REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

EFEITOS DO PRECONDICIONAMENTO ISQUÊMICO NO DESEMPENHO DO EXERCÍCIO RESISTIDO: UMA REVISÃO SISTEMÁTICA

EFFECTS OF ISCHEMIC PRECONDITIONING ON RESISTANCE EXERCISE PERFORMANCE: A SYSTEMATIC REVIEW

EFECTOS DEL PREACONDICIONAMIENTO ISQUÉMICO SOBRE EL RENDIMIENTO EN EL EJERCICIO DE FUERZA: UNA REVISIÓN SISTEMÁTICA

Pedro Augusto Mariz Dantas
Federal Institute of Paraíba, Brazil
E-mail: pedroamdantas@gmail.com

Camille dos Reis Molina
Federal University of Juiz de Fora, Brazil
E-mail: camille.molina@hotmail.com

Jefferson da Silva Novaes
Federal University of Juiz de Fora, Brazil
E-mail: jeffsnovaes@gmail.com

Adenilson Targino de Araújo Júnior
Federal Institute of Paraíba, Brazil
E-mail: adenilsonjunior@yahoo.com.br

Pedro Henrique Marques de Lucena
Federal University of Paraíba, Brazil
E-mail: profpedrolucena@gmail.com

Carlos Renato Paz
Federal University of Paraíba, Brazil
E-mail: carlos.paz@ifpb.edu.br

Natália Herculano Paz
Federal University of Paraíba, Brazil
E-mail: natalia.herculano@hotmail.com

Igor Mariz Dantas
Federal Institute of Paraíba, Brazil
E-mail: igormarizveterinariaifpb@gmail.com

Clizaldo Luiz Maroja Di Pace França
Federal University of Paraíba, Brazil
E-mail: clizaldo@gmail.com

Camila Fernandes Pontes dos Santos
Federal University of Paraíba, Brazil
E-mail: pontescamila6@gmail.com

João Gabriel de Vasconcelos Chaves Pinheiro
Federal University of Paraíba, Brazil
E-mail: joaovasconcelos7@hotmail.com

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

Fábio Thiago Maciel da Silva
Federal Institute of Paraíba, Brazil
E-mail: fabio.maciel@ifpb.edu.br

Daniel Almeida Marinho
University of Beira Interior, Portugal
E-mail: marinhod@gmail.com

Maria do Socorro Cirilo-Sousa
Federal University of Paraíba, Brazil
E-mail: helpcirilo@yahoo.com.br

Resumo

Objetivo: esta revisão sistemática teve como objetivo sintetizar as evidências sobre os efeitos do precondicionamento isquêmico (IPC) no desempenho em exercícios de resistência, bem como identificar padrões metodológicos entre os estudos e discutir sua aplicabilidade prática. Metodologia: a revisão foi conduzida de acordo com as recomendações PRISMA e registrada no PROSPERO (CRD42024529191). As buscas foram realizadas em janeiro de 2026 no PubMed, Scopus, SPORTDiscus e Web of Science. Foram incluídos estudos experimentais randomizados envolvendo adultos saudáveis, treinados ou não treinados, submetidos a IPC e comparados a condições controle ou simuladas, com avaliação de força, resistência muscular e espessura muscular. Dos 1.340 registros inicialmente identificados, 11 estudos atenderam aos critérios de elegibilidade e compuseram a síntese final. Resultados: no geral, os estudos apresentaram qualidade metodológica satisfatória, embora a avaliação do risco de viés tenha indicado uma predominância de "algumas preocupações", particularmente em relação à randomização e à seleção dos resultados relatados. Os resultados mostraram que o IPC esteve principalmente associado a efeitos ergogênicos agudos, incluindo aumento no número de repetições até a falha, no volume total de treinamento e, em alguns casos, na força máxima. Os poucos estudos crônicos também sugeriram benefícios para o ganho de força, mas sem evidências consistentes de aumento na espessura muscular. Conclusões: conclui-se que o IPC tem potencial para melhorar o desempenho em exercícios de resistência, embora a heterogeneidade metodológica e a possível influência de fatores relacionados ao placebo exijam uma interpretação cautelosa.

Palavras-chave: Precondicionamento isquêmico; treinamento resistido; treinamento de força; desempenho físico; revisão sistemática.

Abstract

Objective: this systematic review aimed to synthesize the evidence on the effects of ischemic preconditioning (IPC) on resistance exercise performance, as well as to identify methodological patterns across studies and discuss its practical applicability. Methodology: the review was conducted in accordance with PRISMA recommendations and registered in PROSPERO (CRD42024529191). Searches were carried out in January 2026 in PubMed, Scopus, SPORTDiscus, and Web of Science. Randomized experimental studies involving healthy adults,

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

trained or untrained, submitted to IPC and compared with control or sham conditions, with assessment of strength, muscular endurance, and muscle thickness, were included. Of the 1,340 records initially identified, 11 studies met the eligibility criteria and composed the final synthesis. Results: overall, the studies showed satisfactory methodological quality, although risk-of-bias assessment indicated a predominance of 'some concerns,' particularly regarding randomization and the selection of reported results. Findings showed that IPC was mainly associated with acute ergogenic effects, including increases in repetitions to failure, total training volume, and, in some cases, maximal strength. The few chronic studies also suggested benefits for strength gains, but without consistent evidence of increased muscle thickness. Conclusions: it is concluded that IPC has the potential to improve resistance exercise performance, although methodological heterogeneity and the possible influence of placebo-related factors require cautious interpretation.
Keywords: Ischemic preconditioning; resistance training; strength training; exercise performance; systematic review.

Resumen

Objetivo: esta revisión sistemática tuvo como objetivo sintetizar la evidencia sobre los efectos del preacondicionamiento isquémico (IPC) en el rendimiento del ejercicio de fuerza, así como identificar patrones metodológicos entre los estudios y discutir su aplicabilidad práctica. Metodología: la revisión se realizó de acuerdo con las recomendaciones PRISMA y fue registrada en PROSPERO (CRD42024529191). Las búsquedas se realizaron en enero de 2026 en las bases de datos PubMed, Scopus, SPORTDiscus y Web of Science. Se incluyeron estudios experimentales aleatorizados con adultos sanos, entrenados o no entrenados, sometidos a IPC y comparados con condiciones de control o sham, con evaluación de la fuerza, la resistencia muscular y el grosor muscular. De los 1.340 registros identificados inicialmente, 11 estudios cumplieron los criterios de elegibilidad y compusieron la síntesis final. Resultados: en general, los estudios presentaron una calidad metodológica satisfactoria, aunque la evaluación del riesgo de sesgo indicó un predominio de “algunas preocupaciones”, particularmente en relación con la aleatorización y la selección de los resultados reportados. Los hallazgos mostraron que el IPC se asoció principalmente con efectos ergogénicos agudos, incluyendo aumentos en las repeticiones hasta el fallo, el volumen total de entrenamiento y, en algunos casos, la fuerza máxima. Los pocos estudios crónicos también sugirieron beneficios para las ganancias de fuerza, aunque sin evidencia consistente de aumento del grosor muscular. Conclusiones: se concluye que el IPC tiene potencial para mejorar el rendimiento en el ejercicio de fuerza, aunque la heterogeneidad metodológica y la posible influencia de factores relacionados con el placebo requieren una interpretación cautelosa.
Palabras clave: Preacondicionamiento isquémico; entrenamiento de resistencia; entrenamiento de fuerza; rendimiento deportivo; revisión sistemática.

