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NON-ATHLETIC APPLICATIONS OF CREATINE SUPPLEMENTATION IN WOMEN - A NARRATIVE REVIEW

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ABSTRACT

Creatine is one of the most extensively studied dietary supplements and is well known for its role in cellular energy metabolism, muscle function, and exercise performance. However, increasing evidence suggests that its physiological effects may extend beyond athletic applications, particularly in women.

This narrative review aimed to summarize and evaluate current evidence regarding the non-athletic health benefits of creatine supplementation in women, with a focus on cognitive function, mood, bone health, reproductive health, and overall metabolic and physiological well-being.

A literature search was conducted using PubMed and Google Scholar databases with the keywords "creatine", "supplementation", and "women". English-language studies published from 2015 onward were included, and reference lists of relevant articles were screened to identify additional sources.

The available evidence indicates that creatine supplementation may positively influence cognitive performance, brain health, and reproductive physiology, while also supporting healthy aging in women. Potential benefits appear particularly relevant during periods of hormonal transition, such as pregnancy and menopause, when alterations in creatine metabolism may increase physiological demands. In contrast, findings regarding bone health remain inconsistent and require further investigation.

Overall, creatine supplementation is considered safe and well tolerated when consumed at recommended dosages. Despite promising findings, the current evidence base remains limited by the relatively small number of female-specific studies and methodological heterogeneity. Further high-quality clinical trials are needed to establish the efficacy, safety, and optimal application of creatine supplementation across different stages of the female lifespan.

KEYWORDS

Creatine, Supplementation, Women, Reproductive Health, Menopause, Brain

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1. Introduction

Creatine is one of the most commonly used and extensively studied dietary supplements worldwide, particularly in the fields of sports nutrition and exercise science. It is a naturally occurring non-protein amino acid compound primarily obtained from dietary sources such as meat and fish, while additional amounts are synthesized from glycine, arginine, and methionine in the liver and kidneys. Most of the creatine in the human body is found in skeletal muscles, where it plays a crucial role in cellular energy metabolism through the phosphocreatine system, supporting the regeneration of adenosine triphosphate (ATP) during periods of increased energy demand (Kreider et al, 2017).

Although creatine is primarily associated with athletic performance and muscle physiology, its biological importance extends beyond skeletal muscle. Creatine is also involved in energy homeostasis in other tissues, including the heart muscle, the brain and testes, suggesting broader physiological and clinical relevance. Due to its role in cellular energetics, creatine supplementation has been investigated not only for improving muscle mass, strength, and exercise capacity, but also for its potential applications in health and disease (Kreider & Stout, 2021).

Among nutritional supplements, creatine monohydrate is regarded as one of the most effective and best-researched compounds currently available (Kreider et al, 2017). Decades of scientific investigation have consistently demonstrated its efficacy and favorable safety profile in healthy populations when consumed at recommended dosages (Kreider et al, 2017). Although persistent concerns regarding kidney function remain, current evidence indicates that creatine supplementation does not adversely affect renal health in healthy population. However, caution may be appropriate in individuals with pre-existing kidney disease and pregnant women (Longobardi et al, 2025). Consequently, creatine is widely considered one of the safest supplements used in both athletic and general populations (Kreider et al, 2017; Longobardi et al, 2025).

Despite the extensive body of literature concerning creatine supplementation, studies specifically addressing its effects and applications in women remain relatively limited. Considering the potential influence of sex-specific physiological characteristics, hormonal fluctuations, and differences in creatine metabolism, further evaluation of the non-athletic applications of creatine supplementation in female populations is needed.

2. Methodology

A comprehensive literature review was conducted using the PubMed and Google Scholar databases, applying various combinations of the terms “creatine,” “supplementation,” and “women.” The search included English-language publications published from 2015 onward, such as meta-analyses, systematic reviews, scoping reviews, narrative reviews, clinical trials, original research articles, case reports, and case series. In addition, the reference lists of the selected papers were manually examined to identify any additional relevant studies.

3. Results

3.1. General health effects of creatine and female-specific differences in creatine physiology

Creatine supplementation has traditionally been associated with improvements in athletic performance and skeletal muscle function, however, growing evidence indicates that its physiological relevance extends far beyond sports nutrition. Due to its central role in cellular energy metabolism, creatine has been increasingly investigated in relation to multiple aspects of human health, including cognitive function, aging, neurological health, muscle preservation, and metabolic regulation (Balestrino & Adriano, 2019; Gutiérrez-Hellín et al, 2024). These broader applications warrant particular attention in women, given sex-specific differences in creatine metabolism, including hormonal fluctuations, lower daily creatine intake, reduced endogenous creatine synthesis, and differences in response to supplementation (Smith-Ryan et al, 2021).

