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The effect of curcumin supplementation on muscle strength after physical exercise

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Abstract

Physical Exercise is a movement of the body performed by muscles in a planned, structured, and repetitive manner, using energy in the process, with the goal of maintaining physical fitness. The benefits of physical exercise for the body include improving muscle strength. Muscle strength is the increased ability of muscles to perform physical activities. Some literature also mentions that muscle strength can decrease as a result of physical exercise. After performing physical exercise, muscle capability will decline and require time for recovery to regain optimal function. Curcumin is a compound found in turmeric plants. Turmeric itself has various benefits, such as acting as an anti-inflammatory by inhibiting molecules involved in the inflammatory process. Additionally, turmeric has benefits as an antioxidant by inhibiting lipid peroxidation in studies using experimental animals.

Keywords: Physical Exercise; Muscle Strength; Curcumin; Exercise; Muscle

1. Introduction

Physical exercise is a physical activity carried out systematically and repetitively over a certain period. Physical exercise is a complex activity aimed at maintaining body health. Ideally, physical exercise should be conducted in a programmed, continuous, and systematic manner to achieve maximum benefits and results. Optimally performed physical exercise can enhance physical capabilities[1]. Physical exercise also has a direct effect on the cardiovascular system. The results of such exercise can lead to acute or chronic injuries. Research has shown that prolonged physical exercise increases heart rate, blood lactate levels, body temperature, and blood pressure. There are also long-term effects of physical exercise, particularly in improving blood supply, enhancing blood flow, and reducing blood pressure [6]. Muscle strength is the maximum capability of muscles to handle the workload given. Physiologically, muscle strength refers to the ability of muscles to perform a single maximal contraction against resistance or a given load. Mechanically, muscle strength represents the maximum work generated by muscles [7]. Curcumin has benefits in reducing inflammation by inhibiting the activity of molecules responsible for causing inflammation [5]. Curcumin and its derivatives are also active compounds capable of modulating immunomodulators related to inflammation [8].

2. Methods

This writing employs a literature review method to examine the effects of curcumin administration on muscle strength after physical exercise, aiming to determine whether curcumin has a significant impact on muscle strength.

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3. Results and discussion

Table 1 Analysis of the effects of curcumin with human subjects

Number	Research	Research Intervention		Research Results
		Curcumin Dose	Types of Exercise	
1.	[9]	450 mg of curcumin (90 mg consumed five times) within 48 hours for the treatment subjects, and 5 placebo capsules for the control subjects.	Soccer, each subject performed two training sessions spaced one week apart before the match.	Consuming 180 mg/day of curcumin (~2.74 mg/kg/day) had no impact on muscle soreness, jump performance, or markers of inflammation and muscle damage in collegiate athletes engaged in game-based training.
2.	[10]	A 500 mg curcumin capsule once daily, totaling 1.5 g of curcumin/69 mg of curcuminoids, or a cellulose placebo capsule taken daily for 28 days.	Light or moderate physical activity (≥30 minutes of moderate-intensity physical activity at least three days per week for at least three months or ≥150 minutes).	This study indicates that curcumin supplementation for 28 days can result in reduced muscle damage and muscle soreness after exercise, although no differences were observed in inflammatory markers.
3.	[11]	In this study, participants or subjects consumed 2 g of curcumin and 20 mg of piperine, three times a day.	This study involved rugby players who regularly participated in weekly training and gym sessions. The athletes were asked to perform single-leg jumps with 25 repetitions.	Supplementation with 6 grams of curcumin and 60 mg of piperine daily, between 48 hours before and 48 hours after muscle damage due to exercise, showed effects on the recovery of some aspects of muscle function 24 and 48 hours after exercise. However, these effects were limited to the loss of strength during a 6-second single-leg sprint, with no effects on other aspects of muscle damage or muscle soreness.
4.	[12]	4 grams of curcumin per day for 5 days.	The research subjects are taekwondo athletes who engage in exercise at least five times a week.	Curcumin supplementation with a daily dose of 4 g (2 g twice daily, after breakfast and before sleep with 250 ml of water) for 5 days reduced muscle injury severity and oxidative stress in taekwondo athletes after consecutive taekwondo competition simulations. However, curcumin supplementation had no significant effect on serum IL-6 levels.
5.	[13]	Consuming 60 ml twice a day, each containing 35 mg of curcuminoid..	The participants, who are professional soccer athletes, prepare themselves with individual warm-ups followed by three jumps, with the highest jump being recorded and used in subsequent analysis.	The participants were monitored during eight competitive matches held between October 2021 and April 2022. Blood samples were taken using EDTA tubes to perform checks on each match's samples. Muscle strength was assessed through CMJ (Counter Movement Jump), with participants standing upright with their hands on their hips, squatting to their desired depth, before jumping