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

1. Introduction

Ischemic preconditioning (IPC) consists of the application of brief cycles of vascular occlusion followed by reperfusion, generally by means of pneumatic cuffs positioned on the limbs before the performance of a physical task. The method was originally described in the cardiovascular context, in which sublethal episodes of ischemia were shown to delay cellular injury in response to a subsequent ischemic insult. It later attracted interest in sport sciences, particularly because humoral, vascular, neural, and systemic responses triggered by IPC were hypothesized to enhance exercise tolerance and, consequently, physical performance. In this regard, previous reviews have indicated that IPC may modulate variables related to perfusion, metabolism, and neuromuscular function, although the physiological mechanisms responsible for these effects remain incompletely understood (CARU et al., 2019; MURRY; JENNINGS; REIMER, 1986; O'BRIEN; JACOBS, 2022; SALVADOR et al., 2016).

From an applied perspective, interest in IPC has expanded because it is a relatively simple, short-duration intervention that may be used as a preparatory strategy before exercise. Nevertheless, the literature on sports performance remains marked by conflicting findings. Whereas earlier systematic reviews suggested small to moderate benefits in certain tasks, more recent syntheses emphasize that the superiority of IPC is more evident when compared with no intervention than when compared with placebo protocols. This finding is particularly relevant because it suggests that part of the effects attributed to IPC may depend not only on the occlusion itself but also on contextual, perceptual, and methodological factors, such as the pressure applied, the number of cycles, the time between the intervention and the test, and the quality of placebo control (CARU et al., 2019; SOUZA et al., 2025).

In the context of resistance exercise, this discussion is especially important because small changes in the ability to sustain repetitions, in total training volume, or in maximal strength may have relevant practical implications for both training and competition. Acute studies have shown that IPC may increase the number of repetitions performed, total work volume, and, in some cases, performance in

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

maximal-strength tests. Among the most frequently cited findings are positive effects observed in upper- and lower-limb exercises, in single-joint tasks, and in sessions composed of multiple exercises. In addition, longitudinal investigations suggest that IPC, when combined with resistance training, may potentiate gains in maximal strength, although its effects on morphological adaptations, such as muscle thickness, remain less consistent (CARVALHO; BARROSO, 2019; CARVALHO et al., 2020; MAROCOLO et al., 2016a; MAROCOLO et al., 2016b; NOVAES et al., 2021; RODRIGUES et al., 2023; TELLES et al., 2020; TELLES et al., 2022).

Despite these promising results, interpretation of the literature is still far from consensual. Placebo-controlled studies have shown that part of the improvement in performance may also occur under sham conditions or low compression pressures, which weakens explanations based exclusively on complete arterial occlusion. In parallel, more recent investigations have attempted to clarify alternative mechanisms, suggesting that IPC may influence less explored dimensions such as pain sensitivity, spinal excitability, and voluntary activation. Even so, such evidence remains incipient and does not allow a confident statement as to whether these mechanisms consistently explain the effects observed in resistance exercise (CRUZ et al., 2024; DE SOUZA et al., 2021a; DE SOUZA et al., 2021b; KATAOKA et al., 2024).

In addition, the literature specifically addressing IPC in resistance exercise is still characterized by small samples, a predominance of trained young men, substantial diversity in application protocols, and heterogeneity in the outcomes assessed. Although broad reviews of IPC and sports performance are available, a synthesis specifically focused on resistance exercise remains warranted, one capable of critically integrating findings on strength endurance, maximal strength, total training volume, chronic adaptations, and placebo influence. Accordingly, the aim of the present systematic review was to synthesize the available evidence on the effects of IPC on resistance exercise performance, identify methodological patterns across studies, and discuss the practical applicability of this strategy in the context of strength training.

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

2. Methods

2.1 Search Strategy

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) recommendations (PAGE et al., 2021) and registered in PROSPERO under number CRD42024529191. The literature search was performed in January 2026 through systematic searches in four electronic databases: PubMed, Scopus, SPORTDiscus, and Web of Science. The primary search strategy used was *("athletes" OR "healthy volunteers") AND "ischemic preconditioning"**, with no limits applied during the electronic database searches. Search strategies were adapted to the specific characteristics of each database, and all searches were peer reviewed by two authors (PAMD and CRM). The complete search strategies, consulted sub-databases, search dates, and the number of records retrieved from each electronic database are described in Supplementary Material 1. In addition, study eligibility was manually verified based on three previous reviews by authors (PAMD, CRM, and JSN). The reference lists of all included articles and related reviews were also examined to identify potentially relevant studies not retrieved in the electronic search.

2.2 Eligibility Criteria

Eligibility criteria were defined according to the PICOS strategy. The population included healthy trained or untrained adults of both sexes aged 18 years or older. The intervention of interest was ischemic preconditioning (IPC) performed before resistance exercise or testing. Eligible comparators were control or sham/placebo conditions. The outcomes of interest were muscular strength, muscular endurance, total training volume, and muscle thickness. Only randomized experimental studies published as full-text articles in peer-reviewed journals and written in English were included. Studies were excluded when the occlusion pressure was not clearly described, when no control or sham comparator was provided, or when the exercise task was based primarily on dynamometry or velocity-based training, as these conditions were considered

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

outside the scope of the present review focused on performance in traditional resistance exercise tasks.

2.3 Study Selection

All search results were imported into Rayyan®, which was used for duplicate identification as well as for study selection and data extraction, respectively (OUZZANI et al., 2016). Two authors (PAMD and CRM) independently screened the articles. First, duplicate records were removed, and the titles of potentially eligible studies were assessed. Subsequently, abstracts were screened and, finally, full texts were examined. After full-text reading, articles that met the predefined inclusion criteria were included. In cases of disagreement, a third author (JSN) was consulted to evaluate the discrepancy and decide on study inclusion or exclusion. All steps were conducted in accordance with PRISMA recommendations (PAGE et al., 2021) and are illustrated in Figure 1.