Women generally demonstrate lower endogenous creatine stores than men, potentially due to differences in muscle mass, dietary habits, and hormonal regulation. Interestingly, however, women appear to exhibit slightly higher resting intramuscular creatine concentrations than men, which may reduce their responsiveness to supplementation and potentially necessitate higher doses to achieve comparable effects (Smith-Ryan et al, 2021). Fluctuations in sex hormone levels across the menstrual cycle, pregnancy, and menopause may additionally affect creatine metabolism and phosphocreatine dynamics (Smith-Ryan et al, 2021) suggesting that creatine requirements and physiological responses may vary throughout the female lifespan. Consequently, creatine supplementation has been proposed as a potentially beneficial strategy not only for supporting muscle health and physical function, but also for maintaining overall health and functional capacity in women (Gutiérrez-Hellín et al, 2024).

3.2. Effects of creatine supplementation on bone health in women

The potential effects of creatine supplementation on bone health have attracted increasing attention, particularly in postmenopausal women who are at elevated risk of bone mineral density loss, sarcopenia, and osteoporotic fractures. Since skeletal muscle and bone are closely interconnected both mechanically and metabolically, interventions that improve muscle mass and strength may also indirectly support bone health. However, clinical findings remain inconsistent.

In a 2-year randomized, placebo-controlled trial, Sales et al. evaluated the effects of daily creatine supplementation (3 g/day) in older postmenopausal women. Despite the long intervention period, creatine supplementation did not significantly attenuate changes in areal bone mineral density (aBMD) at clinically relevant sites, including the femoral neck, total hip, or lumbar spine, compared with placebo. Similarly, no significant effects were observed for bone markers, microarchitecture parameters, and the number of falls/fractures (Sales et al, 2020). These findings suggest that long-term creatine supplementation at the investigated dosage may not be sufficient to induce clinically meaningful improvements in bone health among older women.

More favorable outcomes have been reported when creatine supplementation is combined with resistance training. In a 1-year randomized controlled trial, Chilibeck et al. investigated the effects of creatine supplementation during a supervised resistance training program in postmenopausal women. Although changes in BMD did not differ significantly between groups, women receiving creatine exhibited a reduced

rate of 1.2% of bone mineral loss at the femoral neck compared with 3.9% loss in placebo group. As training participation was similar between groups, the attenuation of femoral neck bone loss in the creatine group cannot be readily attributed to differences in exercise volume and may reflect an additional effect of creatine supplementation (Chilibeck et al, 2015).

However, subsequent studies have not consistently replicated these findings. In another 2-year randomized controlled trial, creatine supplementation was combined with exercise training in postmenopausal women. The intervention did not produce significant benefits for bone mineral density, but it showed some positive effects on bone geometry in the proximal femur. The authors concluded that long-term creatine supplementation during exercise training was ineffective in preventing age-related declines in BMD in this population (Chilibeck et al, 2023).

Similarly, Candow et al. assessed the efficacy of creatine supplementation combined with resistance training on bone and muscle outcomes in older adults. Although creatine supplementation improved certain measures of muscular performance, no significant effects were observed on total bone density relative to resistance training alone (Candow et al, 2021). These findings further suggest that any osteogenic effects of creatine are likely modest and may not translate into clinically meaningful improvements in bone health.

3.3. Creatine's effects on brain and cognitive functions in women

Research investigating the role of creatine supplementation in neurological health and cognitive function has expanded considerably in recent years, especially in relation to women experiencing hormonal transitions and aging. Due to its involvement in cellular energy homeostasis and ATP regeneration, creatine may play a key role in supporting neuronal activity, cognitive processes, and brain health. Physiological stages unique to women, including perimenopause and menopause, are associated with modifications in brain energy metabolism that may contribute to an increased vulnerability to cognitive decline, fatigue, mood alterations, and neurological dysfunction.

