity events or unrecognized symptoms. The high rate of immediate return to play (75.9%) indicates that systematic post-impact monitoring remains insufficient in the amateur soccer contexts surveyed in this study. Given that some traumatic hits are known as sub-concussive (Yaqoob et al., 2024).

The disparity between practice settings emerges as preliminary trend**,** suggesting a potential pattern of stricter management of impacts in futsal. While this difference is hypothesized to stem from closer technical support, better visibility of traumatic events in smaller spaces, or increased perception of risk on harder surfaces, our study did not directly measure these environmental or organizational factors. Consequently, the mechanisms underlying these differences remain hypothetical and require

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confirmation in larger, prospective studies. Indoor soccer (futsal) showed a higher withdrawal rate (60% vs. 15.8%; p=0.034) and lower immediate return (40% vs. 84.2%) compared to field soccer, suggesting stricter management of impacts.

A proposed exploratory hypothesis for this difference is closer technical support, better visibility of traumatic events in smaller spaces, and increased perception of risk on harder surfaces (Sarkohi et al., 2025), though our study did not directly measure these factors. Further research is needed to confirm the mechanisms underlying these practice context differences. However, the absence of reported memory loss in mixed-context groups may reflect memory bias or selective underreporting.

The association between strong impact and disorientation (φ=0.352; p=0.007) suggests potential utility of self-perceived impact intensity as a preliminary screening tool. This association aligns with biomechanical literature linking impact magnitude to acute cognitive dysfunction (Baugh et al., 2015). However, it is critical to acknowledge that because multiple associations were tested without specific corrections for multiple comparisons, there is a heightened risk of Type I error. Consequently, these findings are exploratory and serve as a basis for generating hypotheses that must be confirmed in larger, prospective studies with clinical validation.

However, symptom presence did not guarantee diagnosis: 88.2% of disoriented athletes remained without formal diagnosis, evidencing a gap between symptom recognition and clinical attention.

Although this study does not aim to validate diagnostic instruments, it reveals that despite symptomatic presentation, there is a considerable gap between clinical recognition and formal diagnosis, as most symptomatic athletes remain undiagnosed.

A significant pattern suggestive of reliance on visible injury based on visible evidence (Cramér's V = 0.412; p = 0.007) was identified, indicating that self-reported symptoms compatible with concussive events without external manifestations tend to be systematically overlooked. The complete absence of diagnosis among athletes without cutaneous lesions—representing 60.3% of the sample—suggests reliance on observable physical signs rather than functional neurological symptoms (Guskiewicz et al., 2005). This pattern reflects insufficient understanding of concussion as a predominantly functional clinical entity and corroborates previous findings of underrecognition in settings without structured evaluation protocols (Patricios et al., 2023).

The practical implications are preliminary. The absence of exploratory sample post-impact protocols in amateur competitions, combined with limited use of validated screening instruments such as the SCAT3 (Patricios et al., 2023), may perpetuate potential diagnostic gap and unsafe return-to-play decisions. The moderate effect sizes observed (Cramér's V between 0.33–0.39) reinforce the clinical relevance of these associations, particularly considering the established relationship between repeated self-reported symptoms compatible with concussive events and long-term neurological outcomes (Rodrigues et al., 2016).

Additionally, cultural factors—such as the stigma associated with removal from play (Bunc et al., 2017)—likely amplify underreporting, especially in field soccer contexts where peer pressure and limited technical knowledge may influence symptom disclosure (Adams, 2025).

Conclusion

This study identifies a notable diagnostic gap and heterogeneous management of concussive events within an exploratory sample of Brazilian amateur soccer players. Although self-reported symptoms were prevalent, formal medical diagnosis remained rare, reinforcing the presence of a persistent epidemiological blind spot in non-professional settings. A primary finding suggests a pattern of reliance on visible injury, where decision-making processes appear to depend heavily on observable physical signs rather than functional neurological assessments. This limitation may systematically overlook "invisible" concussive events, potentially allowing athletes to continue participation despite ongoing neurological impairment. Furthermore, the influence of practice context emerges as a preliminary trend, suggesting that environmental factors—such as spatial constraints and closer supervision in futsal—may positively influence removal-from-play decisions. However, the high rate of immediate return to play across all contexts indicates that systematic post-impact monitoring remains insufficient. These insights support the hypothesis that standardizing management approaches across different modes of practice is essential for improving athlete safety.

From an applied perspective, these preliminary results suggest that sports organizations should consider implementing standardized sideline assessment tools and educational interventions to enhance symptom recognition among athletes and technical staff. Nevertheless, given the exploratory

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nature of this investigation, these findings serve as hypotheses for policy development rather than definitive mandates. Future research utilizing larger, diverse cohorts and incorporating prospective designs with clinical validation is required to confirm these observations and establish evidence-based safety protocols in amateur soccer.

Conflicts of interest - All authors declare that they have no conflicts of interest.

Study limitations - Limitations include selection bias due to convenience sampling, predominance of male athletes and residents of São Paulo, cross-sectional and self-reported design, absence of clinical confirmation of diagnoses, small size of the exclusive indoor-court subgroup, and possible prior concussion history not controlled. The restricted 12-week recall window may have contributed to underestimating the cumulative prevalence of self-reported symptoms compatible with concussive events.

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