2.4 Data Extraction and Synthesis

Data extraction was performed independently by the reviewers using a standardized form. The following information was extracted from each study: author and year of publication; study design; sample characteristics; IPC protocol characteristics (including occlusion pressure, number and duration of ischemia-reperfusion cycles, application site, mode of application, cuff characteristics, and interval between IPC and exercise/test); comparator condition; and main outcomes, including repetitions to failure, total training volume, maximal strength, muscle thickness, and selected physiological or perceptual variables. Given the marked heterogeneity among studies in terms of participants, IPC protocols, and outcome measures, findings were synthesized narratively.

2.5 Methodological Quality Assessment

Methodological quality and reporting quality of the included studies were assessed using the TESTEX scale, a tool specifically developed for exercise-training studies (SMART et al., 2015). TESTEX comprises 15 points, distributed across 5 study-quality criteria and 10 reporting criteria. In the present review, studies were classified as low quality (0–5 points), moderate quality (6–10 points),

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

or high quality (11–15 points).

2.6 Risk of Bias Assessment

Risk of bias was independently assessed by two reviewers (PAMD and CRM) using the Cochrane Risk of Bias 2 (RoB 2) tool, in accordance with the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions. The following domains were considered: (D1) randomization process; (D2) deviations from intended interventions; (D3) missing outcome data; (D4) measurement of the outcome; and (D5) selection of the reported result. Each domain was judged as low risk of bias, some concerns, or high risk of bias, and an overall judgment was assigned to each study based on domain-level assessments (STERNE et al., 2019).

3. Results

3.1 Search Results

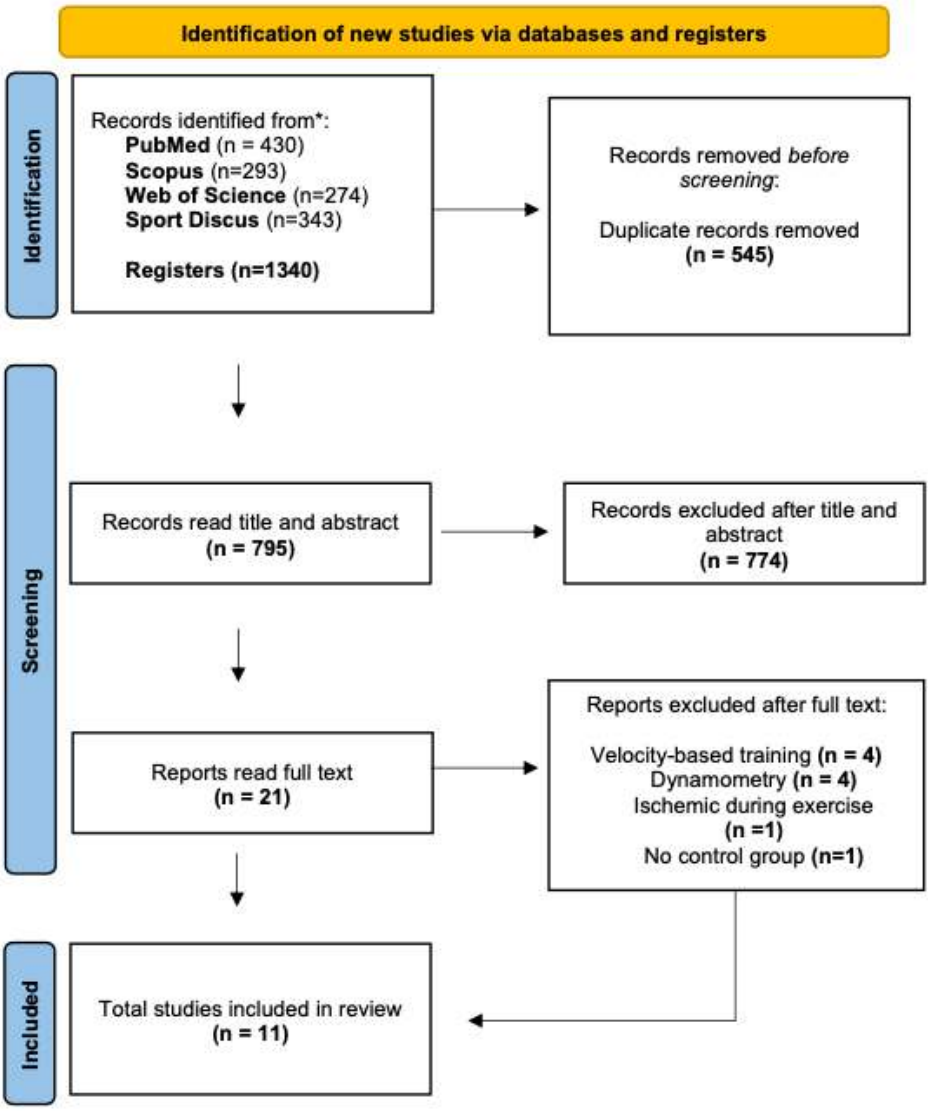
Following PRISMA 2020 recommendations, study selection was conducted through identification, screening, and eligibility stages. Initially, records were identified in PubMed (n = 430), Scopus (n = 293), Web of Science (n = 274), and SPORTDiscus (n = 343), yielding a total of 1,340 records. Duplicates were then removed (n = 545), and the remaining 795 studies underwent title and abstract screening, with 774 excluded for not meeting the eligibility criteria.

During full-text assessment, 21 studies were evaluated, and 10 were excluded for the following reasons: velocity-based training (n = 4), dynamometry (n = 4), ischemia during exercise (n = 1), and absence of a control group (n = 1). At the end of the process, 11 studies met all predefined criteria and were included in the review. The entire process is presented in Figure 1.

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

Figure 1. *Flowchart of the Article Selection Process*



Source: personal collection

3.2 Methodological and Reporting Quality of the Included Studies (TESTEX)

According to the TESTEX scale, total scores ranged from 10 to 12 points, with a mean score of 11.1 ± 0.7, indicating overall high methodological and reporting quality across the included studies. Nevertheless, the domain-specific distribution of points suggests that reporting quality was generally stronger than study-quality criteria, indicating that some methodological limitations remained

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

despite the relatively high total scores.

Table 1 shows that the included studies presented relatively homogeneous scores for methodological quality and reporting criteria. In the study-quality-criterion block, total scores ranged from 3 to 4 points, indicating moderate performance and little variation across articles. In the study-reporting-criterion block, studies scored between 7 and 9 points, suggesting generally better compliance with reporting criteria than with quality criteria. Considering the overall total, scores ranged from 10 to 12 points, with the highest scores observed in Surkar et al. (2020), de Souza et al. (2021a), and de Souza et al. (2021b), all with 12 points, whereas Carvalho and Barroso (2019) and Telles et al. (2022) presented the lowest values, with 10 points. Most studies clustered at 11 points, suggesting methodological consistency among the analyzed studies, although gaps remain in specific quality criteria and in the description of procedures.

