UNIVERSIDADE FEDERAL DE CIÊNCIAS DA SAÚDE DE PORTO ALEGRE
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS DA REABILITAÇÃO

Roberto Carlos Rebolledo Cobos

Estudos com foco na prevenção de lesões em jovens futebolistas: percepções dos atletas e recuperação de força pós-jogo

Porto Alegre

2025

Roberto Carlos Rebolledo Cobos

Estudos com foco na prevenção de lesões em jovens futebolistas: percepções dos atletas e recuperação de força pós-jogo

Tese submetida ao Programa de Pós-Graduação em Ciências da Reabilitação da Universidade Federal de Ciências da Saúde de Porto Alegre como requisito para a obtenção do grau de Doutor.

Orientador: Prof. Dr. Bruno Manfredini Baroni

Porto Alegre

2025

Catalogação na Publicação

Rebolledo Cobos, Roberto Carlos

Estudos com foco na prevenção de lesões em jovens futebolistas: percepções dos atletas e recuperação de força pós-jogo / Roberto Carlos Rebolledo Cobos. -- 2025.

69 p. : 30 cm.

Tese (doutorado) -- Universidade Federal de Ciências da Saúde de Porto Alegre, Programa de Pós-Graduação em Ciências da Reabilitação, 2025.

Orientador(a): Bruno Baroni.

1. Fisioterapia. 2. Medicina esportiva. I. Título.

Sistema de Geração de Ficha Catalográfica da UFCSPA com os dados fornecidos pelo(a) autor(a).

Estudos com foco na prevenção de lesões em jovens futebolistas: percepções dos atletas e recuperação de força pós-jogo

BANCA AVALIADORA

_____

Dr. Jeam Marcel Geremia

Universidade Federal de Rio Grande do Sul

_____

Dr. João Breno de Araujo Ribeiro Alvares

Universidade Federal de Ciências da Saúde de Porto Alegre

_____

Dr. Marcelo Faria Silva

Universidade Federal de Ciências da Saúde de Porto Alegre

Porto Alegre

2025

Universidade Federal de Ciências da Saúde de Porto Alegre – UFCSPA

PRÓ-REITORIA DE PESQUISA, PÓS-GRADUAÇÃO E INOVAÇÃO
Programa de Pós-Graduação em Ciências da Reabilitação

Ata de Defesa de Dissertação/Tese nº 118

De acordo com o estabelecido previamente pela Comissão Coordenadora do Programa de Pós-Graduação em Ciências da Reabilitação da Universidade Federal de Ciências da Saúde de Porto Alegre, aos vinte e quatro dias do mês de novembro do ano de dois mil e vinte e cinco, com início às dezesseis horas, ocorreu a **Defesa de Doutorado** de **ROBERTO CARLOS REBOLLEDO COBOS**, com orientação de **Bruno Manfredini Baroni**. O trabalho foi intitulado: "ESTUDOS COM FOCO NA PREVENÇÃO DE LESÕES EM JOVENS FUTEBOLISTAS: PERCEPÇÕES DOS ATLETAS E RECUPERAÇÃO DE FORÇA PÓS-JOGO".

A Banca Examinadora foi composta por:

Nome completo - CPF

Marcelo Faria Silva – 538.295.490-91

Jeam Marcel Geremia - 003.433.460-28

João Breno de Araujo Ribeiro Alvares – 763.465.010-20

Foram disponibilizados quarenta minutos para exposição oral, seguida de período de arguição pela banca examinadora. Após análise e deliberações, a banca emitiu o parecer:

(**X**) APROVAÇÃO

( ) REPROVAÇÃO

Uma vez tendo obtido aprovação na presente Defesa, e tendo cumprido os demais requisitos exigidos, conforme regulamento do Programa, será concedido o grau de "**Doutor em Ciências da Reabilitação: Fundamentos da Reabilitação Musculoesquelética**".

Nada mais havendo a tratar, foi encerrada a sessão e lavrada a presente ata, que será assinada pela orientação e pela coordenação do Programa.

Porto Alegre, 24 de novembro de 2025.

Documento assinado eletronicamente por **Bruno Manfredini Baroni**, **PROFESSOR 3 GRAU**, em 25/11/2025, às 11:11, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

Documento assinado eletronicamente por **Fernanda Cechetti**, **Coordenadora do Programa de Pós-Graduação em Ciências da Reabilitação**, em 27/11/2025, às 14:41, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

A autenticidade deste documento pode ser conferida no site https://sei.ufcspa.edu.br/sei/controlador_externo.php?acao=documento_conferir&id_orgao_acesso_externo=0, informando o código verificador **2316435** e o código CRC **1498CAF4**.

Dedicatória

A Roberto, meu pai.

AGRADECIMENTO

Agradeço ao curso de Fisioterapia da Universidade Libre – Seccional Barranquilla – e da Universidade Metropolitana (Colombia). Às suas diretoras, Leslie Montealegre e Ana Caro Freile, pelo constante apoio e liderança.

Ao Dr. Jorge Luis Bilbao e à Dra. Yoleydis Collazos, pela confiança e apoio.

Ao grupo de pesquisa AFIDESA, agradeço pelo trabalho incansável e pelo comprometimento exemplar.

Ao Dr. Carlos Rolong Donado, pela disposição permanente e pelo valioso apoio.

Ao grupo SEFUM, sob a coordenação do Dr. Raúl Polo Gallardo e do Eng. Jheifer Páez, por todo o suporte técnico e humano dedicado à minha trajetória.

A todos os jovens sonhadores que participaram dos meus estudos, desejo sucesso e bem-estar.

Aos colegas do Grupo de Ciência no Esporte e do Exercício (GCEE).

Por fim, meu especial agradecimento ao meu orientador, professor Bruno Manfredini Baroni, pela valiosa orientação, paciência, apoio e dedicação. Sua contribuição tem sido essencial para meu crescimento profissional e pessoal.

Epígrafe

“Avaliar apenas na pré-temporada é como escolher uma roupa para usar o ano todo, com base na previsão do tempo de hoje.”

(B.M. Baroni)

RESUMO

Esta tese foi composta por dois estudos realizados com atletas de futebol masculino das categorias de base de clubes de elite da Colômbia. No primeiro estudo, 504 atletas, com idades entre 15 e 20 anos, vinculados a nove clubes de oito cidades diferentes, responderam a um questionário on-line sobre percepções em relação aos fatores de risco e às estratégias preventivas de lesões esportivas. Os resultados mostraram que os atletas identificaram a recuperação pós-exercício insuficiente — caracterizada por sono inadequado, hidratação limitada e déficits de força — como um dos principais fatores predisponentes à lesão. Além disso, reconheceram o aquecimento pré-competitivo, a hidratação, a dieta, o controle da carga de trabalho e as estratégias baseadas em exercícios como condutas protetoras essenciais em suas rotinas. Motivado pela importância atribuída pelos futebolistas à recuperação pós-exercício, o segundo estudo teve como objetivo examinar a cinética de restauração da força excêntrica dos isquiotibiais após uma partida competitiva. Participaram duas equipes da categoria sub-20 que se enfrentaram no primeiro jogo da temporada. A força excêntrica produzida pelos músculos posteriores da coxa durante a execução do exercício nórdico de isquiotibiais foi mensurada na véspera do jogo e aproximadamente 24, 48 e 72 horas após a partida. Os resultados revelaram uma redução significativa da força excêntrica em relação ao valor basal nos três momentos de coleta pós-jogo. No membro dominante, os déficits médios foram de 16,8% em 24 horas, 13,6% em 48 horas e 7,8% em 72 horas, enquanto o membro não dominante apresentou reduções de 14,7%, 12,1% e 8,1%, respectivamente. Em nível individual, 70% dos atletas apresentaram pelo menos um membro não recuperado em 24 horas, proporção que diminuiu para 50% em 48 horas e 40% em 72 horas. Apenas um atleta alcançou recuperação completa em ambos os membros dentro do período de acompanhamento de três dias. Esses achados demonstram que a recuperação da força excêntrica dos isquiotibiais após uma partida competitiva é heterogênea e frequentemente incompleta até 72 horas após o jogo.

