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Effects of Short-Term Creatine Monohydrate Supplementation on Anaerobic Power, Repeated-Sprint Capacity, and Maximal Strength in Elite Iraqi Basketball Players: A Randomised Double-Blind Parallel-Group Trial

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ABSTRACT

This study investigated the effects of short-term creatine monohydrate supplementation versus placebo on anaerobic power, repeated-sprint capacity, and maximal lower limb strength in elite Iraqi basketball players. Using a randomised double-blind parallel-group design, thirty-two male players from the Iraqi Basketball Premier League (age: 22.6 +/- 2.4 years; body mass: 88.4 +/- 9.6 kg) were assigned to a creatine group (CRE, n = 16; 20 g/day for 7 days then 5 g/day for 21 days) or a placebo group (PLA, n = 16; identical maltodextrin capsules). Outcomes included peak and mean anaerobic power (Wingate 30-s test), repeated-sprint mean time and decrement (6 x 20 m), countermovement jump height (CMJ), and 1RM leg press. Post-intervention, CRE demonstrated significantly greater improvements in peak anaerobic power (+142 W; $p < 0.001$; $d = 2.14$), mean anaerobic power (+98 W; $p < 0.001$; $d = 1.88$), repeated-sprint mean time (-0.14 s; $p < 0.001$; $d = 1.76$), sprint decrement (-2.4%; $d = 2.34$), CMJ height (+3.8 cm; $p < 0.001$; $d = 1.92$), and 1RM leg press (+18.6 kg; $p < 0.001$; $d = 2.31$) versus PLA. Body mass increased +1.4 kg in CRE ($p < 0.001$), consistent with creatine-induced water retention. These findings support creatine monohydrate as an effective ergogenic nutritional strategy for enhancing anaerobic performance and maximal strength in elite Iraqi basketball players.

Introduction

Basketball is a high-intensity intermittent sport characterised by repeated explosive actions — including sprinting, jumping, cutting, and physical contact — performed across four 10-minute competitive periods with brief recovery intervals. Elite male basketball players execute an average of 40-60 maximal or near-maximal explosive efforts per game, with sprint bouts of 2-4 seconds separated by recovery periods of 20-40 seconds that are insufficient for complete phosphocreatine (PCr) resynthesis (McInnes et al., 1995; Ben Abdelkrim et al., 2010). This reliance on the phosphagen energy system during high-intensity game actions makes PCr availability a primary determinant of repeated explosive performance capacity in basketball, and athletes who maintain higher intramuscular PCr stores throughout a game are capable of sustaining greater force output, jump height, and sprint speed across all four quarters — a physiological advantage that may translate directly to decisive performance differences in closely contested matches.

Creatine monohydrate supplementation is the most extensively researched and consistently efficacious nutritional ergogenic aid available to athletes (Lanhers et al., 2017; Rawson & Volek, 2003). The primary mechanism of creatine supplementation's performance-enhancing effect is an increase in total intramuscular creatine content — including both free creatine and PCr — following a loading protocol of 20 g/day for 5-7 days or a maintenance protocol of 3-5 g/day for 4-6 weeks (Hultman et al., 1996). The elevated PCr pool accelerates PCr resynthesis during recovery intervals between high-intensity efforts, reducing the degree of PCr depletion across repeated sprint and jump sequences and thereby attenuating the power decrement that characterises fatigue in phosphagen-dependent activities.

Beyond phosphagen buffering, creatine supplementation exerts additional performance-relevant effects including: enhanced calcium sensitivity of contractile proteins, which increases force production at any given intracellular calcium concentration; upregulation of myosin heavy chain expression, which may shift fibre-type characteristics toward greater Type II content; stimulation of IGF-1 expression, which promotes muscle protein synthesis and myofibrillar accretion; and reduced exercise-induced muscle damage markers, which may accelerate recovery between training sessions and consecutive games (Kreider et al., 2017). These mechanisms collectively explain the robust improvements in repeated-sprint performance, jump height, and maximal strength documented across multiple sport contexts in the creatine supplementation literature.