Table 1. *TESTEX*

Study	Study quality criterion						Study reporting criterion											Overall total
	1	2	3	4	5	Total	6.1	6.2	6.3	7	8.1	8.2	9	10	11	12	Total	
Marocolo et al. (2016a)	1	1	0	1	0	3	1	0	1	0	1	1	1	1	1	1	8	11
Marocolo et al. (2016b)	1	1	0	1	0	3	1	0	1	0	1	1	1	1	1	1	8	11
Carvalho and Barroso (2019)	1	1	0	1	0	3	1	0	1	0	1	1	1	1	1	0	7	10
Carvalho et al. (2020)	1	1	0	1	1	4	0	0	1	0	1	1	1	1	1	1	7	11
Surkar et al. (2020)	1	1	0	1	0	3	1	1	1	0	1	1	1	1	1	1	9	12
Telles et al. (2020)	1	1	0	1	0	3	1	0	1	0	1	1	1	1	1	1	8	11
Novaes et al. (2021)	1	1	0	1	0	3	1	0	1	0	1	1	1	1	1	1	8	11
de Souza et al. (2021a)	1	1	0	1	1	4	1	0	1	0	1	1	1	1	1	1	8	12
de Souza et al. (2021b)	1	1	0	1	1	4	1	0	1	0	1	1	1	1	1	1	8	12
Telles et al. (2022)	1	1	0	1	0	3	1	0	1	0	1	1	1	1	1	0	7	10
Rodrigues et al. (2023)	1	1	0	1	1	4	1	0	1	0	1	1	1	1	1	0	7	11

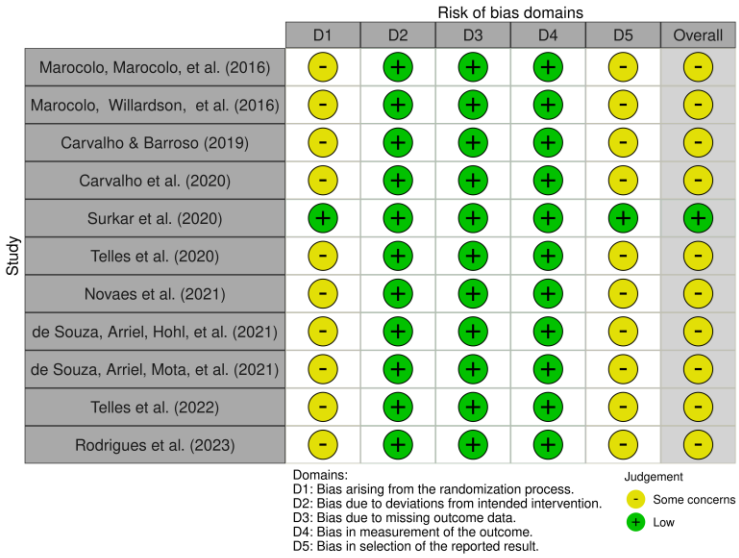
REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

3.3 Risk of Bias Analysis - RoB 2

Figure 2 presents a summary of risk of bias (RoB 2) by domains (D1-D5) across 11 studies using the 'traffic-light' scheme, in which green indicates low risk and yellow indicates some concerns. Overall, a consistent pattern of low risk was observed in domains D2 (deviations from intended interventions), D3 (missing outcome data), and D4 (measurement of outcomes) for nearly all studies. In contrast, domains D1 (randomization process) and D5 (selection of the reported result) concentrated most of the yellow markings, suggesting recurring concerns mainly related to randomization and selective reporting. Consequently, the global judgment was predominantly 'some concerns' in most studies, except for Surkar et al. (2020), which showed low risk of bias across all domains and therefore low overall risk.

Figure 2. *Risk of Bias*



Source: personal collection

3.4 Results of the Included Studies

Analysis of population characteristics (Table 2) showed a predominance of young, healthy men previously trained in resistance exercise, with samples ranging from 9 to 30 participants. In general, the studies included normotensive individuals free from cardiovascular, metabolic, or musculoskeletal disorders, with prior training experience of approximately 3 to 8 years, characterizing a sample composed predominantly of recreationally active or strength-trained participants.

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

Table 2. *Characteristics of the Populations in the Included Studies*

Study	Sample	Age (years)	Population summary
Marocolo et al. (2016a)	21; men	27.3 ± 5.2	Healthy men, recreationally resistance trained; 6.6 ± 2.7 years of experience; 4.3 ± 0.7 days/week.
Marocolo et al. (2016b)	13; men	25.9 ± 4.6	Healthy men with ≥1 year of recreational resistance training; 5.2 ± 3.2 years of experience; 4.1 ± 0.8 days/week.
Carvalho and Barroso (2019)	10; men	22 ± 2	Resistance-trained men; 1RM in unilateral knee extension = 71 ± 13 kg; 5.6 ± 1.7 years of experience.
Carvalho et al. (2020)	20; men	24 ± 2	Resistance-trained men without cardiovascular or muscular disorders; 4.7 ± 2.0 years of experience; placebo (n = 8) and IPC (n = 8) completed the study.
Surkar et al. (2020)	30; men and women	18-40	Healthy young adults with preserved cognitive-motor function; RLIC + strength training (n = 15) or sham + strength training (n = 15); 2 dropouts in the RLIC group.
Telles et al. (2020)	16; men	24.8 ± 2.2	Healthy, normotensive men recreationally trained in resistance exercise; ≥1 year of experience; 5.0 ± 1.6 years of training history.
Novaes et al. (2021)	16; men	24.8 ± 2.2	Normotensive men recreationally trained in resistance exercise; 5.0 ± 1.6 years of training history.
de Souza et al. (2021a)	20; men	24.0 ± 4.4	Young, healthy, trained men; 3.3 ± 2.3 years of training history; HP (n = 7), LP (n = 7), and control (n = 6).
de Souza et al. (2021b)	9; men	22.4 ± 3.4	Young, healthy, moderately resistance-trained men; 3.4 ± 1.7 years of experience; 4.0 ± 0.9 h/week.
Telles et al. (2022)	16; men	25.3 ± 1.7	Recreationally trained men.
Rodrigues et al. (2023)	15; men	29.9 ± 5.9	Resistance-trained men; 8.0 ± 5.0 years of experience.

Legend. *HP = high pressure; LP = low pressure; IPC = ischemic preconditioning; RLIC = remote limb ischemic conditioning.*

3.5 IPC Protocols

With regard to IPC protocols, marked methodological heterogeneity was observed across studies (Table 3). This variability was identified in the number of cycles employed, with protocols composed of 3, 4, or 5 sets of occlusion followed by

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

reperfusion, resulting in interventions lasting between 30 and 50 minutes. Differences were also observed in the site of application, which included arms, thighs, or both segments, as well as in the mode of application, described as alternating, unilateral, or simultaneous. The most pronounced discrepancies were concentrated mainly in occlusion pressure and in the interval between IPC application and the exercise/test. Regarding pressure, some studies adopted fixed values such as 170 mmHg, 220 mmHg, and 250 mmHg, whereas others used individualized criteria based on systolic or diastolic blood pressure; in addition, sham conditions mainly ranged from 10 mmHg to 20 mmHg. Likewise, the interval between the end of the protocol and the start of the exercise/test ranged from 5 to 45 minutes and was not reported in some studies. Taken together, these findings show that, although the studies investigated relatively similar populations, IPC protocols did not follow a uniform pattern, indicating substantial heterogeneity among the interventions analyzed.

