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Use of creatine for muscle hypertrophy in resistance training practitioners: a narrative review

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Abstract: Creatine is a natural substance found in muscles that has gained popularity among physical activity practitioners, especially bodybuilders, due to its various benefits, including improved muscle tone, increased strength, optimized recovery, and muscle mass gain. The most common form of creatine is monohydrate, which is cost-effective and efficacious. However, the unguided use of supplements, including α-methyl guanidinoacetic acid, which has possible pharmacological, nutritional, and physiological effects on fast muscle energy and muscle hypertrophy, is common among exercise practitioners. On the other hand, creatine, also a widely used ergogenic, is capable of rapidly renewing muscular energy and increasing strength and total lean body mass. However, the use of dietary supplements such as creatine should be done with caution and accompanied by a specialized professional capable of establishing parameters that best meet the individual needs of each athlete or individual seeking muscle hypertrophy. It is essential to discuss the factors associated with the development of lean muscle mass, including creatine supplementation, considering its nutritional and pharmacological implications. Therefore, this narrative review aims to analyze the role of creatine as an ergogenic dietary supplement for muscle hypertrophy and identify the risks associated with its consumption.

Keywords: Creatine; Physical Exercise; Resistance Training; Supplementation; Ergogenics.

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1. Introduction

Creatine is a natural substance found in muscles, initially described by the French chemist Michel Chevreul in 1832 [1]. Only in 1844, Justus Liebig confirmed his theory through a comparative study between wild and captive animals, observing a higher concentration of creatine in the muscles of the latter due to greater muscular work [1]. Since the 1990s, creatine has been the subject of study by researchers, and its use was evidenced by high-performance athletes in the Barcelona Olympics in 1992 [2].

Currently, creatine is widely used by physical activity practitioners, especially bodybuilders, due to its various benefits, such as improved muscle tone, increased strength, optimized recovery, and muscle mass gain [3]. It is important to emphasize, however, that these effects are potentiated by regular physical exercise and proper nutrition. Creatine can be found in various forms, such as capsules, gel, bars, and liquids. However, the most common form is monohydrate, due to its low cost and efficacy [3].

Creatine is a natural substance present in muscles that has gained prominence in recent years due to its positive effects on body composition and performance during physical exercise. Based on Oliveira, Azevedo, and Cardoso [4], the unguided use of supplements by exercise practitioners using overload is common, including α-methyl guanidinoacetic acid, which has been increasingly consumed by physically active indi-

viduals and sports athletes in general. This is due to the possible pharmacological, nutritional, and physiological effects of this substance on fast muscle energy and muscle hypertrophy. Although considered safe and studied, the consumption of α-methyl guanidinoacetic acid should be done with caution and with the prescription of a qualified professional, as its inadequate consumption can cause the opposite effect, such as stalling lean mass gain.

According to Menezes, Moraes, and Cardoso [2], there is positive evidence about the use of α-methyl guanidinoacetic acid as an ergogenic aid and dietary supplement. However, its use should only be done when the body is unable to produce enough for the individual's goal and when it is not possible to meet the demand with a balanced diet plan. On the other hand, Martins et al. [5] have shown that creatine, also a widely used ergogenic, is capable of rapidly renewing muscular energy in the fast energy production system through the phosphocreatine mechanism (ATP-CP), increasing strength and total lean body mass.

Thus, the appropriate use of α-methyl guanidinoacetic acid and other ergogenic aids such as creatine, when prescribed and monitored by a qualified professional, can lead to an effective increase in muscle strength and favorable adaptations for muscle mass increase in activities that require greater overload. According to Paula et al. [6], a balanced diet is a fundamental factor for achieving results in sports, regardless of the chosen sport, its intensity, and/or volume. This is because an unbalanced food intake can have a negative impact on athlete performance, compromising the work of all professionals involved.

Additionally, the use of dietary supplements such as creatine can be an effective strategy for improving performance and muscle hypertrophy. According to Zanelli et al. [7], creatine can improve muscle strength in a shorter time interval when combined with strength training and an appropriate diet. Creatine can also be beneficial for individuals with inflammatory muscle pathologies, atrophy and muscle weakness disorders, cognitive deficiency, pre- and post-ischemic conditioning, among others.

However, it is important to emphasize that the use of dietary supplements should be done with caution and accompanied by a specialized professional capable of establishing parameters that best meet the individual needs of each athlete or individual seeking muscle hypertrophy. It is essential to discuss the factors associated with the development of lean muscle mass, including creatine supplementation, considering its nutritional and pharmacological implications.

Here, we aim to analyze, through a narrative review, the role of creatine as an ergogenic dietary supplement for muscle hypertrophy and its response regarding the physiological, metabolic, and biochemical aspects inherent in its use among practitioners of resistance training and high-intensity physical exercises. Therefore, we seek to highlight possible actions of creatine in the body and identify the risks associated with its consumption.

2. Creatine: usage and updates

In addition to the increase in muscular power, strength, and lean mass, there are other benefits associated with the use of creatine, such as increased protein synthesis and re-synthesis of phosphocreatine. There is also water retention, meaning greater absorption of water by the cells at the mitochondrial level, causing them to increase in size and therefore better nourish and hydrate the muscle for hypertrophy, as a hydrated muscle contains more nutrients [8].