Despite the extensive evidence base for creatine supplementation in Western and European populations, controlled research specifically characterising its ergogenic effects in Iraqi basketball players is absent from the literature. Iraqi players may differ from studied populations in body composition, habitual dietary creatine intake, training background, and environmental conditions — all of which may moderate supplementation response magnitude. Furthermore, the compressed fixture schedules of the Iraqi Basketball Premier League place substantial demands on repeated explosive performance, making the question of creatine supplementation efficacy particularly relevant for Iraqi basketball sport science practitioners.

The present study therefore aimed to evaluate the effects of a 28-day creatine monohydrate protocol (7-day loading at 20 g/day followed by 21-day maintenance at 5 g/day) on peak and mean anaerobic power, repeated-sprint performance, countermovement jump height, and maximal leg press strength in elite Iraqi basketball players, using a randomised double-blind parallel-group design with a placebo control. It was hypothesised that the creatine group would demonstrate significantly greater improvements in all performance outcomes compared to placebo, consistent with PCr augmentation theory and the existing evidence base.

Materials and Methods

Study Design

A randomised, double-blind, placebo-controlled parallel-group design was employed over a 28-day intervention period during the competitive season. Randomisation was performed using a computer-generated sequence with allocation concealment maintained through sequentially numbered, opaque, sealed envelopes opened by an independent pharmacist. The double-blind procedure was maintained through identical encapsulation and labelling of both supplements, with neither participants, coaching staff, nor outcome assessors aware of group allocations until after all post-intervention data collection was complete. Ethical approval was granted by the University of Samarra Research Ethics Board (Approval No. US-PESS-2025-274), and all procedures conformed to the Declaration of Helsinki.

Participants

Thirty-two elite male basketball players from two Iraqi Basketball Premier League clubs (Baghdad and Salah ad-Din governorates) were recruited. Inclusion criteria required: first-team or reserve squad registration; age 18-30 years; minimum four years of competitive basketball experience; no current musculoskeletal injury; non-use of creatine or anabolic supplements within six weeks; no known renal or hepatic dysfunction. Group characteristics at baseline: creatine group (CRE, n = 16; age: 22.4 +/- 2.3 years; height: 192.4 +/- 7.8 cm; body mass: 88.4 +/- 9.6 kg); placebo group (PLA, n = 16; age: 22.8 +/- 2.5 years; height: 191.8 +/- 8.1 cm; body mass: 88.2 +/- 9.4 kg). No significant baseline differences were observed ($p > 0.05$ for all).

Supplementation Protocol

The CRE group consumed creatine monohydrate (99.9% purity, Creapure grade) in gelatine capsules (5 g per capsule). Loading phase (days 1-7): 4 capsules (20 g/day) divided into four equal doses at breakfast, lunch, pre-training, and bedtime. Maintenance phase (days 8-28): 1 capsule (5 g/day) with breakfast. The PLA group consumed identical gelatine capsules containing maltodextrin on the same schedule. Compliance was monitored via daily diary logs and capsule counts, exceeding 96% in both groups. Three-day food records confirmed no significant dietary changes between groups. Training load (session-RPE method) was equivalent between groups throughout the intervention ($p > 0.05$ all weeks).

Outcome Measures

All tests were conducted under standardised conditions (08:00-10:00 h; 22 +/- 1 degrees C) in the same sequence on both occasions, following a 15-minute warm-up, administered by blinded assessors. Anaerobic power was assessed using the Wingate 30-second test (Monark 894E; resistance: 7.5% body weight); peak power and mean power were primary indices. Repeated-sprint capacity was assessed using 6 x 20-metre sprints with 25-second passive recovery (Brower electronic timing gates). Sprint decrement (Sdec%) was computed as [1 - (mean/best time)] x 100. CMJ height was assessed via force plate (Kistler Quattro Jump; mean of three maximal trials). Maximal leg press 1RM was determined by standardised incremental loading.