Table 3. *IPC Protocols of the Included Studies*

Study	Cycles	Dur.	Site	Mode	Pressure	Interval	Cuff
Marocolo et al. (2016a)	4 × (5 + 5 min)	40 min	Arms/ thighs	Alternate	220 or 20 mmHg (sham)	8 min	96 × 13 cm
Marocolo et al. (2016b)	4 × (5 + 5 min)	40 min	Thighs	Alternate	220 or 20 mmHg (sham)	8 min	96 × 13 cm
Carvalho and Barroso (2019)	4 × (5 + 5 min)	40 min	Thighs	Alternate	250 or 10 mmHg (sham)	NR	90 × 17.5 cm
Carvalho et al. (2020)	4 × (5 + 5 min)	40 min	Thighs	Alternate	250 or 10 mmHg (sham)	NR	90 × 17.5 cm
Surkar et al. (2020)	5 × (5 + 5 min)	50 min	Arm	Unilateral	SBP +20 or DBP -10 mmHg	NR	NR
Telles et al. (2020)	4 × (5 + 5 min)	40 min	Arms	NR	220 or 20 mmHg (sham)	45 min	56 × 9 cm
Novaes et al. (2021)	4 × (5 + 5 min)	40 min	Arms	Alternate	220 or 20 mmHg (sham)	5 min	56 × 9 cm

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

Study	Cycles	Dur.	Site	Mode	Pressure	Interval	Cuff
de Souza et al. (2021a)	3 × (5 + 5 min)	30 min	Thighs	Alternate	SBP +50 or 20 mmHg	8 min	96 × 13 cm
de Souza et al. (2021b)	3 × (5 + 5 min)	30 min	Thighs	Alternate	SBP +50 or 20 mmHg	8 min	77 × 21.5 cm
Telles et al. (2022)	4 × (5 + 5 min)	40 min	Arms	Alternate	220 or 20 mmHg (sham)	10 min	57 × 9 cm
Rodrigues et al. (2023)	3 × (5 + 5 min)	30 min	Arms	Simult.	170 or 20 mmHg (sham)	10 min	46 × 10 cm

Legend. *IPC = ischemic preconditioning; SBP = systolic blood pressure; DBP = diastolic blood pressure; sham = simulated intervention; min = minutes; NR = not reported.*

3.6 Summary of the Included Studies

Overall, the included studies indicated that ischemic preconditioning was predominantly associated with acute ergogenic effects on resistance exercise performance, including increases in the number of repetitions, total training volume, and, in some studies, maximal strength (1RM), both in single-joint exercises and in sessions composed of multiple exercises. In parallel, chronic studies also pointed to benefits of IPC, especially for strength gains, although without consistent evidence of increases in muscle thickness. By contrast, findings regarding physiological and perceptual variables were less consistent, since lactate, electromyography, rating of perceived exertion, and heart rate variability frequently did not differ between experimental conditions. In addition, part of the literature suggests that these positive effects should be interpreted with caution, as some studies observed similar responses between IPC and sham conditions or even no clear improvement in performance, reinforcing the possible influence of methodological factors and placebo effects. In summary, the main findings point to a potential benefit of IPC on performance and strength in resistance exercise, although results are not uniform across studies and the underlying mechanisms remain not fully elucidated (Table 4).

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

Table 4. *Summary of the Included Studies*

Study	Type	Main outcome	Summary of findings
Marocolo et al. (2016a)	Acute	Repetitions and volume	IPC and SHAM increased repetitions and volume, with no difference between conditions; the effect decreased over the sessions.
Marocolo et al. (2016b)	Acute	Repetitions, fatigue, and lactate	IPC and placebo increased repetitions in the 1st and 2nd sets vs. control; no differences were found for fatigue or lactate.
Carvalho and Barroso (2019)	Acute	Repetitions, EMG, and lactate	IPC increased the number of repetitions by ~20%; EMG and lactate did not differ between conditions.
Carvalho et al. (2020)	Chronic	Repetitions, 1RM, and muscle thickness	IPC increased the mean number of repetitions during training and 1RM gains; no change in muscle thickness was observed.
Surkar et al. (2020)	Chronic	1RM and EMG	Both groups increased strength, but the RLIC group showed greater 1RM gains; no significant interaction was observed for EMG.
Telles et al. (2020)	Acute	Repetitions, volume, and RPE	IPC increased repetitions and total volume compared with other warm-up conditions; no difference was found for RPE.
Novaes et al. (2021)	Acute	Repetitions, volume, and RPE	IPC increased the number of repetitions and total session volume compared with control and CUFF; RPE was similar.
de Souza et al. (2021a)	Acute	Repetitions, total load, and fatigue	High and low pressure increased repetitions and total load vs. control; no differences were found for isometric strength or fatigue.
de Souza et al. (2021b)	Acute	Repetitions, MVIC, fatigue, and volume	No significant differences were observed among baseline, IPC, and SHAM; no clear ergogenic effect was found.
Telles et al. (2022)	Acute	1RM and HRV	High- and low-pressure IPC increased maximal strength in all exercises vs. control; no difference was found between pressures.
Rodrigues et al. (2023)	Acute	1RM and RPE	IPC increased bench-press 1RM load and reduced RPE compared with control and SHAM.

Legend. *RPE = rating of perceived exertion; EMG = electromyography; MVIC = maximal voluntary isometric contraction; 1RM = one-repetition maximum; HRV = heart rate variability.*

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

4 Discussion

The present systematic review synthesized the available evidence on the effects of IPC on resistance exercise performance and showed that, overall, this intervention has ergogenic potential, particularly for acute outcomes such as number of repetitions to failure, total training volume, and, to a lesser extent, maximal strength. However, interpretation of these findings requires caution. When the results of this review are placed within the broader literature on IPC and physical performance, the effects appear to be modest, variable across studies, and highly dependent on experimental design. Earlier reviews had already pointed to inconsistency between positive and null findings, whereas the most recent meta-analysis suggests that IPC tends to outperform the control condition but does not show consistent superiority over placebo, which weakens its use as a universally effective ergogenic strategy (CARU et al., 2019; SALVADOR et al., 2016; SOUZA et al., 2025).

