

# INPLASY

## The Influence of Anthropometric Characteristics on Punch Impact

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### ADMINISTRATIVE INFORMATION

**Support** - Without sources of financing.

**Review Stage at time of this submission** - Preliminary searches.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202480138

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 31 August 2024 and was last updated on 31 August 2024.

### INTRODUCTION

**Review question / Objective** The PICOS framework for this study is as follows:

- Population (P): striking combat sport athletes and practitioners, with a focus on varying anthropometric characteristics, such as height.
  - Intervention (I): Analysis of different types of punches (straight, hook, and uppercut) and the associated anthropometric characteristics that influence punch impact.
  - Comparison (C): Comparison between athletes of different heights and weight, to determine the impact of these anthropometric variables on the punch impact.
  - Outcome (O): The primary outcomes would be the effectiveness of punch impact, measured in terms of force (N) and power (W), and how these relate to anthropometric characteristics.
  - Study Design (S): Empirical studies involving anthropometric characteristics and impact assessment of punches in combat sports.
- Research Question: How do varying anthropometric characteristics influence the punch

impact in combat sports, as measured by force and power?

**Rationale** The rationale for this study stems from the complex and multifaceted nature of combat sports, particularly boxing, where the technical proficiency and effectiveness of punches are critical determinants of success. Height and other anthropometric characteristics have long been considered crucial in shaping an athlete's technical profile and combat strategy. While some studies suggest that height can influence the choice of attack, positioning, and movement during a bout, the evidence linking height to victory remains inconclusive. This gap in the literature underscores the need for a deeper exploration of the relationship between anthropometric factors, particularly height, and their impact on combat outcomes.

Existing research on the technical aspects of striking combat sport athletes has provided valuable insights into the types of punches—straight, hook, and uppercut—and their biomechanical execution. The effectiveness of

these punches is not solely dependent on the technique but also on the physiological and biomechanical factors that contribute to the punch's impact. The generation of punch impact involves a coordinated effort of the upper and lower body muscles, with key components including arm muscle contribution, trunk rotation, and leg push-off. These biomechanical factors are critical for maximizing the force and speed of a punch, thereby enhancing its effectiveness in a match.

Moreover, the variability in punch impact across different weight categories and the influence of limb length further complicate the understanding of what makes a punch effective. Different methods of assessing punch impact, ranging from direct measurements using force platforms to indirect assessments via target acceleration, provide varied perspectives on punch efficacy. However, the dynamic nature of punches, which involves not just force but also power—defined as the rate at which work is performed—suggests that measuring punch power in watts may offer a more comprehensive evaluation of a punch's effectiveness.

Despite the wealth of studies examining various aspects of punch impact, there remains a need to integrate these findings to better understand how anthropometric characteristics like height influence the overall effectiveness of punches in combat sports. By focusing on the biomechanical and physiological underpinnings of punch impact, this study aims to clarify the role of height and other physical attributes in determining combat outcomes. The findings could have significant implications for training strategies, allowing coaches and athletes to tailor their techniques based on individual anthropometric profiles, ultimately enhancing performance and success in striking combat sport athletes.

**Condition being studied** The condition of interest in this systematic review is technical performance of striking combat sport athletes. In this context, the "condition" refers to the effectiveness of different types of punches (straight, hook, uppercut) and how these are influenced by athletes' anthropometric characteristics, such as height.

Striking combat sports are high-intensity sport where athletes engage in a physically demanding contest of strength, speed, and strategy. The success of an athlete in this type of sports heavily depends on their ability to deliver effective punches, which are complex movements requiring the coordinated effort of multiple muscle groups. The effectiveness of these punches can determine the outcome of a match, making it a critical area of

study. Understanding how physical attributes like height influence punch power and force can provide valuable insights into optimizing training and performance strategies. This review aims to clarify the relationship between anthropometric characteristics and punch impact, contributing to the broader understanding of performance factors in combat sports.

## METHODS

**Search strategy** The search was conducted using the electronic databases PubMed, SPORTDiscus and Web of Science to identify and select relevant studies for inclusion in this review, combining three sets of terms: (i) terms related to the population of interest; (ii) terms related to anthropometric characteristics; (iii) terms related to punches. The following combination of terms was used for the search: (boxing OR combat sports OR muay thai OR kickboxing OR karate OR mma OR kung fu) AND (height OR anthropometric characteristics OR body measurements OR anthropometry OR physical Attributes) AND (punch OR strength OR impact force OR power OR performance OR activity profile OR punch performance). The search was performed on August 30, 2024. Additionally, a manual search of the literature cited in articles and reference journals was conducted.

**Participant or population** The participants addressed in this systematic review will include athletes engaged in various combat sports, specifically those involved in boxing, Muay Thai, kickboxing, karate, mixed martial arts (MMA), and kung fu. These athletes represent a diverse range of combat sports, each with unique technical and tactical demands, but all share a common emphasis on striking techniques, particularly punches.