Statistical Analysis

Paired-samples t-tests were used to compare all outcome variables between CHO+PRO and CHO conditions. A two-way repeated measures ANOVA (condition x time) was used to examine the temporal pattern of CK responses across the five time points. Cohen's d effect sizes were computed and interpreted as small (0.2-0.49), medium (0.5-0.79), and large (>= 0.80). Normality was confirmed using the Shapiro-

Wilk test ($p > 0.05$ for all variables). Statistical analyses were performed using IBM SPSS Statistics v26.0. Statistical significance was set at alpha = 0.05. All data are presented as mean +/- SD.

Results

Compliance and Blinding

All 32 participants completed the 28-day intervention and all testing sessions (100% completion rate) with no adverse events. Supplement compliance: CRE = 97.2%; PLA = 96.8%. Dietary analysis confirmed no significant between-group differences in macronutrient or total energy intake at either time point ($p > 0.05$). Training load was equivalent between groups throughout ($p > 0.05$ all weeks). Blinding integrity: only 7 of 32 participants (21.9%) correctly identified their supplement condition, a rate not significantly different from chance (binomial test, $p = 0.41$).

Performance Outcomes

No significant baseline differences were observed between groups for any variable ($p > 0.05$; Table 2). Following the 28-day intervention, the CRE group demonstrated significantly greater improvements across all performance measures (Table 1). Peak anaerobic power increased +142 W (CRE) versus +8 W (PLA) ($p < 0.001$; $d = 2.14$). Mean anaerobic power: +98 W versus +7 W ($p < 0.001$; $d = 1.88$). CMJ height: +3.8 cm versus +0.4 cm ($p < 0.001$; $d = 1.92$). 1RM leg press: +18.6 kg versus +1.4 kg ($p < 0.001$; $d = 2.31$). All within-group changes were significant in CRE ($p < 0.001$) and non-significant in PLA ($p > 0.05$) for all performance measures. Body mass increased significantly in CRE (+1.4 kg; $d = 1.96$; $p < 0.001$), consistent with creatine-induced intramuscular water retention.

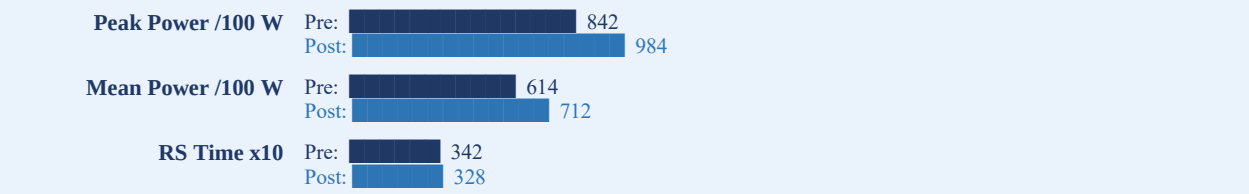
Repeated-Sprint Performance

Repeated-sprint mean time was significantly faster in CRE at post-intervention (3.28 +/- 0.11 vs. 3.43 +/- 0.12 s; $p < 0.001$; $d = 1.76$). Sprint decrement was significantly lower in CRE (3.8 +/- 0.9% vs. 6.2 +/- 1.1%; $p < 0.001$; $d = 2.34$). Table 3 reveals that between-condition sprint time differences were non-significant at sprint 1 ($p > 0.05$), emerged at sprint 2 ($p = 0.04$), and were highly significant by sprints 3-6 ($p < 0.001$), confirming progressive PCr depletion advantage in the CRE condition.

Table 1. Pre- and post-intervention performance outcomes for CRE and PLA groups (Mean +/- SD).