Within the specific context of resistance exercise, the findings of this review suggest that IPC appears to favor mainly tasks in which exercise tolerance and maintenance of performance across sets are decisive. This pattern is consistent with the included studies, which more frequently reported benefits for strength endurance and total volume than for classical physiological markers. Even so, the practical relevance of these effects should not be interpreted solely in light of statistical significance tests. Recent literature has argued that IPC should also be examined in terms of effect magnitude, the smallest worthwhile change, and the possibility of heterogeneous interindividual responses, since group means may mask clinically or sport-relevant benefits that occur only in a subset of participants. From this perspective, the positive results observed in some resistance exercise protocols are promising but still insufficient to characterize IPC as an invariably effective resource in applied settings (MAROCOLO et al., 2019).

One of the most relevant issues for interpreting this review concerns the role of placebo. The studies by Marocolo et al. (2016a), Marocolo et al. (2016b), de Souza et al. (2021a), and de Souza et al. (2021b), included in this review, had already suggested that part of the improvement attributed to IPC could stem from

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

perceptual, motivational, and contextual factors. This interpretation is supported by the broader literature, which has begun to discuss the psychophysiological dimension of the maneuver more explicitly. The meta-analysis by Souza et al. (2025) showed that, although IPC has a favorable effect compared with control, it does not outperform placebo for most outcomes, while placebo itself may also improve performance compared with no intervention. In a convergent view, Marocolo et al. (2023) argued that the sensation produced by the cuff, the expectation of benefit, and the subjective interpretation of the procedure may all be part of the ergogenic response to IPC, so that the classical opposition between 'physiological effect' and 'placebo effect' may be overly simplistic in this context. Thus, the findings of this review reinforce that future studies should prioritize three-arm designs - IPC, sham, and control - in order to isolate the specific and nonspecific components of the intervention more accurately (MAROCOLO et al., 2023; SOUZA et al., 2025).

Findings related to maximal strength and chronic effects also deserve careful analysis. In this review, the studies by Telles et al. (2022), Rodrigues et al. (2023), Carvalho et al. (2020), and Surkar et al. (2020) indicated that IPC may favor performance in 1RM tests and potentiate strength gains over the course of resistance-training interventions. These results are relevant because they suggest that IPC effects are not restricted to strength endurance but may also extend to tasks involving maximal force production. Still, the number of longitudinal studies is very small, and the empirical basis remains insufficient for firm conclusions about chronic adaptations. Recent reviews focused on physiological mechanisms have proposed that IPC may exert short-term effects associated with vascular function and exercise capacity, as well as more cumulative long-term effects potentially related to recovery, modulation of exercise-induced muscle damage, and repeated physiological adaptations. However, these hypotheses still require specific confirmation in resistance-training protocols, especially with larger samples and adequately controlled designs (MAROCOLO et al., 2025).

From a physiological standpoint, this review supports the notion that IPC probably operates through multifactorial pathways rather than through a single

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

dominant mechanism. The reviews by O'Brien and Jacobs (2022) and Marocolo et al. (2025) indicate that the acute effects of IPC may involve alterations in vascular function, greater oxygen availability, changes in erythrocyte deformability, autonomic modulation, and adjustments in afferent-efferent integration during exercise. However, the literature remains inconsistent regarding the concrete expression of these phenomena during resistance exercise. In several studies included in this review, performance improvements occurred without parallel changes in lactate, electromyography, rating of perceived exertion, or heart rate variability. Rather than necessarily weakening the ergogenic hypothesis, this pattern suggests that IPC may act at levels not fully captured by these traditional markers or that its effects depend on interaction between central and peripheral factors rather than on isolated physiological responses (MAROCOLO et al., 2025; O'BRIEN; JACOBS, 2022).

More recently, some studies have refined this discussion by exploring psychophysiological and neural mechanisms. Slysz and Burr (2021) showed that IPC may modulate pain sensitivity, although this change alone does not explain the improvement in performance. In parallel, Cruz et al. (2024) observed increased spinal excitability and voluntary activation after IPC, suggesting that part of the benefit may be mediated by greater neural drive, especially in situations involving recruitment of underutilized muscles. On the other hand, more controlled evidence also imposes limits on interpretations excessively based on isolated mechanisms. Recent experimental studies indicate that IPC does not promote consistent changes in local hemodynamic and electromyographic variables during sustained and intermittent non-fatiguing voluntary contractions and does not appear to confer ergogenic benefit directly to skeletal muscle via an isolated humoral component. Taken together, these data suggest that IPC mechanisms may depend less on a direct peripheral effect and more on a complex interaction among neural, perceptual, and contextual factors, whose expression may vary according to exercise type and sample profile (ALLOIS et al., 2025; CRUZ et al., 2024; MORLEY; MURRANT; BURR, 2023; SLYSZ; BURR, 2021).

Another important contribution of this review lies in making explicit the

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

degree of methodological heterogeneity present in the literature. The included studies varied in cuff width, occlusion pressure, number of cycles, duration of occlusion and reperfusion, site of application, and the interval between the end of the protocol and the start of exercise. Recent methodological reviews point out that this variability is one of the main reasons for the low reproducibility of findings and for the difficulty in establishing an optimal IPC protocol. In particular, O'Brien and Jacobs (2021) highlight that differences between absolute and individualized pressure, cuff type, and pre-exercise timing may substantially modify the physiological and ergogenic response. Moreover, extrapolation of results to other groups remains limited, since most studies - including those in this review - focused on trained young men. Evidence from outside the resistance-exercise context even suggests that responses to IPC may differ between sexes: Mota et al. (2020) did not observe performance improvement in women, and Teixeira et al. (2023) reported improved functional sympatholysis in men, but not in women. Although these findings cannot be automatically transferred to resistance training, they reinforce the need for caution when generalizing the currently available results (MOTA et al., 2020; O'BRIEN; JACOBS, 2021; TEIXEIRA et al., 2023).

From an applied standpoint, the results of this review allow IPC to be considered a potentially useful strategy in specific situations, especially when the goal is to acutely increase exercise tolerance, raise total training volume, or optimize performance in maximal-strength tasks. Nevertheless, its routine adoption in professional practice should be cautious. The available literature does not currently support recommending IPC as a robust, predictable, and generalizable resource for all populations and training contexts. In practical terms, it seems more appropriate to understand it as an intervention with context-dependent potential benefit, whose response depends on the protocol used, participant profile, task type, and quality of experimental control. Therefore, future investigations should prioritize greater methodological standardization, rigorous placebo-controlled designs, more diverse samples, and simultaneous assessment of performance outcomes, perception, and physiological mechanisms, so that it becomes clearer not only whether IPC works, but for whom, under which conditions, and through

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

which pathways it may actually exert an ergogenic effect (MAROCOLO et al., 2015; MAROCOLO; BILLAUT; DA MOTA, 2018; O'BRIEN; JACOBS, 2021; SOUZA et al., 2025).