Recent evidence suggests that creatine supplementation may confer cognitive and neurological benefits in middle-aged and older women. Korovljev et al. investigated the effects of an 8-week supplementation protocol using creatine hydrochloride (Creatine HCl) and creatine ethyl ester in perimenopausal and menopausal women. Supplementation with Creatine HCl at a daily dose of 1500 mg resulted in improved reaction time, increased creatine concentrations in the frontal brain, and a potential reduction in mood swings. These findings suggest that creatine supplementation may support brain energetics and cognitive function during hormonally mediated aging in women. Importantly, no adverse effects were reported throughout the intervention period (Korovljev et al, 2026).

In addition to cognition, creatine supplementation may influence pathways associated with neuroplasticity, inflammation, and oxidative stress, which are important factors in age-related neurological decline. Fernandez-Garrido et al demonstrated that creatine supplementation combined with resistance training improved markers related to neuroplasticity, physical functioning, cognitive performance and reduced oxidative stress in older adults (Fernandez-Garrido et al, 2026). Although the study population included both sexes, the findings may be particularly relevant for older women, who are at increased risk of functional and neurological deterioration with aging.

Creatine has also been explored as a potential adjunctive intervention in neurological and psychiatric disorders. A review by Chang and Leem (2023) evaluated the potential neuroprotective properties of creatine in the context of neurodegenerative diseases. The proposed mechanisms underlying these effects include enhanced mitochondrial function, improved energy homeostasis, and reduced oxidative stress. While substantial evidence from animal and in vitro studies supports the neuroprotective potential of creatine, these promising findings have not been consistently replicated in human clinical trials (Chang & Leem, 2023). Furthermore, a review by Juneja et al. suggested that creatine supplementation may alleviate depressive symptoms by modulating brain bioenergetics and neurotransmitter function, particularly when used in combination with selective serotonin reuptake inhibitors (SSRIs). While creatine was found to be well tolerated, caution is advised in patients with bipolar disorder, as there is a potential risk of triggering manic episodes (Juneja et al, 2024). Given the higher prevalence of depression among women, these findings may have particular clinical relevance in female populations.

3.4. Creatine and women's reproductive health

Emerging evidence suggests that creatine supplementation may play a supportive role in several aspects of female reproductive health, including menstrual physiology, pregnancy, postpartum recovery, and postmenopausal health. Due to fluctuations in endogenous estrogen levels across the female lifespan, women may experience periods of altered creatine synthesis, storage, and utilization, potentially increasing the relevance of dietary creatine intake or supplementation (Ellery et al, 2016; Smith-Ryan et al, 2025).

Estrogen appears to influence creatine kinase activity (Ellery et al, 2016; Smith-Ryan et al, 2025), with reductions in estrogen during menstruation, postpartum, and menopause potentially contributing to decreased creatine availability and impaired cellular energetics. Consequently, creatine supplementation has been proposed as a strategy to support energy metabolism during hormonally vulnerable periods in women (Smith-Ryan et al, 2025).

Particular attention has been given to pregnancy, during which creatine demand may increase substantially due to fetal growth and placental metabolism. Experimental and translational evidence indicates that creatine may support fetal development (Ellery et al, 2016) and protect tissues against hypoxic stress (Smith-Ryan et al, 2025). Although human clinical evidence remains limited, creatine has been hypothesized to reduce the risk of adverse pregnancy outcomes associated with fetal hypoxia, including perinatal injury and preterm birth (Smith-Ryan et al, 2025). Furthermore, creatine concentrations in breast milk appear to be regulated independently of creatinine and macronutrient content, suggesting a specific physiological demand for creatine during pregnancy and lactation (Smith-Ryan et al, 2025). Consequently, maternal creatine stores may become depleted during these periods and supplementation could help maintain adequate physiological reserves.

Dietary patterns may additionally influence creatine availability during pregnancy. Women following plant-based diets may have lower habitual creatine intake due to the absence of animal-derived food sources, potentially increasing the importance of supplementation during pregnancy and lactation (Herrero Jiménez et al, 2025). This may be especially relevant given the elevated metabolic demands associated with fetal and neonatal development.

Although creatine supplementation is not currently recommended during pregnancy, pregnant women generally appear to show a high level of acceptance toward nutritional supplementation. A study exploring attitudes toward creatine supplementation during pregnancy found that women would consider taking creatine if it were recommended by a healthcare professional. However, healthcare providers emphasized the need for robust evidence regarding the safety, efficacy, and potential benefits of creatine supplementation before incorporating it into clinical practice. Consequently, the implementation of creatine as a recommended supplement during pregnancy will require substantial empirical evidence, updates to clinical guidelines, and improved public education regarding its potential role and benefits (de Guingand et al, 2020).