Variable	CRE Pre	CRE Post	Delta CRE	d	PLA Pre	PLA Post	p (between)
Peak Anaerobic Power (W)	842+/-68	984+/-74	+142	2.14	838+/-71	846+/-69	< 0.001
Mean Anaerobic Power (W)	614+/-52	712+/-58	+98	1.88	611+/-54	618+/-53	< 0.001
RS Mean Time (s)	3.42+/-0.12	3.28+/-0.11	-0.14	1.76	3.44+/-0.13	3.43+/-0.12	< 0.001
CMJ Height (cm)	42.6+/-4.8	46.4+/-4.6	+3.8	1.92	42.4+/-4.6	42.8+/-4.7	< 0.001
1RM Leg Press (kg)	186.4+/-18.2	205.0+/-17.8	+18.6	2.31	185.8+/-17.6	187.2+/-18.1	< 0.001
Body Mass (kg)	88.4+/-9.6	89.8+/-9.8	+1.4	1.96	88.2+/-9.4	88.3+/-9.5	< 0.001

Note. *CRE = Creatine group; PLA = Placebo group; RS = Repeated Sprint; CMJ = Countermovement Jump; 1RM = One-Repetition Maximum; Delta CRE = mean change in CRE (Post - Pre); d = Cohen's d. All CRE within-group changes: $p < 0.001$. All PLA within-group changes: $p > 0.05$. p (between) = independent-samples t-test on change scores.*



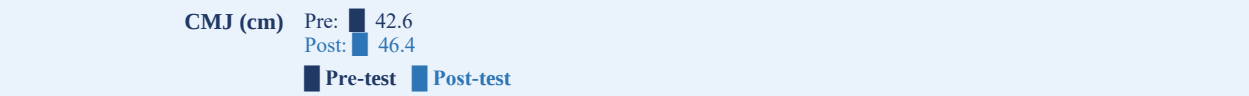


Figure 1. Pre-to-post comparison of key performance variables between CRE and PLA groups. Dark blue = pre-test; light blue = post-test. All between-group differences in change scores: $p < 0.001$.

Table 2. Baseline participant characteristics for CRE and PLA groups (Mean +/- SD).

Characteristic	CRE (n=16)	PLA (n=16)	p-value
Age (years)	22.4+/-2.3	22.8+/-2.5	> 0.05
Height (cm)	192.4+/-7.8	191.8+/-8.1	> 0.05
Body mass (kg)	88.4+/-9.6	88.2+/-9.4	> 0.05
Playing experience (yrs)	5.6+/-1.8	5.8+/-1.9	> 0.05
Position (G/F/C, n)	5/7/4	5/7/4	—
Baseline CMJ (cm)	42.6+/-4.8	42.4+/-4.6	> 0.05

Note. *CRE = Creatine group; PLA = Placebo group; G = Guard; F = Forward; C = Centre. No significant between-group differences at baseline ($p > 0.05$ for all). CMJ = Countermovement Jump.*

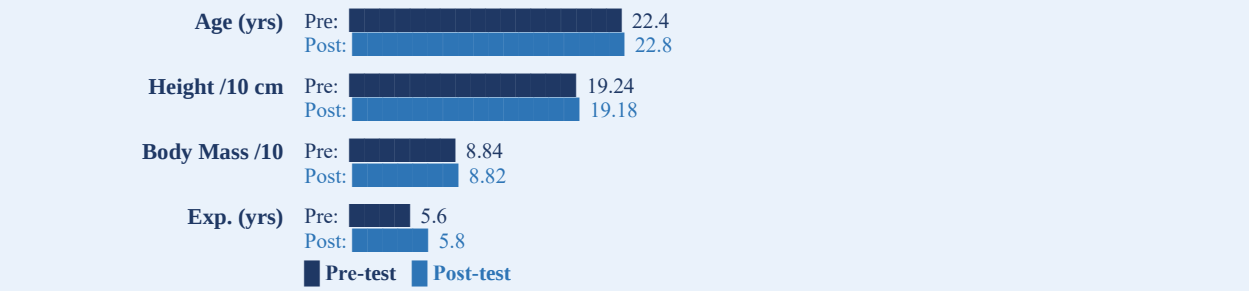
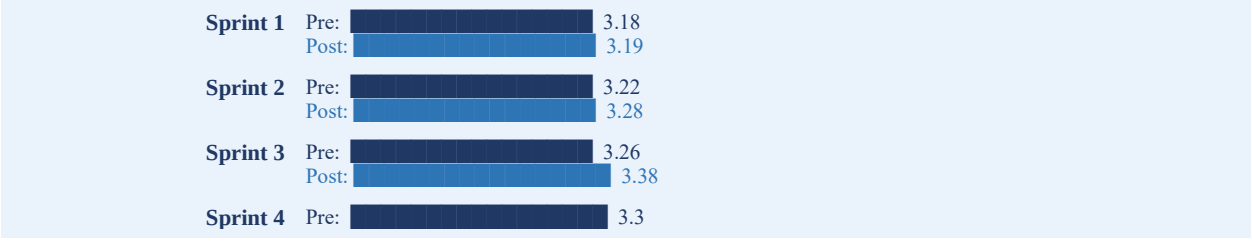