5 Conclusion

In summary, ischemic preconditioning appears to have the potential to acutely improve resistance exercise performance, especially in variables related to strength endurance, such as number of repetitions to failure and total training volume. More recent evidence also indicates favorable effects on maximal strength, whereas the few available chronic intervention studies suggest that IPC may contribute to greater strength gains over the course of training.

However, the current evidence should still be interpreted with caution, since the studies present substantial methodological heterogeneity, small samples, and partially conflicting results, especially regarding the distinction between a physiological effect intrinsic to IPC and the influence of placebo. Therefore, although the method appears promising as an ergogenic strategy in the context of resistance training, there is still insufficient basis to recommend it broadly and definitively. New studies with greater methodological rigor, better placebo control, standardized protocols, and inclusion of different populations are needed to clarify the true magnitude, mechanisms, and practical applicability of IPC in performance and adaptations to resistance exercise.

REFERENCES

ALLOIS, R.; PERTUSIO, R.; PAGLIARO, P.; ROATTA, S. Ischemic preconditioning: exploring local ergogenic mechanisms in non-fatiguing voluntary contractions. **Frontiers in Physiology**, [S. l.], v. 16, art. 1542394, 2025. DOI: https://doi.org/10.3389/fphys.2025.1542394

CARU, M.; LEVESQUE, A.; LALONDE, F.; CURNIER, D. An overview of ischemic preconditioning in exercise performance: a systematic review. **Journal of Sport and Health Science**, [S. l.], v. 8, n. 4, p. 355-369, 2019. DOI: https://doi.org/10.1016/j.jshs.2019.01.008

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

CARVALHO, L.; BARROSO, R. Ischemic preconditioning improves strength endurance performance. **Journal of Strength and Conditioning Research**, [S. l.], v. 33, n. 12, p. 3332-3337, 2019. DOI: https://doi.org/10.1519/JSC.0000000000002846

CARVALHO, L.; CONCON, V.; MELONI, M.; DE SOUZA, E. O.; BARROSO, R. Effects of resistance training combined with ischemic preconditioning on muscle size and strength in resistance-trained individuals. **Journal of Sports Medicine and Physical Fitness,** [S. l.], v. 60, n. 11, p. 1431-1436, 2020. DOI: https://doi.org/10.23736/S0022-4707.20.11032-6

CRUZ, R.; TRAMONTIN, A. F.; OLIVEIRA, A. S.; CAPUTO, F.; DENADAI, B. S.; GRECO, C. C. Ischemic preconditioning increases spinal excitability and voluntary activation during maximal plantar flexion contractions in men. **Scandinavian Journal of Medicine & Science in Sports**, [S. l.], v. 34, n. 3, art. e14591, 2024. DOI: https://doi.org/10.1111/sms.14591

DE SOUZA, H. L. R.; ARRIEL, R. A.; HOHL, R.; DA MOTA, G. R.; MAROCOLO, M. Is ischemic preconditioning intervention occlusion-dependent to enhance resistance exercise performance? **Journal of Strength and Conditioning Research**, [S. l.], v. 35, n. 10, p. 2706-2712, 2021a. DOI: https://doi.org/10.1519/JSC.0000000000003224

DE SOUZA, H. L. R.; ARRIEL, R. A.; MOTA, G. R.; HOHL, R.; MAROCOLO, M. Does ischemic preconditioning really improve performance or it is just a placebo effect? **PLOS ONE**, [S. l.], v. 16, n. 5, art. e0250572, 2021b. DOI: https://doi.org/10.1371/journal.pone.0250572

KATAOKA, R.; SONG, J.; YAMADA, Y.; HAMMERT, W.; SEFFRIN, A.; SPITZ, R.; WONG, V.; KANG, A.; LOENNEKE, J. The impact of different ischemic preconditioning pressures on pain sensitivity and resistance exercise performance. **Journal of Strength and Conditioning Research**, [S. l.], v. 38, n. 5, p. 864-872, 2024. DOI: https://doi.org/10.1519/JSC.0000000000004718

MAROCOLO, M.; BILLAUT, F.; DA MOTA, G. R. Ischemic preconditioning and exercise performance: an ergogenic aid for whom? **Frontiers in Physiology**, [S. l.], v. 9, art. 1874, 2018. DOI: https://doi.org/10.3389/fphys.2018.01874

MAROCOLO, M.; DA MOTA, G. R.; SIMIM, M. A. M.; APPELL CORIOLANO, H. J. Myths and facts about the effects of ischemic preconditioning on performance. **International Journal of Sports Medicine**, [S. l.], v. 37, n. 2, p. 87-96, 2015. DOI: https://doi.org/10.1055/s-0035-1564253

MAROCOLO, M.; HOHL, R.; ARRIEL, R. A.; MOTA, G. R. Ischemic preconditioning and exercise performance: are the psychophysiological responses underestimated? **European Journal of Applied Physiology**, [S. l.], v. 123, n. 4, p. 683-693, 2023. DOI: https://doi.org/10.1007/s00421-022-05109-9

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

MAROCOLO, M.; MAROCOLO, I. C.; DA MOTA, G. R.; SIMÃO, R.; MAIOR, A. S.; CORIOLANO, H. J. A. Beneficial effects of ischemic preconditioning in resistance exercise fade over time. **International Journal of Sports Medicine**, [S. l.], v. 37, n. 10, p. 819-824, 2016a. DOI: https://doi.org/10.1055/s-0042-109066

MAROCOLO, M.; SIMIM, M. A. M.; BERNARDINO, A.; MONTEIRO, I. R.; PATTERSON, S. D.; DA MOTA, G. R. Ischemic preconditioning and exercise performance: shedding light through smallest worthwhile change. **European Journal of Applied Physiology**, [S. l.], v. 119, n. 10, p. 2123-2149, 2019. DOI: https://doi.org/10.1007/s00421-019-04214-6

MAROCOLO, M.; SOUZA, H. L. R.; SURKE, P.; FERRAUTI, A. Potential short- and long-term physiological effects of ischemic preconditioning as an ergogenic aid: revisiting foundational mechanisms and applications. **Sports Medicine**, [S. l.], v. 55, n. 7, p. 1547-1557, 2025. DOI: https://doi.org/10.1007/s40279-025-02232-3

MAROCOLO, M.; WILLARDSON, J. M.; MAROCOLO, I. C.; DA MOTA, G. R.; SIMÃO, R.; MAIOR, A. S. Ischemic preconditioning and placebo intervention improves resistance exercise performance. **Journal of Strength and Conditioning Research**, [S. l.], v. 30, n. 5, p. 1462-1469, 2016b. DOI: https://doi.org/10.1519/JSC.0000000000001232

MORLEY, W. N.; MURRANT, C. L.; BURR, J. F. Ergogenic effect of ischemic preconditioning is not directly conferred to isolated skeletal muscle via blood. **European Journal of Applied Physiology**, [S. l.], v. 123, n. 8, p. 1851-1861, 2023. DOI: https://doi.org/10.1007/s00421-023-05197-1