				as high as possible while standing on a force plate. No difference in physical performance measurements was found between the curcumin group and the control group (all p-values > 0.29). The results of this study indicate that consuming curcumin supplements twice a day can reduce signs of inflammation and subjective muscle soreness in male soccer players after matches.
6.	[14]	200 mg of curcumin, 50 mg of curcumin, and a placebo for 56 days.	The participants in this study are healthy men and women aged 19 to 29 years. Before muscle function assessment, participants warmed up for five minutes at their own pace on a treadmill. Then, each participant sat with their knees aligned with the axis of the dynamometer lever arm. The dynamometer warm-up consisted of three repetitions of concentric extension and flexion at 50% of the maximum perceived force. After the warm-up, participants were given a 90-second recovery period.	In conclusion, the results of this study highlight the ability of a high dose of curcumin (1000 mg, resulting in 200 mg of curcuminoids) to prevent the decline observed in peak extension torque values, which were seen one and 24 hours after muscle-damaging exercise. In comparison, a lower dose of curcumin, providing 50 mg of curcumin, was unable to mitigate performance changes, showing similar patterns to those observed in subjects who consumed a placebo.
7.	[15]	500 mg of Meriva® curcumin (5 tablets) taken with lunch for three days, followed by another 500 mg consumed immediately before exercise..	*Cycling or stationary cycling.*	No statistically significant differences were found in pro-inflammatory cytokines between the control and intervention subjects.
8.	[16]	150 mg of curcumin was administered for 2 days.	A drop jump of 10 sets with 10 repetitions, with a 1-minute recovery between sets (1 hour after breakfast).	Curcumin is effective in accelerating recovery from DOMS (Delayed Onset Muscle Soreness), as evidenced by a significant reduction in muscle soreness in the treatment group 48 hours after eccentric activity.
9.	[17]	500 mg of curcumin for 12 weeks of intervention.	Running exercise using a treadmill.	There was no significant difference in muscle soreness between supplementation conditions over time.

Table 1 above presents experiments using curcumin and its effects on muscles with humans as subjects. The results from various studies are quite varied, considering that the measurement standards used differ across studies.

Table 2 Analysis of the effects of curcumin on experimental animal subjects

Number	Research	Research Intervention		Research Results
		Curcumin Dose	Types of Exercise	
1.	[18]	Curcumin 3 mg is dissolved in normal saline to a concentration of 15 mg/ml.	Downing running using treadmill	Curcumin can also provide antioxidant effects after muscle damage induced by downhill running.
2.	[19]	Curcumin 50 mg/kg body weight and curcumin 100 mg/kg body weight.	Swimming for 2 hours per day, with each session lasting 30 minutes separated by a 5-minute break.	Curcumin enhances the effects of eTR in the regulation of mitochondrial biogenesis in skeletal muscle through the increase of cAMP levels.
3.	[20]	10 mg of curcumin every day for 3 days.	150 minutes of running on a treadmill.	Anti-inflammatory phytochemical curcumin can speed recovery

4. Conclusion

The results from various studies indicate differences in the outcomes of each research. Some studies show that curcumin has significant effects on muscle strength. The differences in the results of curcumin supplementation may be due to variations in the doses administered to the subjects. Additionally, the duration of supplementation and differences in measurement methods could also influence the results of the studies.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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