3.5. Other applications of creatine

Beyond its established role in exercise performance and musculoskeletal health, as well as the applications mentioned above, creatine supplementation has recently gained attention for several emerging clinical and therapeutic uses in women. These areas include healthy aging, cardiovascular support, management of urinary incontinence, recovery from post-viral syndromes, and supportive care in oncology.

Research in older women suggests that long-term low-dose creatine supplementation is safe and well tolerated, but does not produce significant changes in bone mineral density, body composition, or muscle function. In a one-year randomized controlled trial, creatine (1 g/day) showed no significant effects on lean mass, fat mass, markers of bone health, or functional performance compared with placebo, and no adverse effects were observed (Lobo et al, 2015). While it does not appear to confer measurable improvements in musculoskeletal outcomes, creatine may still be considered a safe nutritional option that can fit within broader strategies for healthy aging focused on maintaining long-term physiological resilience without increasing health risks.

Creatine has also been investigated for its effects on cardiovascular and hematological parameters. However, acute and short-term supplementation with creatine nitrate did not demonstrate significant hematological or hemodynamic responses, including clinical blood parameters, blood pressure, pulse pressure, or heart rate (Dalton et al, 2017). These findings suggest that, under the studied conditions, creatine nitrate does not meaningfully affect acute cardiovascular physiology. Further research is warranted to determine whether different dosing strategies, populations, or longer-term supplementation may yield different effects.

Another developing area involves pelvic floor dysfunction and urinary incontinence. A randomized controlled pilot trial evaluating a specialized nutritional supplement combined with pelvic floor muscle training in women with stress-predominant urinary incontinence demonstrated improvements in symptom severity and quality of life, as reflected by decreased UDI-6 (Urogenital Distress Inventory Short Form) and IIQ-7 (Incontinence Impact Questionnaire) scores (Takacs et al, 2023). While the intervention included multiple nutritional ingredients rather than isolated creatine monohydrate, creatine was considered one of the compounds potentially supporting muscular function and pelvic floor performance. These preliminary findings suggest that creatine-containing formulations may have relevance in female pelvic health and rehabilitation strategies.

Interest in creatine has further increased following the COVID-19 pandemic, particularly in relation to persistent post-viral fatigue and other long COVID symptoms. In both men and women experiencing long COVID, eight weeks of creatine–glucose supplementation was associated with improvements in several clinical manifestations, including difficulties concentrating, breathing problems, headaches, body aches, and general malaise (Slankamenac et al, 2024). Given creatine's central role in cellular bioenergetics, supplementation may help mitigate the impaired energy metabolism observed in post-viral syndromes. Although larger randomized controlled trials are required to confirm these findings, the available evidence suggests a promising novel therapeutic application of creatine in the management of long COVID symptoms.

Oncological supportive care represents another emerging area of interest for creatine supplementation. Patients with cancer frequently experience cachexia, sarcopenia, and declines in physical function as a consequence of both disease progression and treatment-related toxicities. A recent systematic review evaluating creatine supplementation in cancer patients reported mixed results regarding its effects on the preservation of body weight, lean body mass, and fat mass (Del Arco et al, 2025). Although the current evidence remains limited, creatine supplementation could potentially help attenuate muscle wasting and enhance physical resilience, particularly in the early stages of cancer treatment. Further well-designed clinical studies are required to establish optimal supplementation protocols and identify the patient populations most likely to benefit from this intervention.

4. Discussion

The present review highlights the growing body of evidence suggesting that creatine supplementation may offer health benefits for women that extend beyond its well-established role in sports performance and skeletal muscle physiology. While creatine has traditionally been studied in athletic populations, recent research indicates potential applications in areas such as cognitive health, reproductive physiology, healthy aging, and the management of selected clinical conditions. These findings are particularly relevant given the sex-specific differences in creatine metabolism and the influence of hormonal fluctuations across the female lifespan (Smith-Ryan et al, 2021).

One of the most important observations emerging from the reviewed literature is the apparent relationship between female hormonal status and creatine metabolism. Variations in estrogen concentrations during menstruation, pregnancy, postpartum recovery, and menopause may influence creatine synthesis, storage, and utilization, potentially altering physiological requirements and responsiveness to supplementation (Ellery et al, 2016; Smith-Ryan et al, 2021, 2025). This may partially explain why women represent a unique population in which creatine supplementation could provide benefits extending beyond physical performance. However, despite increasing interest in this area, the optimal dosing strategies for women at different life stages remain poorly defined.