Palavras-chave: Lesão; Prevenção do lesões; Risco de Lesão; Força; Fadiga; Futebol.

Objetivos de desenvolvimento sustentável: saúde e bem-estar

ABSTRACT

This thesis comprised two studies conducted with male football players from the youth academies of elite clubs in Colombia. In the first study, 504 players aged 15 to 20 years, affiliated with nine clubs across eight different cities, completed an online questionnaire regarding their perceptions of injury risk factors and preventive strategies. The results showed that players identified insufficient post-exercise recovery — characterized by inadequate sleep, limited hydration, and strength deficits — as one of the main predisposing factors for injury. Moreover, they recognized pre-competition warm-up, hydration, nutrition, workload control, and exercise-based strategies as essential protective measures in their routines. Motivated by the importance that football players attributed to post-exercise recovery, the second study aimed to examine the time course of eccentric hamstring strength restoration following a competitive match. Two under-20 teams that faced each other in the first game of the season participated in the study. Eccentric strength produced by the hamstring muscles during the execution of the Nordic hamstring exercise was measured on the day before the match and approximately 24, 48, and 72 hours afterward. The findings revealed a significant reduction in eccentric strength compared with baseline at all three post-match time points. In the dominant limb, mean deficits were 16.8% at 24 hours, 13.6% at 48 hours, and 7.8% at 72 hours, whereas the non-dominant limb showed reductions of 14.7%, 12.1%, and 8.1%, respectively. At the individual level, 70% of players had at least one limb not recovered at 24 hours, decreasing to 50% at 48 hours and 40% at 72 hours. Only one player achieved full recovery in both limbs within the three-day follow-up period. These findings demonstrate that eccentric hamstring strength recovery after a competitive football match is heterogeneous and often incomplete up to 72 hours post-match.

Keywords: Injury; Injury prevention; Injury risk; Strength; Fatigue; Football.

Sustainable Development Goals: Good Health and Well-being

LISTA DE FIGURAS

Artigo 1

Artigo 2

LISTA DE ABREVIATURAS E SIGLAS

HSI	Hamstring strain injuries
FIFA	Fédération Internationale de Football Association
NHE	Nordic hamstring exercise
CI	Confidence interval
MD+1	One day after the match
MD+2	Two days after the match
MD+3	Three days after the match
ICC	Intraclass correlation coefficient
CV	Coefficient of variation
MDC	Minimal detectable change
SAFT90	Soccer Aerobic Field Test

SUMÁRIO

1 CONTEXTUALIZAÇÃO

As lesões esportivas constituem um problema relevante no campo das ciências do esporte, devido ao seu impacto sobre o desempenho, a continuidade competitiva e a saúde dos atletas. Nos últimos anos, o avanço da epidemiologia esportiva tem permitido identificar padrões de incidência, mecanismos e fatores de risco específicos em diferentes contextos competitivos. No futebol — esporte caracterizado por sua elevada exigência física, técnica e tática — as lesões musculoesqueléticas representam uma das principais causas de tempo perdido e limitação funcional, tanto em categorias profissionais quanto de formação (López-Valenciano et al., 2020; Pulici et al., 2022). A compreensão integral desse fenômeno exige não apenas abordar os componentes biomecânicos e fisiológicos envolvidos, mas também considerar dimensões perceptuais, comportamentais e contextuais que influenciam a adoção de medidas preventivas.

Diversos estudos apontam que o futebol apresenta uma das mais altas taxas de incidência de lesões entre os esportes coletivos, atingindo aproximadamente 8 lesões a cada 1.000 horas de exposição total, com frequência significativamente maior durante as partidas em comparação com os treinamentos (López-Valenciano et al., 2020). No futebol juvenil de elite, os índices de lesão aproximam-se perigosamente dos observados em jogadores profissionais, especialmente nas categorias sub-17 e sub-21, nas quais são registrados valores de 7,9 lesões por 1.000 horas de exposição (Jones et al., 2019). Esse panorama é particularmente preocupante, uma vez que os jovens atletas lesionados apresentam menor probabilidade de alcançar o nível

profissional em comparação com seus pares não lesionados (Bangert et al., 2024). Assim, a prevenção de lesões no futebol de base adquire não apenas uma dimensão sanitária, mas também educacional e de desenvolvimento esportivo.

Entre os diferentes tipos de lesões, as lesões musculares destacam-se por sua alta frequência e recorrência, representando entre 30% e 40% do total de lesões no futebol profissional (Ekstrand et al., 2022). Dentro desse grupo, as lesões dos isquiotibiais (hamstring strain injuries, HSI) constituem um foco prioritário de atenção. Estudos multicêntricos europeus relatam que as HSI correspondem a até 24% de todas as lesões musculares no futebol masculino profissional, com tendência crescente nas últimas duas décadas (Ekstrand et al., 2022; Diemer et al., 2021). Sua relevância reside não apenas na alta taxa de recorrência, mas também no impacto funcional, uma vez que a musculatura isquiotibial participa ativamente de ações críticas do jogo, como o sprint, a mudança de direção e o chute.

As causas das lesões de isquiotibiais são multifatoriais. Entre os fatores intrínsecos, a fraqueza excêntrica e os desequilíbrios de força entre os grupos musculares flexores e extensores do joelho foram identificados como preditores relevantes (Bourne et al., 2015; Lee et al., 2018). Além disso, sugere-se que o encurtamento das fibras musculares do biceps femoris e déficits na capacidade de geração de força excêntrica aumentam significativamente o risco de lesão (Timmins et al., 2016). No entanto, a literatura apresenta controvérsias, uma vez que nem todos os estudos confirmam associações consistentes entre força isocinética ou excêntrica e ocorrência de lesões (van Dyk et al., 2016). Essas inconsistências podem estar relacionadas à natureza variável da força muscular,

influenciada pela fadiga, pelo momento da temporada e pelas cargas acumuladas (Opar et al., 2021).

A eficácia dos programas de prevenção de lesões não depende apenas de seu desenho funcional ou biomecânico, mas também da adesão e da percepção dos atletas. Sob uma perspectiva biopsicossocial, a prevenção requer integrar a evidência científica, a experiência clínica e os valores do atleta (Herbert et al., 2011). Nesse contexto, compreender as percepções dos jovens jogadores sobre fatores de risco e estratégias preventivas é essencial para promover seu envolvimento com as intervenções (Finch & Donaldson, 2010; Babatunde et al., 2017).

Pesquisas recentes em academias de futebol de elite na América Latina demonstram que os jovens futebolistas tendem a priorizar fatores de risco externos ou imediatos — como hidratação, aquecimento e descanso inadequado —, enquanto subestimam aspectos intrínsecos, como força muscular, fadiga neuromuscular e qualidade do movimento (Liporaci et al., 2022; Zech & Wellmann, 2017). Esse achado revela uma lacuna entre a percepção do atleta e a evidência científica, destacando a necessidade de intervenções educativas que promovam uma compreensão mais profunda dos determinantes fisiológicos do risco de lesão. Ao alinhar o conhecimento dos jogadores às práticas baseadas em evidências, favorece-se a adesão a programas multicomponentes, como o FIFA 11+ ou o FUNBALL, ambos comprovadamente eficazes na redução significativa da incidência de lesões não traumáticas (Silvers-Granelli et al., 2015; Obërtinca et al., 2024).

