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Neurofeedback in Football: A Systematic Review of Cognitive, 2 Technical, Physical and Psychological Outcomes

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ADMINISTRATIVE INFORMATION

Support - None.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 February 2026 and was last updated on 11 February 2026.

INTRODUCTION

Review question / Objective The aim of this review was to systematically identify studies applying neurofeedback or integrated neurofeedback programmes to football players.

Rationale Given the increasing interest among coaches and sport psychologists in mental training, a systematic synthesis of current evidence and innovative applications of neurofeedback is both timely and necessary to establish coherent methodologies tailored to football and to guide the development of effective cognitive training strategies capable of enhancing on-field performance.

Condition being studied Although anecdotal reports highlight potential benefits of neurofeedback interventions in sport, including football, empirical evidence remains limited, with only a few studies suggesting improvements in reaction time and affective processes and very little research specifically targeting football players. Systematic reviews have largely overlooked football and other team sports, despite the crucial interaction between cognitive and physical performance, and while some literature explores EEG neurofeedback's capacity to enhance cognitive functions, its application in football remains underexamined.

METHODS

Search strategy The present review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and the Population–Intervention–Comparator–Outcomes–Study design (PICOS) framework. The protocol was no registered a priori, but the methods were defined before the search began. Four electronic databases were systematically searched: PubMed/

MEDLINE, Web of Science (all Core Collection citation indexes), SCOPUS, and SportsDiscus. Because the topic combines sport performance with neurophysiology, these databases cover both biomedical and sport-science literature. The search was designed to identify all peer-reviewed journal articles published until November 2025 (final search in November 2025) involving neurofeedback interventions for football (soccer) players. No limits were applied for language, but only articles accessible in English were analysed.

Participant or population Male and female football (soccer) or futsal players of any age and competitive level.

Intervention Any form of neurofeedback training (EEG-based neurofeedback, brain-computer interface training, sensorimotor rhythm (SMR) protocols, alpha-band neurofeedback) delivered alone or in combination with other biofeedback modalities. We included studies employing integrated autonomic bio-feedback programmes if EEG neurofeedback formed part of the intervention. Studies that only assessed resting EEG without a feedback component were excluded.

Comparator Eligible studies included randomised controlled trials, quasi-experimental (pre-post) designs, case series and pilot studies with or without control/sham conditions. Cross-sectional studies without an intervention and purely descriptive neuroscience studies were excluded.

Study designs to be included Original peer-reviewed research articles with full-text available. Reviews, commentaries, conference abstracts, theses, and editorials were excluded.

Eligibility criteria The eligibility criteria were defined according to the PICOS framework.

Information sources PubMed/MEDLINE, Web of Science (all Core Collection citation indexes), SCOPUS, and SportsDiscus.

Main outcome(s) Behavioural, cognitive, psychomotor, technical or physiological outcomes related to football performance. Examples include working memory, attention, decision making, technical skills (e.g., shooting accuracy), physical tests (e.g., Yo-Yo Intermittent Recovery Test), physiological metrics (e.g., EEG spectral power, peak alpha frequency), injury prevention and psychological states (e.g., resilience or flow). Studies that reported only biochemical markers or injury rehabilitation without neurofeedback were excluded.

Quality assessment / Risk of bias analysis Methodological quality was assessed using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist, which includes 22 items covering title/abstract, introduction, methods, results, discussion and other information. Each item was scored as 1 point if clearly described 0.5 points if partially described or unclear, and 0 points if missing. The maximum possible score was 22. Studies with scores ≥ 85 % were classified as high quality, those scoring 50 – 84.9 % as moderate quality, and those scoring < 50 % as low quality[8]. Two reviewers independently rated each study. The inter-rater agreement (Cohen's κ) was 0.90 (95 % confidence interval 0.86–0.94); disagreements were resolved by consensus.

Strategy of data synthesis For each included study, the following information was extracted: authors and year; country and competitive level; sample characteristics (sex, age, playing position, competitive level and sample size); neurofeedback protocol (targeted frequency band, electrode locations, number and duration of sessions, feedback modality and equipment); study design (randomized controlled trial, pre–post design or case series); comparator condition (control or sham group when available); outcome measures (cognitive, technical, physical, physiological and psychological variables); and main findings. Means ± standard deviations (SD), effect sizes, confidence intervals and p-values were recorded when provided.

Subgroup analysis Study (year), Sample & level, Neurofeedback protocol Design/comparator, Outcomes, Main findings and Quality.

Sensitivity analysis Effect sizes, confidence intervals and p-values were recorded whenprovided.

Language restriction English.

Country(ies) involved Portugal and Spain.

Keywords neurofeedback; football; cognitive performance; psychophysiology; biofeed- 39back.

Dissemination plans Journal Article.

Contributions of each author
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