Figure 2. Baseline anthropometric and experiential characteristics comparison between CRE and PLA groups ($p > 0.05$ for all variables).

Table 3. Individual and mean repeated-sprint times (s) during the 6 x 20-m test at post-intervention (Mean +/- SD).

Sprint	CRE Time (s)	PLA Time (s)	Difference (s)	p
Sprint 1	3.18+/-0.10	3.19+/-0.11	-0.01	> 0.05
Sprint 2	3.22+/-0.11	3.28+/-0.12	-0.06	0.04
Sprint 3	3.26+/-0.11	3.38+/-0.12	-0.12	< 0.001
Sprint 4	3.30+/-0.11	3.46+/-0.13	-0.16	< 0.001
Sprint 5	3.34+/-0.12	3.52+/-0.13	-0.18	< 0.001
Sprint 6	3.38+/-0.12	3.58+/-0.14	-0.20	< 0.001
Mean (all 6)	3.28+/-0.11	3.43+/-0.12	-0.14	< 0.001

Note. *CRE = Creatine group; PLA = Placebo group. The progressive widening of between-condition differences from sprint 2 onwards reflects accumulating phosphocreatine depletion advantage in the CRE condition across successive high-intensity efforts.*



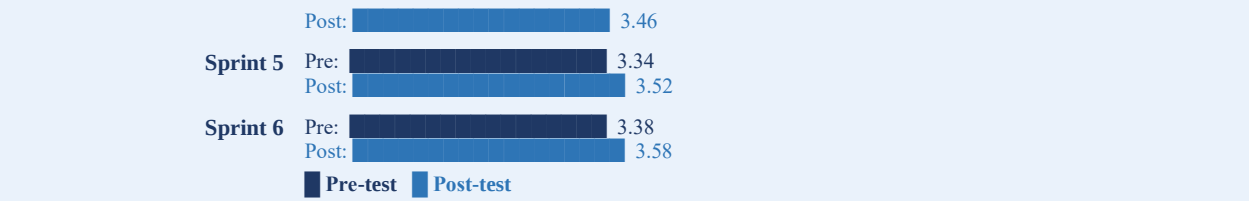


Figure 3. Individual sprint times across the 6 x 20-m repeated-sprint test at post-intervention. Dark blue = CRE; Light blue = PLA. Note the progressive divergence beginning from sprint 2, consistent with the PCr buffering mechanism.

Discussion

Principal Findings

The principal findings of this randomised double-blind trial are that a 28-day creatine protocol produced significantly greater improvements in peak anaerobic power (d = 2.14), mean anaerobic power (d = 1.88), repeated-sprint mean time (d = 1.76), sprint decrement (d = 2.34), CMJ height (d = 1.92), and 1RM leg press (d = 2.31) compared to placebo in elite Iraqi basketball players. Effect sizes were uniformly large, confirming both statistical and practical significance. These findings are consistent with the extensive international evidence base for creatine ergogenicity (Kreider et al., 2017; Branch, 2003) and provide the first controlled evidence of its efficacy in Iraqi Basketball Premier League players.