Entre as estratégias preventivas mais eficazes, o treinamento excêntrico dos isquiotibiais, especialmente por meio do exercício nórdico (Nordic Hamstring

Exercise, NHE), demonstrou reduzir o risco de HSI em até 51% em jogadores profissionais (Nunes et al., 2024). No entanto, sua aplicação isolada não é suficiente para manter resultados a longo prazo sem um sistema regular de monitoramento da força e da fadiga muscular. Nesse sentido, o acompanhamento sistemático do desempenho excêntrico pode fornecer informações valiosas sobre o estado de recuperação e o risco potencial de lesão (Wollin et al., 2020; Adams et al., 2024).

O monitoramento da força excêntrica após as partidas emergiu como um indicador objetivo da fadiga residual e, portanto, uma ferramenta útil para a prevenção secundária (Bueno et al., 2021; Rhodes et al., 2019). Estudos recentes com futebolistas juvenis de elite demonstraram que a recuperação completa da força excêntrica dos isquiotibiais pode demorar mais de 72 horas após uma partida competitiva (Cosio et al., 2025; Springham et al., 2024). Esses achados tornam-se especialmente relevantes em períodos de congestão de jogos, nos quais intervalos de descanso inferiores a quatro dias estão associados a uma maior incidência de lesões musculares (Bengtsson et al., 2018). Assim, a incorporação de testes sistemáticos de força excêntrica permite otimizar a tomada de decisões quanto à exposição ao treinamento e ao planejamento da carga, especialmente em jovens atletas em processo de maturação fisiológica.

As evidências disponíveis sugerem que as lesões musculares, particularmente as de isquiotibiais, continuam sendo um desafio persistente no futebol, mesmo em contextos com programas preventivos bem estruturados. A falta de alinhamento entre a percepção do risco pelos jogadores e as recomendações baseadas em evidências pode comprometer a eficácia das intervenções. Além disso, as variações individuais na recuperação pós-jogo e a

ausência de monitoramento excêntrico sistemático nas categorias de base representam lacunas críticas na literatura atual. Portanto, justifica-se o aprofundamento do estudo sobre a relação entre o conhecimento e a percepção dos jogadores juvenis acerca do risco de lesão e o monitoramento objetivo da força excêntrica, a fim de contribuir com estratégias integradas que aprimorem a segurança, o desempenho e a longevidade esportiva dos futebolistas em formação.

REFERÊNCIAS

Adams, S. R., Wollin, M., Drew, M. K., Thorborg, K., Bourne, M. N., & Pizzari, T. (2024). Monitoring eccentric hamstring strength after football matches: implications for load management and injury prevention. Physical Therapy in Sport, 70, 15–21. https://doi.org/10.1016/j.ptsp.2024.02.005

Babatunde, F., MacDermid, J., & MacIntyre, N. (2017). Characteristics of therapeutic alliance in musculoskeletal physiotherapy and occupational therapy practice: a scoping review of the literature. BMC Health Services Research, 17(1), 375. https://doi.org/10.1186/s12913-017-2311-3

Bangert, Y., Jaber, A., Trefzer, R., Mühlbauer, T., Kunz, P., & Krutsch, W. (2024). The impact of injury on career progression in elite youth football: findings at 10 years. Journal of Clinical Medicine, 13(7), 1915. https://doi.org/10.3390/jcm13071915

Bengtsson, H., Ekstrand, J., Hägglund, M., Waldén, M., Kristenson, K., & Karlsson, J. (2018). Muscle injury rates in professional football increase with fixture congestion: an 11-year follow-up of the UEFA Champions League

injury study. British Journal of Sports Medicine, 52(17), 1116–1122. https://doi.org/10.1136/bjsports-2016-097399

Bourne, M. N., Opar, D. A., Williams, M. D., Al Najjar, A., Kerr, G. K., & Shield, A. J. (2015). Muscle activation patterns in the Nordic hamstring exercise: impact of prior strain injury. American Journal of Sports Medicine, 43(11), 2663–2670. https://doi.org/10.1177/0363546515599636

Bueno, C. A., Ribeiro-Alvares, J. B., Oliveira, G. D. S., Junior, R. P., Vaz, M. A., & Baroni, B. M. (2021). Post-match recovery of eccentric knee flexor strength in professional football players: implications for injury prevention. Physical Therapy in Sport, 47, 140–146. https://doi.org/10.1016/j.ptsp.2020.12.001

Cosio, P. L., Moreno-Simonet, L., Fernández, D., Cuadrado, M., Noya, J., & Valero-Cabré, A. (2025). Time course of hamstring eccentric strength recovery after competitive soccer matches in elite youth players. European Journal of Applied Physiology, 125(5), 1449–1461. https://doi.org/10.1007/s00421-025-05082-3

Diemer, W. M., Winters, M., Tol, J. L., Reurink, G., Weir, A., & van Dyk, N. (2021). Epidemiology and recurrence of hamstring injuries in professional male football players: a 15-year study in the Netherlands. Journal of Orthopaedic & Sports Physical Therapy, 51(1), 27–36. https://doi.org/10.2519/jospt.2021.9978

Ekstrand, J., Bengtsson, H., Waldén, M., Hägglund, M., Ekblom, B., & Andersen, T. (2022). Injury incidence, patterns, and burden in men's professional

football: the UEFA Elite Club Injury Study. British Journal of Sports Medicine, 56(4), 234–240. https://doi.org/10.1136/bjsports-2021-104460

Finch, C. F., & Donaldson, A. (2010). A sports setting matrix for understanding the implementation context for community sport. British Journal of Sports Medicine, 44(13), 973–978. https://doi.org/10.1136/bjsm.2008.056069

Herbert, R., Jamtvedt, G., & Hagen, K. (2011). Practical evidence-based physiotherapy (2nd ed.). Churchill Livingstone.

Jones, S., Almousa, S., Gibb, A., Andersen, T. E., Johnson, A., & Geertsema, C. (2019). Injury incidence, prevalence and severity in high-level male youth football: a systematic review. Sports Medicine, 49(12), 1879–1899. https://doi.org/10.1007/s40279-019-01169-8

Lee, J. W. Y., Mok, K. M., Chan, H. C. K., Yung, P. S. H., & Chan, K. M. (2018). Eccentric hamstring strength deficit and poor hamstring-to-quadriceps ratio are risk factors for hamstring strain injury in football: a prospective study. Journal of Science and Medicine in Sport, 21(8), 789–793. https://doi.org/10.1016/j.jsams.2017.12.006

Liporaci, R. F., Yoshimura, S., & Baroni, B. M. (2022). Perceptions of professional football players on injury risk factors and prevention strategies. Science and Medicine in Football, 5(2), 148–152. https://doi.org/10.1080/24733938.2021.1937689

López-Valenciano, A., Ruiz-Pérez, I., García-Gómez, A., Vera-García, F. J., De Ste Croix, M., & Ayala, F. (2020). Epidemiology of injuries in professional football: a systematic review and meta-analysis. British Journal of Sports Medicine, 54(12), 711–718. https://doi.org/10.1136/bjsports-2018-099577

Nunes, H., Fernandes, L. G., Martins, P. N., Ferreira, R. M., Oliveira, T., & Reis, J. F. (2024). The effects of Nordic hamstring exercise on performance and injury in the lower extremities: an umbrella review. Healthcare (Basel), 12(15), 1462. https://doi.org/10.3390/healthcare12151462

Obërtinca, R., Meha, R., Hoxha, I., Krasniqi, E., Kelmendi, F., & Dervishi, A. (2024). Efficacy of a new injury prevention programme (FUNBALL) in young male football players: a cluster-randomised controlled trial. British Journal of Sports Medicine, 58(10), 548–555. https://doi.org/10.1136/bjsports-2023-107388

Opar, D. A., Timmins, R. G., Behan, F. P., Bourne, M. N., Duhig, S. J., & Hickey, J. T. (2021). Strength and power development as modifiable risk factors for hamstring injury. Sports Medicine, 51(9), 1935–1945. https://doi.org/10.1007/s40279-021-01489-5

Rhodes, D., McNaughton, L., & Greig, M. (2019). The temporal pattern of recovery in eccentric hamstring strength post-match in professional soccer players. Research in Sports Medicine, 27(3), 339–350. https://doi.org/10.1080/15438627.2018.1556950

