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Effects of Warm-up on Golf Performance: A Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION

Support - No.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 19 September 2025 and was last updated on 19 September 2025.

INTRODUCTION

Review question / Objective Objective: To systematically evaluate the effects of warm-up on golf-specific performance and compare the effectiveness of different warm-up strategies.

Condition being studied The condition being studied is golf-specific performance in healthy amateur and professional golfers, with a focus on outcomes such as clubhead speed, ball speed, carry distance, accuracy, and swing quality.

METHODS

Participant or population The population of interest consisted of healthy golfers (both amateur and professional), typically aged 18–45 years, including male and mixed-sex samples, with playing levels ranging from intermediate handicap golfers to near-scratch and professional players.

Intervention Warm-up interventions included dynamic stretching and sport-specific activation, post-activation potentiation/enhancement (PAP/PAPE) protocols such as weighted-club swings or countermovement jumps, static stretching, resistance-band warm-up, foam rolling combined with dynamic stretching, whole-body vibration, and neuromodulation (e.g., transcranial direct current stimulation).

Comparator Comparators included no warm-up, sham warm-up, routine warm-up, or alternative warm-up modalities. For the meta-analysis, eligible comparators were restricted to no warm-up or sham warm-up conditions.

Study designs to be included RCTs, crossover trials, and controlled trials (CTs).

Eligibility criteria Peer-reviewed English-language RCTs, crossover, or controlled trials involving healthy golfers, testing warm-up interventions (dynamic, PAP/PAPE, static, resistance-band, foam rolling, vibration, neuromodulation) versus no/sham

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warm-up, reporting golf-specific performance outcomes.

Information sources We systematically searched four electronic databases—PubMed, Scopus, SPORTDiscus with Full Text, and Web of Science—from 1986 to August 2025, using combinations of keywords related to "golf," "warm-up," and "performance." The search was conducted up to September 1, 2024, and was supplemented by manual screening of reference lists and forward citation tracking to identify additional eligible studies.

Main outcome(s) The primary outcomes were golf-specific performance indicators, including clubhead speed (CHS), ball speed (BS), and carry distance (CD). Additional outcomes reported in some studies included shot accuracy, consistency of ball contact, swing efficiency, kinematic parameters (e.g., X-factor), and subjective evaluations of swing quality.

Quality assessment / Risk of bias analysis The methodological quality of the included studies was assessed independently by two reviewers using the revised Cochrane Risk of Bias tool for randomized trials (RoB 2). This tool evaluates five domains: randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting. Discrepancies between reviewers were resolved by discussion or adjudication by a third reviewer. Each study received an overall risk-of-bias judgment based on the Cochrane criteria.Risk of bias was assessed using the Cochrane RoB 2 tool across five domains, with independent dual review and consensus resolution.

Strategy of data synthesis Data were synthesized using meta-analysis with RevMan 5.4 software. Standardized mean differences (SMDs) with 95% confidence intervals were calculated for continuous outcomes. A random-effects model was applied throughout due to expected variability in participants, interventions, and outcome measures. Statistical heterogeneity was assessed using Cochran's Q and the I^2 statistic, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively. Subgroup analyses were conducted to explore potential effect modifiers (e.g., intervention type), and publication bias was assessed with funnel plots.

Subgroup analysis Subgroup analyses were conducted for clubhead speed (CHS), the most consistently reported outcome across studies. Interventions were categorized into dynamic warm-up, static stretching, and post-activation potentiation/performance enhancement (PAP/PAPE). Additional exploratory subgroup analyses compared emerging or hybrid approaches such as resistance-band warm-up, foam rolling plus dynamic stretching, whole-body vibration, and neuromodulation (tDCS).

Sensitivity analysis Sensitivity analyses were performed using the leave-one-out method, in which each study was sequentially removed to evaluate the robustness and stability of the pooled estimates. This approach was applied particularly for non-significant results to determine whether individual studies disproportionately influenced the overall findings.

Country(ies) involved China, Malaysia.

Keywords Golf; Warm-up; Clubhead speed; Ball speed; Carry distance; Dynamic stretching; Post-activation potentiation (PAP); Post-activation performance enhancement (PAPE); Systematic review; Meta-analysis.

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