MOTA, G. R.; RIGHTMIRE, Z. B.; MARTIN, J. S.; MCDONALD, J. R.; KAVAZIS, A. N.; PASCOE, D. D.; GLADDEN, L. B. Ischemic preconditioning has no effect on maximal arm cycling exercise in women. **European Journal of Applied Physiology**, [S. l.], v. 120, n. 2, p. 369-380, 2020. DOI: https://doi.org/10.1007/s00421-019-04281-9

MURRY, C. E.; JENNINGS, R. B.; REIMER, K. A. Preconditioning with ischemia: a delay of lethal cell injury in ischemic myocardium. **Circulation,** [S. l.], v. 74, n. 5, p. 1124-1136, 1986. DOI: https://doi.org/10.1161/01.CIR.74.5.1124

NOVAES, J. da S.; TELLES, L. G. da S.; MONTEIRO, E. R.; ARAUJO, G.; VINGREN, J. L.; PANZA, P. S.; REIS, V. M. H.; LATERZA, M. C.; VIANNA, J. M. Ischemic preconditioning improves resistance training session performance. **Journal of Strength and Conditioning Research**, [S. l.], v. 35, n. 11, p. 2993-2998, 2021. DOI: https://doi.org/10.1519/JSC.0000000000003532

O'BRIEN, L.; JACOBS, I. Methodological variations contributing to heterogenous ergogenic responses to ischemic preconditioning. **Frontiers in Physiology**, [S. l.], v. 12, art. 656980, 2021. DOI: https://doi.org/10.3389/fphys.2021.656980

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

O'BRIEN, L.; JACOBS, I. Potential physiological responses contributing to the ergogenic effects of acute ischemic preconditioning during exercise: a narrative review. **Frontiers in Physiology**, [S. l.], v. 13, art. 1051529, 2022. DOI: https://doi.org/10.3389/fphys.2022.1051529

OUZZANI, M.; HAMMADY, H.; FEDOROWICZ, Z.; ELMAGARMID, A. Rayyan: a web and mobile app for systematic reviews. **Systematic Reviews**, [S. l.], v. 5, n. 1, art. 210, 2016. DOI: https://doi.org/10.1186/s13643-016-0384-4

PAGE, M. J. et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. **BMJ,** [S. l.], v. 372, art. n71, 2021. DOI: https://doi.org/10.1136/bmj.n71

RODRIGUES, A. L.; IDE, B. N.; SASAKI, J. E.; DE OLIVEIRA, D. C. X.; ASSUMPÇÃO, C. D. O.; MAROCOLO, M.; MOTA, G. R. Ischemic preconditioning improves the bench-press maximal strength in resistance-trained men. **International Journal of Exercise Science**, [S. l.], v. 16, n. 4, p. 217-229, 2023. DOI: https://doi.org/10.70252/JLBH8684

SALVADOR, A. F.; AGUIAR, R. A. de; LISBÔA, F. D.; PEREIRA, K. L.; CRUZ, R. S. D. O.; CAPUTO, F. Ischemic preconditioning and exercise performance: a systematic review and meta-analysis. **International Journal of Sports Physiology and Performance**, [S. l.], v. 11, n. 1, p. 4-14, 2016. DOI: https://doi.org/10.1123/ijspp.2015-0204

SLYSZ, J. T.; BURR, J. F. Ischemic preconditioning: modulating pain sensitivity and exercise performance. **Frontiers in Physiology**, [S. l.], v. 12, art. 696488, 2021. DOI: https://doi.org/10.3389/fphys.2021.696488

SMART, N. A.; WALDRON, M.; ISMAIL, H.; GIALLAURIA, F.; VIGORITO, C.; CORNELISSEN, V.; DIEBERG, G. Validation of a new tool for the assessment of study quality and reporting in exercise training studies: TESTEX. **International Journal of Evidence-Based Healthcare**, [S. l.], v. 13, n. 1, p. 9-18, 2015. DOI: https://doi.org/10.1097/XEB.0000000000000020

SOUZA, H. L. R.; OLIVEIRA, G. T.; MEIRELES, A.; SANTOS, M. P. dos; VIEIRA, J. G.; ARRIEL, R. A.; PATTERSON, S. D.; MAROCOLO, M. Does ischemic preconditioning enhance sports performance more than placebo or no intervention? A systematic review with meta-analysis. **Journal of Sport and Health Science,** [S. l.], v. 14, art. 101010, 2025. DOI: https://doi.org/10.1016/j.jshs.2024.101010

STERNE, J. A. C. et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. **BMJ,** [S. l.], v. 366, art. l4898, 2019. DOI: https://doi.org/10.1136/bmj.l4898

SURKAR, S. M.; BLAND, M. D.; MATTLAGE, A. E.; CHEN, L.; GIDDAY, J. M.; LEE, J. M.; HERSHEY, T.; LANG, C. E. Effects of remote limb ischemic

REMUNOM
ISSN 2178-6925

Received: 13/03/2026 - **Accepted:** 08/05/2026
Vol: 13.09
DOI: 10.66104/af0s1t29
Pages: 1-24

conditioning on muscle strength in healthy young adults: a randomized controlled trial. **PLOS ONE,** [S. l.], v. 15, n. 2, art. e0227263, 2020. DOI: https://doi.org/10.1371/journal.pone.0227263

TEIXEIRA, A. L.; GANGAT, A.; BOMMARITO, J. C.; BURR, J. F.; MILLAR, P. J. Ischemic preconditioning acutely improves functional sympatholysis during handgrip exercise in healthy males but not females. **Medicine & Science in Sports & Exercise,** [S. l.], v. 55, n. 7, p. 1250-1257, 2023. DOI: https://doi.org/10.1249/MSS.0000000000003148

TELLES, L. G.; BILLAUT, F.; DE SOUZA RIBEIRO, A.; JUNQUEIRA, C. G.; LEITÃO, L.; BARRETO, A. C.; PANZA, P.; VIANNA, J. M.; DA SILVA NOVAES, J. Ischemic preconditioning with high and low pressure enhances maximum strength and modulates heart rate variability. **International Journal of Environmental Research and Public Health,** [S. l.], v. 19, n. 13, art. 7655, 2022. DOI: https://doi.org/10.3390/ijerph19137655

TELLES, L. G. da S.; CARELLI, L. C.; BRÁZ, I. D.; JUNQUEIRA, C.; MONTEIRO, E. R.; REIS, V. M.; VIANNA, J. M.; NOVAES, J. da S. Effects of ischemic preconditioning as a warm-up on leg press and bench press performance. **Journal of Human Kinetics**, [S. l.], v. 75, n. 1, p. 267-277, 2020. DOI: https://doi.org/10.2478/hukin-2020-0055