Silvers-Granelli, H., Mandelbaum, B., Adeniji, O., Insler, S., Bizzini, M., & Snyder-Mackler, L. (2015). Efficacy of the FIFA 11+ injury prevention program in the collegiate male soccer player. American Journal of Sports Medicine, 43(11), 2628–2637. https://doi.org/10.1177/0363546515602009

Timmins, R. G., Bourne, M. N., Shield, A. J., Williams, M. D., Lorenzen, C., & Opar, D. A. (2016). Short biceps femoris fascicles and eccentric knee flexor weakness increase the risk of hamstring injury in elite football. British

Journal of Sports Medicine, 50(24), 1524–1535. https://doi.org/10.1136/bjsports-2015-095362

van Dyk, N., Bahr, R., Whiteley, R., Tol, J. L., Kumar, B. D., & Hamilton, B. (2016). Hamstring and quadriceps isokinetic strength deficits are weak risk factors for hamstring strain injury: a 4-year cohort study. American Journal of Sports Medicine, 44(7), 1789–1795. https://doi.org/10.1177/0363546516632526

Wollin, M., Thorborg, K., Drew, M., & Pizzari, T. (2020). Monitoring the time course of hamstring strength recovery after football match-play. British Journal of Sports Medicine, 54(9), 498–499. https://doi.org/10.1136/bjsports-2018-099984

Zech, A., & Wellmann, K. (2017). Perceptions of football players regarding injury risk factors and prevention strategies. PLoS ONE, 12(5), e0176829. https://doi.org/10.1371/journal.pone.0176829

2 OBJETIVOS

Artigo 1

Descrever as percepções de jovens futebolistas do sexo masculino, vinculados à clubes de elite da Colômbia, acerca dos fatores de risco de lesão e as estratégias de prevenção empregadas no contexto do futebol.

Artigo 2

Examinar os efeitos de uma partida competitiva de futebol sobre a força excêntrica dos isquiotibiais em atletas sub-20 de elite ao longo de um período de três dias.

3 ARTIGO 1

PERCEPTIONS OF ELITE YOUNG MALE FOOTBALL PLAYERS REGARDING INJURY RISK FACTORS AND PREVENTION STRATEGIES

Artigo publicado no periódico *Journal of Sport Rehabilitation*

(ISSN: 1543-3072; Fator de Impacto 1.650)

Rebolledo-Cobos RC, Rolong-Donado C, Baroni BM. Perceptions of Elite Young Male Football Players Regarding Injury Risk Factors and Prevention Strategies. J Sport Rehabil. 2025:1-6. doi: 10.1123/jsr.2024-0379. Epub ahead of print. PMID: 40268282.

ABSTRACT

Context: Football players aged 15–20 years experience injury incidence rates similar to those of professionals, with players injured in this age group being significantly less likely to reach the professional level. Understanding the factors that influence young footballers' acceptance, adoption, and compliance with injury prevention programs is crucial. Therefore, this study aimed to describe the perceptions of male football players from premier league academies regarding injury risk factors and prevention strategies. Design: Cross-sectional observational study. **Methods:** An online survey was used to explore perceptions of injury risk factors and prevention strategies among young football players

(under-17 and under-20 teams) from premier league academies. **Results:** A total of 504 footballers (mean age: 18 [2] y) across 9 academies in 8 different cities participated in this study. No risk factor was elected as very important by at least half of participants. The top 5 injury risk factors elected by players were “poor hydration,” “inadequate warm-up,” “poor rest/sleep,” “inadequate diet,” and “poor strength/power.” At least 1 quarter of participants considered “genetics,” “advanced age,” “attention level,” “wheatear conditions,” and “alcohol consumption” as irrelevant factors for injury. There was no consensus for any prevention strategy. Fourteen strategies were ranked as efficient by at least 3 quarters of participants. The top 5 prevention strategies elected by players were “warm-up before training/matches,” “functional training,” “hydration before and during training/matches,” “flexibility training,” and “workload monitoring.” Lower than a half of participants endorsed “ankle braces” and “thermal shorts” for injury prevention. **Conclusions:** The results of this study offer valuable insights into the perceptions of elite young football players regarding injury risk factors and the effectiveness of preventive strategies. These perceptions are essential for understanding how athletes view injury prevention approaches in their daily routines.

Keywords: Soccer; Athletic Injuries; Injury prevention.

INTRODUCTION

Injuries are a major concern within the football (soccer) community. A systematic review of 44 studies concluded that professional football players experience an injury incidence rate of 8.1 per 1,000 hours of total exposure, with specific rates of 3.7 and 36 injuries per 1,000 hours during training and matches,

respectively.[1] These injuries have serious consequences for individual and club performance and economy.[2] In elite football academies, epidemiological research indicates a lower injury risk among early adolescents; however, pooled data reveal that footballers in the under-17 to under-21 age categories incur 7.9 injuries per 1,000 hours of total exposure.[3] This evidence suggests that older adolescent players face an injury risk comparable to that of professionals. This is particularly alarming given that young players who suffer injuries in this age group are significantly less likely to reach the professional level.[4]

Contemporary prevention programs adopt a holistic and biopsychosocial approach to address the web of factors potentially associated with increased injury risk.[5] Strategies focused on exercises to enhance physical attributes like strength, mobility, and stability still play a central role in football clubs.[6,7] Concurrently, there have been impressive advances in preventive measures such as monitoring internal and external workload measures,[8,9] using post-exercise recovery techniques,[10] and systematically collecting objective and subjective parameters to address the players' physical and mental status.[11] Interestingly, the effectiveness of these and other prevention strategies, particularly when applied together, still needs to be fully elucidated to better support the healthcare staff decision-making in football clubs.

Evidence-based practice is supported by three pillars: scientific evidence, clinical expertise, and patient values.[12] Patient values, including beliefs, preferences, concerns, and expectations, are crucial for building a therapeutic alliance, which influences engagement and outcomes in intervention programs.[13] Similarly, to prevent sport injuries, it is crucial to understand the factors that influence athletes to accept, adopt and comply with the elements of the

intervention,[14] especially because those with high compliance to prevention programs are less susceptible to injuries.[15,16]

The perception of professional football players regarding injury risk factors and the effectiveness of preventive strategies has been investigated in both male,[17-19] and female contexts.[20-22] Given their longer experience in the sport and typically enlarged history of injuries compared to adolescent players, it is reasonable to expect differences in perceptions between professional and young footballers. To date, our understanding of young footballers' perceptions on these topics is based on a subgroup of players from a single club.[17] Therefore, this study aimed to describe the perceptions of male football players from premier league academies regarding injury risk factors and prevention strategies.

METHODS

Study design

In this cross-sectional observational study, an online survey was conducted to explore perceptions regarding injury risk factors and prevention strategies among male young football players associated with premier league academies. All participants or their guardians provided informed consent prior to the collection of data.

Participants

Male football players aged 15 to 20 years, affiliated with Colombian premier league academies, were invited to participate. To qualify for the study, volunteers had to be actively engaged in the under-20 or under-17 team's training

regimen at the time of data collection. Participants under 15 years old were excluded, regardless of their team affiliation. No specific exclusion criteria were established regarding playing positions, experience level, injury history, or health status. All teams involved in the study usually conducted 5 weekly training sessions and regularly competed in regional and national tournaments, with some teams having prior experience in international competitions. These football academies were associated with professional football clubs in Colombia. In addition to undergoing football training overseen by professional coaching staffs, all athletes were followed by the academies' multidisciplinary healthcare staff.