The evidence regarding bone health remains inconclusive. Although the theoretical rationale for creatine supplementation is supported by the close functional relationship between skeletal muscle and bone, most long-term clinical trials have failed to demonstrate significant improvements in bone mineral density among postmenopausal women (Candow et al, 2021; Chilibeck et al, 2023; Sales et al, 2020). Some studies suggest that creatine supplementation combined with resistance training may attenuate bone loss at specific skeletal sites, such as the femoral neck (Chilibeck et al, 2015), but these findings have not been consistently replicated. Consequently, current evidence does not support the use of creatine supplementation as a standalone strategy for the prevention of osteoporosis or age-related bone loss in women.

In contrast, the available data regarding neurological and cognitive health appear more promising. Studies in perimenopausal and postmenopausal women suggest that creatine supplementation may improve cognitive performance, support brain energetics, and potentially alleviate mood swings (Korovljev et al, 2026).

Furthermore, mechanistic evidence indicates that creatine may influence pathways associated with neuroplasticity, mitochondrial function, oxidative stress, and inflammation, all of which are implicated in age-related cognitive decline (Chang & Leem, 2023; Fernandez-Garrido et al, 2026). Although clinical evidence remains limited, these findings support the hypothesis that creatine may represent a valuable nutritional strategy for preserving neurological health during aging. Similarly, preliminary evidence suggests a possible role for creatine as an adjunctive intervention in depressive disorders, particularly when combined with standard pharmacological treatment (Juneja et al, 2024).

Another notable finding concerns the potential role of creatine in female reproductive health. Experimental and translational studies suggest that creatine may support maternal energy metabolism, fetal development, and provide protection against hypoxic stress during pregnancy (Ellery et al, 2016; Smith-Ryan et al, 2025). These observations are biologically plausible given the increased metabolic demands associated with fetal growth and placental development. Nevertheless, the current lack of robust human clinical trials prevents definitive conclusions regarding the efficacy and safety of creatine supplementation during pregnancy. As highlighted by healthcare professionals, stronger evidence is required before creatine can be incorporated into routine prenatal care recommendations (de Guingand et al, 2020).

The review also identified several emerging therapeutic applications of creatine supplementation. Preliminary findings suggest potential benefits in the management of long COVID symptoms, particularly general malaise, problems with concentration, breathing difficulties and headaches (Slankamenac et al, 2024). Similarly, creatine could potentially contribute to supportive oncological care by helping to attenuate muscle wasting and preserve physical function in selected patient populations (Del Arco et al, 2025). However, these areas remain in an early stage of investigation, and the currently available evidence is insufficient to support routine clinical implementation. Larger randomized controlled trials are needed to establish efficacy, optimal dosing protocols, and long-term safety in these populations.

Importantly, the reviewed literature consistently supports the favorable safety profile of creatine supplementation. Studies conducted in women across different age groups have generally reported good tolerability and a low incidence of adverse effects (Korovljev et al, 2026; Lobo et al, 2015). These findings are consistent with broader evidence indicating that creatine monohydrate is one of the safest and most extensively studied dietary supplements available (Kreider et al, 2017; Longobardi et al, 2025). Nevertheless, caution remains warranted in specific populations, including pregnant women and individuals with pre-existing renal disease.

Several limitations of the current evidence base should also be acknowledged. Many studies investigating creatine supplementation in women involve relatively small sample sizes, heterogeneous populations, varying supplementation protocols, and short intervention periods. Furthermore, some of the available research includes mixed-sex populations, limiting the ability to draw conclusions specifically applicable to women. The underrepresentation of women in creatine research remains a significant challenge and highlights the need for sex-specific investigations that account for hormonal status, menopausal stage, dietary patterns, and reproductive factors.

5. Conclusions

The available evidence suggests that creatine supplementation may represent a valuable nutritional intervention for several aspects of women's health, particularly cognitive and neurological function, reproductive health, and healthy aging across different stages of the female lifespan. However, the strength of evidence varies substantially across outcomes, and many proposed applications remain preliminary. Future research should focus on conducting large, well-designed randomized controlled trials specifically in female populations to clarify the efficacy, safety, and optimal use of creatine supplementation throughout the female lifespan.

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