Participants will encompass both male and female athletes across different weight categories and competitive levels, from amateur to professional. The review will consider studies involving adult athletes, as well as those involving younger participants if they meet the inclusion criteria. The focus will be on athletes whose training and competition involve the execution of punches as a primary combat technique, regardless of their specific combat sport discipline. This broad inclusion criterion will allow for a comprehensive analysis of how various physical and biomechanical factors influence punching effectiveness across different combat sports.

**Intervention** Interventions that involve the direct measurement of punch impact using advanced tools such as force platforms, accelerometers, and

load cells. These studies typically quantify the punch's force in newtons (N) and power in watts (W), providing precise metrics for evaluating punch effectiveness.

**Comparator** The comparative intervention applied to the target population in this systematic review will involve analyzing the relationship between athletes' anthropometric characteristics—specifically height, weight—and the effectiveness of their punches. The review will compare how these physical attributes influence key performance metrics such as punch force and power and impact across different combat sports disciplines.

**Study designs to be included** All study types were considered for inclusion in the review, except qualitative studies, systematic reviews, and meta-analyses.

**Eligibility criteria** All studies published to date reporting participants' anthropometric characteristics (e.g., height, weight) related to punch impact analysis in Newton (N) or Watts (W) units were included. All study types were considered for inclusion in the review, except qualitative studies, systematic reviews, and meta-analyses. The review was limited to articles published in English.

**Information sources** Electronic databases PubMed, SPORTDiscus and Web of Science. Additionally, a manual search of the literature cited in articles and reference journals was conducted.

**Main outcome(s)** The main outcomes expect from the systematic review on the relationship between anthropometric characteristics and punch impact in combat sports could include difference in the type of punch and anthropometric characteristics such as height (e.g., taller fighters create more impact in straight punch than smaller fighters) across various combat sports.

**Quality assessment / Risk of bias analysis** To assess the quality of the included studies, an adapted version of the Quality Assessment Tool for Quantitative Studies from the Effective Public Health Practice Project will be used, recommended by the Cochrane Public Health Review Group. This tool allows for the evaluation of the quality of experimental and observational studies across eight domains: representativeness (selection bias); study design; confounding factors; blinding; data collection; data analysis; presentation of results; and representativeness (exclusions/dropouts). Each domain is rated as strong (good

methodological quality), moderate, or weak (poor methodological quality), with the final assessment determined according to the ratings in each domain.

**Strategy of data synthesis** The articles resulting from the search were initially identified as potentially eligible based on their titles and abstracts. After a full reading and based on the eligibility criteria, the articles for this review will be selected. Zotero for Windows will be used to manage the references.

A specific form was developed for data extraction, including information on:

- i. Study characteristics: authors, year of publication, and design;
- ii. Sample characteristics: size, gender, age, height, weight, weight index (BMI);
- iii. Type of sport;
- iv. Variables of interest (types of technical gestures analyzed);
- v. Measuring instruments;
- vi. Main results.

The qualitative synthesis of the data will be presented in table format.

**Subgroup analysis** Given the complex nature of how anthropometric characteristics influence punch impact in striking combat sports, several subgroup analyses could be conducted to better understand these relationships:

1. Impact Force by Weight Category;
2. Impact Force by Gender;
3. Punch Type (Straight vs. Hook);
4. Influence of Height on Impact Force;
5. Measurement Type (Fmax vs. Fmean).

**Sensitivity analysis** To conduct sensitivity analysis, we will first evaluate how changes in the inclusion criteria influence the results. This involves examining whether altering the criteria for including studies—such as by adjusting quality scores, publication dates, or specific types of punches—affects the overall conclusions of the review.

Next, we will assess the variability in study quality. By analyzing the impact of including or excluding studies based on their quality, such as differences in study design, sample size, and measurement accuracy, we can determine if the results differ significantly between high-quality and lower-quality studies.

We will also investigate how methodological differences impact the findings. This includes comparing results based on various measurement tools, such as force platforms, accelerometers, and load cells, to see if different methods of assessing punch impact yield different insights.

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Finally, sensitivity to outliers will be assessed by identifying and evaluating the influence of outlier studies or extreme values on the conclusions of the review. This will involve checking if including or excluding outlier studies significantly alters the results.

**Language restriction** This review was limited to articles published in English.

**Country(ies) involved** Portugal.

**Keywords** Combat Sports; Punch; Anthropometric Characteristics; Impact Force; Impact Power.

#### **Contributions of each author**

Author 1 - Manuel Pinto, principal autor that drafted the manuscript.

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Author 2 - João Crisóstomo - The autor collaborate by determine the specific research question to be addressed in the review.

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Author 3 - Gil Silva - Author create a detailed plan outlining the search strategy, data extraction process, and analysis methods.

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Author 4 - Luís Monteiro - The autor set clear inclusion and exclusion criteria for the studies to be included, ensuring a focused and relevant review and provided statistical expertise.

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