Procedures

The data collection instrument utilized in this study was created using a structured questionnaire developed by our research group and previously employed in a study involving professional football players in Brazil.[19] Initially, the questionnaire underwent a thorough review and translation by a native Spanish-speaking researcher. Subsequently, the questionnaire was assessed by three individual collaborators, each possessing at least 5 years of experience working with football: a strength and conditioning coach, a medic, and a physiotherapist. Their review focused on ensuring linguistic accuracy in Spanish and linguistic accessibility within the cultural context of Colombian footballers. The final version of the questionnaire was accessible to participants via virtual survey (Google Forms) between June 3 and closed on August 17, 2023.

Healthcare staff leaders from academies meeting the eligibility criteria outlined in this study were contacted. Those who expressed interest in taking part and had approval from the academy's director board were sent a web link with

the online questionnaire to be delivered to players engaged with under-20 and under-17 teams. Upon clicking the provided web link, participants gained access to a comprehensive explanation regarding the survey's purpose and procedure. Following their agreement to participate in the study, participants were directed to the questionnaire. After providing demographic data, participants answered two multiple choice situations:

(i) *'Listed below are some risk factors for football player injuries. In your opinion, what is the degree of importance of each factor for the athlete to suffer injuries?'* Participants should mark one of the possible answers for each risk factor: 'not important', 'somewhat important', 'important', or 'very important'. An option 'other' was also available if the participant wanted to add a risk factor not contemplated in the options.

(ii) *'Listed below are some injury prevention strategies commonly used in football. Check out those you believe actually work to reduce the chance of an athlete suffering injuries.'* Participants could mark as many options as they wanted. An option 'other' was also available if the participant wanted to add a prevention strategy not contemplated in the options, as well as an option 'none of the above' if the participant did not believe in any strategy.

Data analysis

Raw data were exported and analyzed on Microsoft Excel software. To calculate the importance of each risk factor, points were awarded based on a Likert scale. Each time a risk factor was rated 'very important' it was awarded a value of 3 points; 'important', 2 points; 'somewhat important', 1 point; and 'not

important', zero points. Points were summed and risk factors ranked in order from highest to lowest score. Regarding the players' confidence in prevention strategies, the distribution of 'yes' and 'no' responses was analyzed for each strategy.

RESULTS

Twelve premier league academies were invited to participate in this study. Questionnaires were returned by nine academies located in eight different cities, comprising eight under-17 teams and nine under-20 teams. Overall, 504 elite young male football players aged 15 to 20 years took part in this study (mean age 17.58±1.59 years, 95%CI 17.44 to 17.72), with 245 players from under-17 teams and 259 players from under-20 teams. This sample consisted of 35 goalkeepers (6.94%), 155 defenders (30.76%), 165 midfielders (32.74%), and 149 forwards (29.56%).

Players' perceptions regarding injury risk factors are summarized in Figure 1. No risk factor was elected as very important by at least half of participants. No risk factor obtained 1,008 or more points, representing two-thirds of the maximum accumulated score. The top-five injury risk factors elected by players were '*poor hydration*', '*inadequate warm-up*', '*poor rest/sleep*', '*inadequate diet*', and '*poor strength/power*'. At least one-quarter of participants considered 'genetics', *'advanced age'*, *'attention level'*, *'wheatear conditions'*, and *'alcohol consumption'* as irrelevant factors for injury.

Players' perceptions regarding effectiveness of injury prevention strategies are summarized in Figure 2. There was no consensus for any prevention strategy.

Fourteen strategies were ranked as efficient by at least three-quarters of participants. The top-five prevention strategies elected by players were '*warm-up before training/matches'*, '*functional training'*, '*hydration before and during training/matches'*, '*flexibility training'*, and '*workload monitoring'*. Lower than a half of participants endorsed '*ankle braces'* and *'thermal shorts'* for injury prevention.

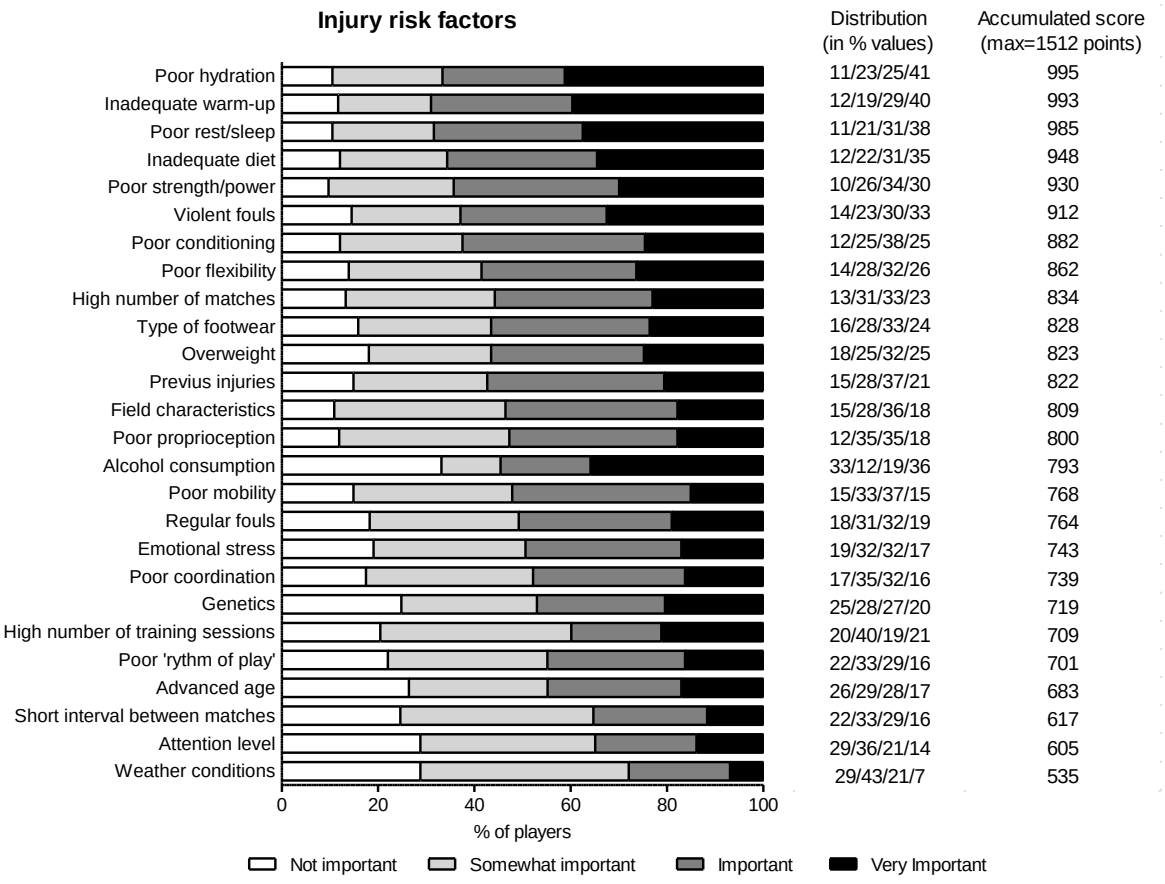

Figure 1. Football players' perceptions regarding injury risk factors.