As for water retention as an adverse effect, current scientific studies show that it is something that creatine users are aware of and very accepting of, as it is an osmotically active substance that offers many benefits when combined with physical exercise. About renal dysfunction/damage, despite the concern being quite common among people who consume creatine, daily doses, when prescribed correctly, do not affect kidney function [9].

However, current studies still differ regarding weight gain and protein synthesis, making more detailed research necessary to confirm these hypotheses. In addition, creatine increases the energy of muscle tissues and acts on cognition, improving energy supply and protecting nervous system cells against any weakness [10]. It should be noted that all these effects have been associated with its use in conjunction with intense exercise and short rest intervals. Thus, influenced by its great power in favoring the storage of ATP/CP as a supplement, its nutritional matrix makes creatine able to help meet individuals' bioenergetic demands and improve their availability, as well as their absorption as an ergogenic resource. A recent study showed that even with the use of this supplementation, practitioners of high-intensity physical exercise did not achieve good results [1].

It is believed that the reason why this happened was due to the individuals' creatine reserves being full. Therefore, there was no uptake by the muscle fiber, as this would only be possible when there is low or insufficient concentration of creatine in the body. Once the ideal amount is reached, the substance stops being absorbed, and its ingestion becomes useless [4]. Creatine can be found in natural foods such as red and white meats (poultry and fish), where its concentration varies from four to five grams per kilogram of food [11]. Therefore, according to Kreider et al. [12], its use is not prohibited because there is still no scientific evidence of any adverse effects, as it is consumed through diet from childhood.

Nevertheless, its consumption is increasing among the exercising public because it can be manipulated in the form of capsules and powder, making it possible to use it as a mixture in various natural beverages, such as juices and smoothies, making its ingestion more enjoyable. Furthermore, it is easier to reach the ideal levels for skeletal muscle tissue by supplementing with it, as opting for the absorption of this ergogenic through a balanced diet would require a higher daily intake of food, which is often unbearable for the athlete to consume. Thus, creatine supplements for athletes should contain 1.5 to 3g of creatine in the portion defined by the manufacturer [13].

Despite different protocols regarding the form of consumption and individual response to the use of this supplement, discussions about the ideal and most efficient amount for full absorption in the body vary, linking its positive effects regarding muscle hypertrophy, considering doses of 5g to 20g as fundamental for increasing absorption. However, studies are increasingly emphatic in relating low quantities, with the need being met for this purpose in small daily doses. Reinforcing this idea, Oliveira et al. [4] state that the daily dose should not exceed 5g, as there is no scientific evidence to guarantee safe consumption above this value.

The response regarding creatine consumption related to hypertrophy and its benefits, such as increased strength, recovery capacity, and performance improvement, are of chronic action, where ingestion is daily and correlated with training. However, studies have demonstrated acute responses that show the benefits of short, medium, and long duration. Thus, it is necessary to understand the broad context in which muscle hypertrophy is inserted. Above all, it is possible to observe, through studies in the academic sphere correlated to the context itself, that creatine consumption, associated with resistance training and diet, is indeed an interesting strategy regarding the consumption of ergogenic resources in the form of dietary supplements for muscle mass gains and hypertrophy [14].

Due to these aspects directly related to the use of creatine by exercise practitioners, whether for aesthetic or performance purposes, we observe its use more closely, since these are usually the biggest consumers of this supplement, that is, those who use dietary supplements the most. This is linked to the excellent results with the use of ergogenic resources, and creatine is being an important tool to achieve good results in relation to hypertrophy when associated with good dietary and physical planning.

It is important to note that as the consumption of creatine becomes increasingly common in gym environments among weightlifters, the positive result of its ingestion

without the indication of a qualified professional, such as a nutritionist, puts its efficiency into reflective discussion. Therefore, creatine should be consumed under the guidance of qualified professionals, such as nutritionists and pharmacists. However, the most current studies show its efficacy, especially regarding muscular hypertrophy, safely and without harm to the health of its users when prescribed by a professional.

It is notable that the use of creatine as an ergogenic resource, aiming to improve body composition and hypertrophy, can be an interesting, effective, and safe strategy compared to other substances for athletes and exercise practitioners in general, as well as for people seeking significant gains in muscle mass. However, it is necessary to emphasize that the physiological response is correlated to daily consumption in portions of average intake between 1.5g and 3g. These doses are sufficient to improve the body's response compared to larger doses, and it is important to use it under the supervision of a qualified professional who guides the best way to use it, making consumption efficient for the body and without harm to health. Since the body itself is unable to absorb supplementation if the body's stock is full.

Another important point that should be highlighted is the chronic response, that is, consumption needs to be daily and linked to the practice of intense physical exercises, using overload and short rest intervals, as well as a balanced diet that meets the needs of each individual. It is expected that further studies will demonstrate new aspects related to the use of this supplement in response to hypertrophy since there are still disagreements among scholars regarding the most effective protocols to be followed. Thus, bringing more knowledge and precision to professionals regarding the dose they will prescribe to patients and providing them with security regarding the use of this resource.

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