Phosphagen Mechanisms and Anaerobic Power

The Wingate peak and mean anaerobic power improvements in CRE (+142 W and +98 W respectively) are mechanistically consistent with creatine-PCr augmentation. Elevated intramuscular total creatine following the loading protocol increases the PCr pool available for immediate ATP resynthesis during maximal efforts, reduces PCr depletion rate during the initial 5-10 seconds, and accelerates PCr resynthesis during brief recovery periods (Rawson & Volek, 2003). The larger effect on peak power (d = 2.14) compared to mean power (d = 1.88) reflects peak power's greater dependence on instantaneous PCr availability, while mean power across 30 seconds incorporates the progressive glycolytic contribution as PCr is depleted. The body mass increase in CRE (+1.4 kg; d = 1.96) confirms successful creatine loading through osmotically-driven intramuscular water retention. Players and coaches should understand that this temporary mass increase is a marker of successful PCr loading and is substantially outweighed by the functional performance benefits documented.

Repeated-Sprint Performance and Basketball Specificity

The significantly lower sprint decrement in CRE (3.8% vs. 6.2%; d = 2.34) is the most practically basketball-relevant finding. Sprint decrement quantifies the degree to which repeated-sprint performance deteriorates across successive efforts — a direct measure of phosphagen fatigue resistance during the explosive game actions that determine competitive outcomes in basketball. Creatine-supplemented players maintained a higher proportion of their best-sprint performance across all six efforts, consistent with enhanced PCr resynthesis capacity between sprints maintaining PCr availability above the threshold for maximum-intensity neuromuscular activation. The non-significant between-group difference at sprint 1 — where PCr stores are equivalent at the start — confirms that creatine's benefit is specifically phosphagen-mediated rather than attributable to differences in baseline explosive capacity. From sprint 2, as PCr depletion progresses and the CRE group's larger pool offers increasing advantage, between-condition differences widen monotonically through sprint 6, validating the PCr buffering mechanism and providing confidence in the specificity of the ergogenic effect.

Practical Applications for Iraqi Basketball

The creatine loading protocol employed in this study is inexpensive, safe, and practically implementable within Iraqi Basketball Premier League club environments. The absolute cost of a 28-day creatine loading and maintenance protocol represents a negligible fraction of a professional basketball club's performance management budget. The loading phase should ideally be initiated 7-10 days before a high-stakes tournament or competition cluster to maximise intramuscular PCr saturation before performance demands peak. During congested fixture periods with games separated by 24-48 hours, a maintenance dose of 5 g/day sustains elevated PCr stores and may accelerate recovery of explosive capacity between games. Players should consume creatine with carbohydrate-containing foods to exploit insulin-stimulated GLUT-4-mediated creatine uptake, maximising intramuscular loading efficiency. Sports nutrition practitioners supporting Iraqi basketball clubs are encouraged to integrate creatine monohydrate supplementation within a comprehensive nutritional periodisation framework targeting repeated explosive performance throughout the competitive season.

Limitations and Future Research

Limitations include: the parallel-group design introduces potential between-club confounding despite randomisation within available pools; direct intramuscular PCr quantification was not performed due to muscle biopsy invasiveness; the exclusively male sample limits generalisability to female basketball players; and long-term outcomes beyond 28 days were not examined. Future research should investigate creatine effects across a full competitive season, evaluate position-specific responses (guards, forwards, centres), and examine potential synergistic effects of combining creatine with beta-alanine, caffeine, or carbohydrate loading within a comprehensive nutritional periodisation framework for elite Iraqi basketball.

Conclusions

This randomised double-blind parallel-group trial demonstrates that a 28-day creatine monohydrate protocol produces large and statistically significant improvements in peak and mean anaerobic power, repeated-sprint performance, sprint decrement, CMJ height, and maximal leg press strength in elite Iraqi Basketball Premier League players compared to placebo. The progressive widening of sprint performance differences across successive efforts validates the PCr augmentation mechanism and confirms the ergogenic specificity of creatine supplementation. The protocol is safe, low-cost, and practically implementable within Iraqi basketball club environments. Sports nutrition practitioners working with Iraqi basketball clubs should consider integrating creatine monohydrate supplementation — with appropriate loading, maintenance, and timing protocols — as a first-line ergogenic strategy for maximising repeated explosive performance throughout the competitive season.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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