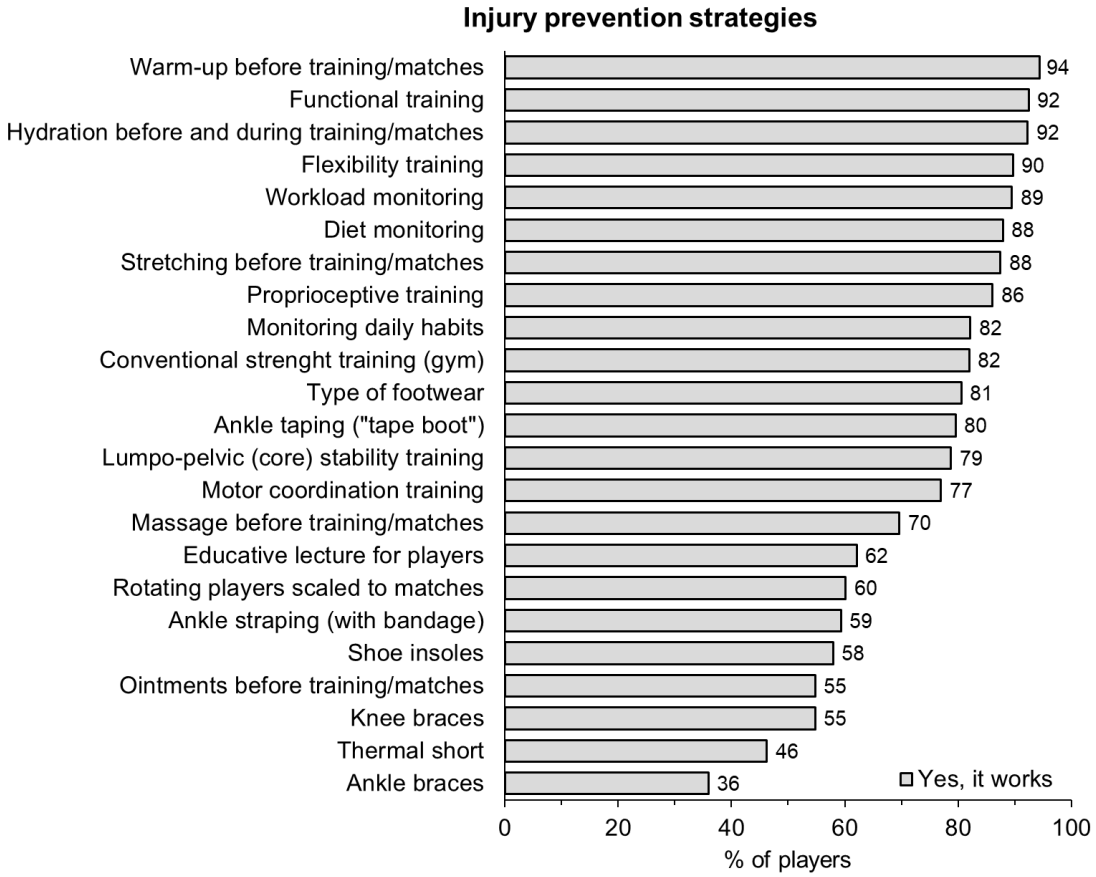

Figure 2. Football players' perceptions regarding effectiveness of injury prevention strategies.

DISCUSSION

The current study asked elite young male football players about the importance they attribute to different injury risk factors, as well as their opinions on the effectiveness of commonly used injury prevention strategies. The responses from over 500 participants, affiliated with under-17 and under-20 teams from nine premier league academies, provide a comprehensive understanding of their perspectives on injury prevention in youth football.

Research on football players' perceptions regarding injury prevention has primarily been conducted in European clubs. [17,18,21,22] With some of the most

traditional and well-funded leagues, Europe is a top target for young football talents globally. During the 2023/24 season, for example, more than 40 players under 20 years old from South America transferred to European clubs, generating approximately €226,6 million in transfer fees.[23] Therefore, gaining insight into the beliefs of South American footballers aged 15 to 20 is crucial not only for local clubs but also for international markets that invest significantly in promising South American talent.

Zech and Wellmann (2017) were pioneers in documenting injury prevention perceptions among 97 young footballers (under-15 to under-19) from a German second division club.[17] As the only study of its kind to date, their work provides a valuable benchmark. However, direct comparisons with our findings are limited due to differences in how the issues were approached. In contrast, a previous study conducted by our research group explored perceptions of injury risk factors and prevention strategies among 100 professional football players engaged in the main Brazilian leagues.[19] While Brazil and Colombia are neighboring countries in South America, cultural differences may influence the results. Despite this potential confounding factor, the consistent question format used in both studies enables a meaningful comparison between the perceptions of young players in the current research and those of professional players examined by Liporaci et al. (2022).[19]

While 80% of professional footballers perceived previous injury as an important or very important injury risk factor,[19] only 58% of young players acknowledged its relevance in the present study. Considering that previous injury is widely recognized as a key risk factor for sports injuries, it is important to make young players, especially those with a history of injuries, aware of the significance

of preventive measures. Interestingly, while four of the top five risk factors identified by professionals were associated with fatigue (poor sleep/rest, short intervals between matches, a high number of matches, and excessive training),[19] a significant portion of young players does not assign the same importance to these factors, with the exception of poor sleep/rest. The vigor of youth may help mitigate the negative effects of fatigue associated with football routines. However, considering those who progress to senior team will face congested match schedules, they should be mindful of its association with injury risk.[24] Additionally, young players expressed notable concern about hydration and diet, factors that are not primary concerns for professionals.[19] Although it seems plausible that poor hydration and nutrition could increase injury risk, there is a lack of studies confirming this in football contexts.

One point of agreement between professional players,[19] and young players is the recognition of inadequate muscle strength/power as a primary risk factor for football injuries. This perception is supported by scientific evidence, including prospective studies on hamstring,[25] and groin injuries.[26] Acknowledging muscular strength as a protective factor against injuries suggests an opportunity to implement resistance exercise programs, such as Nordic curls,[27] and Copenhagen adduction,[28] which have proven effective in injury prevention. Conversely, it is noteworthy that a significant portion of young athletes did not view deficits in proprioception, mobility, and coordination as potential contributors to injuries. For example, the dreaded anterior cruciate ligament rupture has been linked to poor hip and ankle mobility,[29] as well as to biomechanical patterns related to landing,[30] and cutting.[31] Considering the scientific advances in understanding risk factors related to movement quality, it is essential to educate

young footballers who mistakenly prioritize factors like footwear type over more critical issues such as proprioception, mobility, and coordination.

An analysis of the responses regarding the perceived effectiveness of prevention strategies shows that young players tend to have more confidence in such strategies compared to professionals.[19] Fourteen strategies were rated as effective by at least three-quarters of young players, while only eight strategies received this level of approval among professionals.[19] Neither study asked which strategies the participants had previously been exposed to, so it cannot be concluded that the higher rejection rate among professionals was due to unsuccessful experiences with certain strategies. In contrast, these findings indicate that young footballers are more receptive to implementing preventive programs that encompass a broader range of strategies. Confidence in the proposed strategy is crucial for acceptance and adherence to the prevention program,[14] which is directly linked to its effectiveness.[15,16] Therefore, healthcare practitioners may find more fertile ground for implementing prevention strategies among young players than in professional squads. However, poor infrastructure (facilities and/or materials), insufficient human resources, and limited support from club board or coaching staff could pose barriers for practitioners working in football academies worldwide.[32]

Warming up before training or matches was regarded as an effective strategy by at least 9 out of 10 young or professional footballers.[19] There is no scientific evidence supporting the effectiveness of unstructured warm-ups in reducing injury rates. Conversely, the integration of specific multicomponent exercise-based programs into football team warm-ups, such as FIFA 11+,[15] and FUNBALL,[33] has been shown to effectively prevent injuries among young players.

These programs include exercises that target strength, core stability, balance, coordination, and plyometrics, along with running and jumping tasks. Consequently, these multicomponent programs address factors that many young players may overlook, such as coordination. This underscores the importance of educating footballers about evidence-based risk factors and the recommended strategies to mitigate them. In addition, it is noteworthy that both FIFA 11+ and FUNBALL incorporate levels of progression, thus players should be encouraged to gradually increase exercise difficulty continuously to optimize the results. By doing so, players can begin to view warm-up not merely as a preparatory routine but as an integral part of training that enhances performance while simultaneously preventing injuries.

