

Impacts of Functional Electrical Stimulation on Architectural Parameters of Skeletal Muscles: A systematic review protocol

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202520067

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 13 February 2025 and was last updated on 13 February 2025.

INTRODUCTION

Review question / Objective This review utilises the following question: What are the impacts of functional electrical stimulation interventions on the architectural parameters of human skeletal muscles as examined in randomised controlled trials?

Rationale The architectural parameters of human skeletal muscles are associated with force production, physical performance, and the risk of orthopaedic injuries. In recent years, there has been an increased focus on muscle architecture, with various studies exploring its relevance to rehabilitation and performance enhancement. Functional Electrical Stimulation (FES) has emerged as a rehabilitation tool that aims to restore, preserve, and improve muscle function. FES works by delivering intermittent electrical impulses to superficial skeletal muscles, promoting the activation of intramuscular nerve branches and

resulting in visible muscle contractions; examining the impact of FES on the architecture of human skeletal muscles through systematic reviews is essential to understand its therapeutic potential better.

Condition being studied Impacts of functional electrical stimulation on architectural parameters of skeletal muscles.

METHODS

Search strategy Cochrane Library (CENTRAL), PubMed, ProQuest and OpenGrey databases will be searched by using combinations of the following key terms: "functional electrical stimulation", "functional electric stimulation", "functional electrical muscle stimulation", FES, ACSA, Architectur*, "Cross Sectional Area", "Cross-sectional Area", Fascic*, "Fiber Length", "Fibre Length", Pennat*, Pinnat*, "Muscle

Thickness”, “Muscle Volume”, “Muscle Structure”, “Muscle Length” and PCSA.

Participant or population Studies involving human participants will be included.

Intervention Functional electrical stimulation.

Comparator Control/placebo/sham groups.

Study designs to be included Randomised controlled trials.

Eligibility criteria a) Being a randomised controlled trial (RCT), b) the use of FES as an intervention, c) utilising muscle architecture parameters as an outcome measure, and d) being conducted with human participants.

Information sources Cochrane Library, PubMed, ProQuest, OpenGrey, and the reference lists of the included studies.

Main outcome(s) Architectural characteristics of human skeletal muscles.

Data management The authors will independently extract the data under blinded conditions. The extraction and analysis of data will be conducted utilizing EndNote X21, Rayyan, Microsoft Excel, Word, RevMan, and GRADEPro GDT software.

Quality assessment / Risk of bias analysis The potential for bias inherent in each study included in the analysis will be systematically assessed utilising the Cochrane Collaboration’s instrument tailored for parallel group randomised controlled trials (RCTs). In the context of quantitative data synthesis, the overall quality of evidence will be appraised by employing the GRADE system (Grading of Recommendations Assessment, Development, and Evaluation).

Strategy of data synthesis Meta-analyses will be conducted using the Review Manager (RevMan) software provided by the Cochrane Collaboration or the Comprehensive Meta-analysis software. Furthermore, the GRADEpro GDT software will be utilized to evaluate the quality of the overall body of evidence.

Subgroup analysis Subgroup analyses shall be conducted based on the type of intervention, characteristics of the population, or in accordance with assessments of risk of bias.

Sensitivity analysis In the event that substantial heterogeneity is observed among the studies, a

sensitivity analysis will be performed in accordance with the methodological characteristics of the included studies.

Language restriction English.

Country(ies) involved Turkey and Japan.

Keywords FES; electrical stimulation; muscle architecture; muscle structure; muscle morphology.

Contributions of each author

Author 1 - Sena Adanir - Screening, data extraction, risk of bias assessment, meta-analyses, methodology, visualisation, grading the evidence levels, and writing the original draft.

Author 2 - Gokhan Yagiz - Screening, data extraction, risk of bias assessment, meta-analyses, methodology, visualisation, grading the evidence levels, writing the original draft, and supervision.

Author 3 - Nami Shida - Meta-analyses, methodology, visualisation, grading the evidence levels, writing the original draft, and supervision. Screening, data extraction, risk of bias assessment, supervision.

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