It is challenging to determine which components are most critical within a multicomponent exercise-based program. Interestingly, a meta-analysis examining the effectiveness of exercise interventions for reducing noncontact injuries in female footballers found that strength exercises were the most frequently included component.[34] Contemporary literature suggests that various forms of strength training whether traditional resistance, eccentric, or flywheel are valid methods for reducing injury risk in football players.[35] Therefore, the confidence in functional and conventional strength training, expressed by the majority of athletes interviewed in this study, aligns well with current scientific findings. Training programs that focus on neuromuscular control and core stability already proven effective in reducing knee injuries,[36] also seem to be well-received by young athletes. Conversely, the effectiveness attributed by young players to stretching interventions remains unproven. A review of 300 studies on varied

stretching programs in athletes found that only five trials assessed injury-related outcomes, none of which supported the preventive role of stretching.[37]

This study has limitations. The questionnaire was not reviewed by young football players or tested for reliability, which may have affected the clarity and consistency of the responses. The use of unsupervised virtual questionnaires could also have impacted how attentively participants completed the survey. Additionally, confounding factors like injury history and player experience were not controlled, which may have influenced the results. At the same time, a few strengths of this study should be noted. First, the robustness of the sample size. While most previous studies on injury prevention perceptions have involved less than 200 football players,[17,19-22], the inclusion of over 500 youth footballers makes this the largest sample to date. Players were drawn from multiple elite academies across different regions of the country, which enhances the generalizability of the findings beyond a single localized context. However, similar studies need to be conducted in other countries to enhance ecological validity and identify any differences compared to the Colombian context examined in the present study.

CONCLUSION

The results of this study offer valuable insights into the perceptions of elite young football players regarding injury risk factors and the effectiveness of preventive strategies. These perceptions are essential for understanding how athletes view injury prevention in their daily routines. Considering the unique context of each football academy, it is advisable for the healthcare staff to assess and enhance players' understanding of this topic before or alongside the implementation of injury prevention programs aimed at optimizing adherence.

REFERENCES

1. López-Valenciano A, Ruiz-Pérez I, Garcia-Gómez A, et al. Epidemiology of injuries in professional football: a systematic review and meta-analysis. *Br J Sports Med*. 2020;54(12):711-718. doi: 10.1136/bjsports-2018-099577
2. Pulici L, Certa D, Zago M, Volpi P, Esposito F. Injury Burden in Professional European Football (Soccer): Systematic Review, Meta-Analysis, and Economic Considerations. *Clin J Sport Med*. 2022. doi: 10.1097/JSM.0000000000001107
3. Jones S, Almousa S, Gibb A, et al. Injury Incidence, Prevalence and Severity in High-Level Male Youth Football: A Systematic Review. *Sports Med*. 2019;49(12):1879-1899. doi: 10.1007/s40279-019-01169-8
4. Bangert Y, Jaber A, Trefzer R, et al. The Impact of Injury on Career Progression in Elite Youth Football-Findings at 10 Years. *J Clin Med*. 2024;13(7):1915. doi: 10.3390/jcm13071915
5. Coles P. A. An injury prevention pyramid for elite sports teams. *Br J Sports Med*. 2018; 52(15):1008–1010. doi: 10.1136/bjsports-2016-096697
6. McCall A, Carling C, Nedelec M, et al. Risk factors, testing and preventative strategies for non-contact injuries in professional football: current perceptions and practices of 44 teams from various premier leagues. *Br J Sports Med*. 2014;48(18):1352-1357. doi: 10.1136/bjsports-2014-093439
7. Meurer MC, Silva MF, Baroni BM. Strategies for injury prevention in Brazilian football: Perceptions of physiotherapists and practices of premier league teams. *Phys Ther Sport*. 2017;28:1-8. doi: 10.1016/j.ptsp.2017.07.004

8. Delecroix B, McCall A, Dawson B, Berthoin S, Dupont G. Workload and non-contact injury incidence in elite football players competing in European leagues. E*ur J Sport Sci*. 2018;18(9):1280-1287. doi: 10.1080/17461391.2018.1477994

9. Bowen L, Gross AS, Gimpel M, Bruce-Low S, Li FX. Spikes in acute:chronic workload ratio (ACWR) associated with a 5-7 times greater injury rate in English Premier League football players: a comprehensive 3-year study. *Br J Sports Med*. 2020;54(12):731-738. doi: 10.1136/bjsports-2018-099422

10. Querido SM, Brito J, Figueiredo P, Carnide F, Vaz JR, Freitas SR. Postmatch recovery practices carried out in professional football: a survey of 56 portuguese professional football teams. *Int J Sports Physiol Perform*. 2022;17(5):748-754. doi: 10.1123/ijspp.2021-0343

11. Delaval B, Abaïdia AE, Delecroix B, et al. Recovery During a Congested Schedule and Injury in Professional Football. *Int J Sports Physiol Perform*. 2022;17(9):1399-1406. doi: 10.1123/ijspp.2021-0504

12. Herbert R, Jamtvedt G, Hagen K. *Practical Evidence-Based Physiotherapy*. London, GB: Churchill Livingstone; 2011.

13. Babatunde F, MacDermid J, MacIntyre N. Characteristics of therapeutic alliance in musculoskeletal physiotherapy and occupational therapy practice: a scoping review of the literature. *BMC Health Serv Res*. 2017;17(1):375. doi: 10.1186/s12913-017-2311-3

14. Finch CF, Donaldson A. A sports setting matrix for understanding the implementation context for community sport. *Br J Sports Med*. 2010;44(13):973–978. doi: 10.1136/bjsm.2008.056069

15. Soligard T, Nilstad A, Steffen K, et al. Compliance with a comprehensive warm-up programme to prevent injuries in youth football. *Br J Sports Med*. 2010;44 (11):787–793. doi: 10.1136/bjsm.2009.070672

16. Silvers-Granelli H, Mandelbaum B, Adeniji O, et al. Efficacy of the FIFA 11+ injury prevention program in the collegiate male soccer player. *Am J Sports Med*. 2015;43(11):2628–2637. doi: 10.1177/0363546515602009

17. Zech A, Wellmann K. Perceptions of football players regarding injury risk factors and prevention strategies. *PLos ONE*. 2017;12(5):e0176829. doi: 10.1371/journal.pone.0176829

18. Loose O, Achenbach L, Fellner B, et al. Injury prevention and return to play strategies in elite football: no consent between players and team coaches. *Arch Orthop Trauma Surg*. 2018;138(7):985–992. doi: 10.1007/s00402-018-2937-6

19. Liporaci RF, Yoshimura S, Baroni BM. Perceptions of professional football players on injury risk factors and prevention strategies. *Sci Med Football*. 2022;5(2):148–152. doi: 10.1080/24733938.2021.1937689

20. Geertsema C, Geertsema L, Farooq A, et al. Injury prevention knowledge, beliefs and strategies in elite female footballers at the FIFA Women's World Cup France 2019. *Br J Sports Med*. 2021;55(14):801–806. doi: 10.1136/bjsports-2020-103131

21. Horan D, Kelly S, Hägglund M, et al. Players', head coaches', and medical personnels' knowledge, understandings and perceptions of injuries and injury prevention in elite-level women's football in ireland. *Sports Med Open*. 2023;9(1):64. doi: 10.1186/s40798-023-00603-6

22. Bolling C, Tomás R, Verhagen E. 'Considering the reality, I am very lucky': how professional players and staff perceive injury prevention and performance protection in women's football. *Br J Sports Med*. 2024:bjsports-2023-106891. doi: 10.1136/bjsports-2023-106891
23. Transfermarkt GmbH & Co. KG. Accessed July 24, 2024. https://www.transfermarkt.co.uk
24. Bengtsson H, Ekstrand J, Hagglund 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(12):743–747. doi: 10.1136/bjsports-2013-092383
25. Timmins RG, Bourne MN, Shield AJ, et al. Short biceps femoris fascicles and eccentric knee flexor weakness increase the risk of hamstring injury in elite football (soccer): a prospective cohort study. *Br J Sports Med*. 2016;50(24):1524-1535. doi: 10.1136/bjsports-2015-095362
26. Esteve E, Casals M, Saez M, et al. Past-season, pre-season and in-season risk assessment of groin problems in male football players: a prospective full-season study. *Br J Sports Med*. 2022;56(9):484-489. doi: 10.1136/bjsports-2020-102606
27. Nunes H, Fernandes LG, Martins PN, Ferreira RM. The effects of nordic hamstring exercise on performance and injury in the lower extremities: an umbrella review. *Healthcare (Basel)*. 2024;12(15):1462. doi: 10.3390/healthcare12151462
28. Harøy J, Clarsen B, Wiger EG, et al. The Adductor Strengthening Programme prevents groin problems among male football players: a cluster-

randomised controlled trial. *Br J Sports Med*. 2019;53(3):150-157. doi: 10.1136/bjsports-2017-098937

29. Bedi A, Warren RF, Wojtys EM, et al. Restriction in hip internal rotation is associated with an increased risk of ACL injury. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(6):2024-2031. doi: 10.1007/s00167-014-3299-4
30. Sigward SM, Pollard CD, Powers CM. The influence of sex and maturation on landing biomechanics: implications for anterior cruciate ligament injury. *Scand J Med Sci Sports*. 2012;22(4):502-509. doi: 10.1111/j.1600-0838.2010.01254.x
31. Havens KL, Sigward SM. Cutting mechanics: relation to performance and anterior cruciate ligament injury risk. *Med Sci Sports Exerc*. 2015;47(4):818-24. doi: 10.1249/MSS.0000000000000470
32. Vianna KB, Ribas LO, Rodrigues LG, et al. Injury prevention in Brazilian women's football: Perceptions of physiotherapists and practices within elite clubs. *Phys Ther Sport*. 2024;67:68-76. doi: 10.1016/j.ptsp.2024.04.001
33. Obërtinca R, Meha R, Hoxha I, et al. Efficacy of a new injury prevention programme (FUNBALL) in young male football (soccer) players: a cluster-randomised controlled trial. *Br J Sports Med*. 2024;58(10):548-555. doi: 10.1136/bjsports-2023-107388
34. Crossley KM, Patterson BE, Culvenor AG, et al. Making football safer for women: a systematic review and meta-analysis of injury prevention programmes in 11773 female football (soccer) players. *Br J Sports Med*. 2020;54(18):1089–1098. doi: 10.1136/bjsports-2019-101587

35. Beato M, Maroto-Izquierdo S, Turner AN, Bishop C. Implementing strength training strategies for injury prevention in soccer: scientific rationale and methodological recommendations. *Int J Sports Physiol Perform*. 2021;16(3):456-461. doi: 10.1123/ijspp.2020-0862

36. Waldén M, Atroshi I, Magnusson H, Wagner P, Hägglund M. Prevention of acute knee injuries in adolescent female football players: cluster randomised controlled trial. *BMJ*. 2012;344:e3042. doi: 10.1136/bmj.e3042

37. Afonso J, Andrade R, Rocha-Rodrigues S, et al. What we do not know about stretching in healthy athletes: a scoping review with evidence gap map from 300 trials. *Sports Med*. 2024;54(6):1517-1551. doi: 10.1007/s40279-024-02002-7

4 ARTIGO 2

TIME COURSE OF POST-MATCH ECCENTRIC HAMSTRING STRENGTH RECOVERY IN ELITE YOUTH FOOTBALL PLAYERS

5. CONCLUSÃO GERAL

O artigo 1 evidencia um padrão de percepção desequilibrado em 504 atletas juvenis de elite de nove academias, no qual nenhum fator foi considerado “muito importante” por ≥50% dos participantes e se priorizaram riscos externos/imediatos (hidratação, aquecimento, descanso, dieta) em detrimento de determinantes intrínsecos (força/potência). Ademais, não houve consenso sobre as estratégias preventivas, embora 14 tenham sido julgadas eficazes por pelo menos três quartos da amostra, o que revela alta receptividade potencial se a oferta for adequada. À luz desses achados, a orientação prática é operacionalizar a prevenção por meio de (i) alfabetização em saúde e educação específica sobre fatores intrínsecos e seu vínculo causal com a lesão, avaliando a compreensão antes e durante a implementação; (ii) programas multicomponentes estruturados integrados ao microciclo (força — incluindo a excêntrica —, controle motor e monitoramento de carga) com métricas de adesão e de resultado claramente definidas; e (iii) retroalimentação individualizada para alinhar crenças às melhores evidências e aos valores do atleta, em coerência com os três pilares da prática baseada em evidências.

No artigo 2, a investigação sobre a cinética de recuperação da força excêntrica dos isquiotibiais após a competição em atletas sub-20 respondeu ao objetivo proposto ao evidenciar déficits residuais heterogêneos, frequentemente persistentes por ≥72 h, e assimetrias entre membros. Isso justifica um modelo de prevenção secundária que incorpore testes excêntricos seriados nos dias subsequentes à partida, com limiares operacionais para a tomada de decisão clínica e para a prescrição de recuperação/treinamento (por exemplo, “recuperado”, “parcial”, “não recuperado”). Em cenários de congestão

competitiva, a programação deve evitar exposições de alta exigência quando persistirem déficits relevantes, priorizando estratégias de recuperação direcionadas e modulação de cargas. Para robustecer a validade externa e a aplicabilidade, recomenda-se a condução de ensaios controlados por conglomerados que comparem rotas de manejo baseadas na monitorização excêntrica versus o cuidado habitual, integrando métricas de carga interna/externa, maturação biológica, marcadores bioquímicos e desempenho específico (sprint, mudanças de direção).

6. IMPACTOS DO TRABALHO

Os dois estudos aportam evidências inéditas para o contexto de futebol juvenil de elite. O artigo 1 reúne uma amostra multicêntrica robusta (504 atletas das categorias sub-17 e sub-20), permitindo mapear de forma sem precedentes o “perfil perceptual” dos atletas sobre risco e prevenção, informação escassa na literatura e ausente na realidade latino-americana. O artigo 2 descreve, em uma amostra de atletas sub-20, a cinética de recuperação da força excêntrica dos isquiotibiais após jogo, evidenciando heterogeneidade interindividual e possíveis assimetrias entre membros em até 72 horas. Em conjunto, os achados avançam o estado da arte ao integrar dimensões cognitivas e comportamentais (percepções e crenças) a marcadores objetivos de fadiga residual, oferecendo um arcabouço conceitual e aplicado para delinear estratégias de prevenção primária (educação e treinamento) e secundária (monitoramento pós-jogo) específicas para populações em formação.

As evidencias podem fomentar programas preventivos mais assertivos nas academias. A partir do artigo 1, recomenda-se incorporar educacao estruturada em saude (alfabetizacao em fatores intrinsecos, como forca excentrica e controle motor) e feedback individualizado, elevando adesao e eficacia. A partir do artigo 2, a implementacao rotineira de monitoramento da recuperacao pos-jogo orienta decisoes sobre carga e retorno ao treino/jogo. Espera-se, como consequencia, reducao do risco de lesoes, menor tempo de afastamento, diminuicao de custos com reabilitacao e maior continuidade formativa, beneficios que se estendem a atletas, familias, clubes e federacoes, com impacto social positivo na trajetoria esportiva e no bem-estar dos jovens.

O artigo 2 demonstra, ainda, a viabilidade tecnológica de um dispositivo de baixo custo para mensurar a força excêntrica de isquiotibiais durante o NHE, com usabilidade em ambientes de campo e integração potencial a rotinas de controle de carga. A solução viabiliza coleta em tempo real, definição de limiares operacionais (recuperado/parcial/não recuperado) e geração de dashboards de decisão clínica para equipes multiprofissionais. Essa acessibilidade tecnológica favorece a disseminação do monitoramento excêntrico em academias com recursos limitados, promove padronização de protocolos e cria bases para futuros sistemas de suporte à decisão que integrem dados de força, carga interna/externa e desempenho específico, consolidando um ciclo contínuo de prevenção baseada em dados.