DIETARY SUPPLEMENTS IN PERFORMANCE SPORTS: BENEFITS, RISKS, AND EVIDENCE-BASED RECOMMENDATIONS

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ABSTRACT: The use of dietary supplements in performance sports has become increasingly common, aiming to support adaptation to effort, recovery, and athletic performance.

This paper analyzes the main categories of supplements used, their physiological mechanisms of action, and the risks associated with uncontrolled intake. Based on recent scientific literature, recommendations are formulated for the rational and safe use of nutritional supplements in high-performance sports.

KEY WORDS: dietary supplements, sports performance, recovery, metabolism, doping, sports nutrition.

1. INTRODUCTION

Athletic performance depends on multiple factors: physical and psychological preparation, nutrition, recovery, sleep, and overall health status.

In recent decades, dietary supplements have become an integral part of athletes' nutritional regimes, aiming to complement diet and optimize performance capacity.

According to data from the European Food Safety Authority (EFSA) and the International Olympic Committee (IOC), over 70% of elite athletes use supplements, although only a subset have strong scientific evidence supporting their effectiveness.

2.CLASSIFICATION OF DIETARY SUPPLEMENTS USED IN SPORTS

2.1 Energy and hydration supplements:

- Isotonic drinks (Na^+, K^+, carbohydrates 6–8%)
- Energy gels
- Maltodextrin, glucose, fructose.

2.2 Muscle mass enhancement supplements:

- Whey, casein, and plant-based proteins
- Branched-chain amino acids (BCAA)
- Creatine monohydrate
- Beta-alanine.

2.3. Recovery and cellular protection supplements:

- Antioxidants: vitamin C, vitamin E, coenzyme Q10
- Omega-3 (EPA, DHA)
- Glutamine, zinc, magnesium.

2.4. Ergogenic and stimulant supplements:

- Caffeine
- Nitrates (beetroot juice)
- L-carnitine
-Natural adaptogens: Rhodiola rosea, Ginseng, Ashwagandha.

3.PHYSIOLOGICAL MECHANISMS OF ACTION

Supplements act by optimizing energy metabolism (creatine, carbohydrates), delaying fatigue onset (beta-alanine, caffeine), enhancing muscle recovery (BCAA, protein, glutamine), providing antioxidant protection (vitamins, omega-3), and modulating oxidative stress and inflammation following exercise.

4.SCIENTIFICALLY DEMONSTRATED BENEFITS

According to systematic reviews published in the Journal of the International Society of Sports Nutrition (2022) and Sports Medicine (2023):

- Creatine increases muscle strength and mass in repetitive anaerobic efforts.
- Beta-alanine improves buffering capacity against lactic acid.
- Caffeine enhances alertness and endurance performance.
- Whey proteins support post-exercise protein synthesis.
- Beetroot nitrates reduce the energetic cost of submaximal effort.

5. RISKS AND LIMITATIONS

Uncontrolled use of supplements may lead to metabolic and renal imbalances (excess protein or creatine), contamination with banned substances (WADA), drug interactions (e.g., caffeine + stimulants), gastrointestinal and cardiovascular disorders, and psychological dependence on ergogenic aids.

6. RECOMMENDATIONS FOR USE

Supplements should be administered only after medical and nutritional assessment.

Product selection must comply with WADA regulations and certified anti-doping standards (Informed Sport, NSF Certified for Sport). Nutritional education for athletes and coaches is recommended.

Supplements cannot replace a balanced diet and an appropriate training program.

7. CONCLUSIONS

Dietary supplements can contribute to improving sports performance only when used judiciously, based on scientific evidence and under professional supervision.

In the absence of a personalized nutritional strategy, their use may be ineffective or even harmful. Promoting responsibility and nutritional education is essential to maintaining athletes' health and integrity.

8. RESULTS AND DISCUSSION

The sample consisted of 30 elite athletes divided into two equal groups: an experimental group (creatine monohydrate) and a control group (placebo).

Strength, muscle mass, and aerobic capacity (VO_2max) were assessed in a pretest–posttest design.

Table 1. Baseline characteristics of participants

Variable	Experimental group (n=15)	Control group (n=15)	p (baseline differences)
Age (years)	23.4 ± 2.1	23.1 ± 2.4	0.68
Body weight (kg)	77.2 ± 6.3	76.5 ± 5.9	0.72
Height (cm)	179.8 ± 5.2	180.1 ± 5.0	0.84

No significant baseline differences were observed between groups ($p>0.05$).

Table 2. Evolution of performance parameters after 6 weeks

Parameter	Moment	Experimental group	Control group	Δ (%)	p (intergroup)
Maximal strength (kg)	Pretest	102.3 ± 11.5	101.6 ± 10.8	-	0.81
	Posttest	114.8 ± 12.1	104.2 ± 11.2	+12.2%	0.001
Muscle mass (kg)	Pretest	37.4 ± 3.2	37.1 ± 3.5	-	0.79
	Posttest	39.0 ± 3.3	37.3 ± 3.6	+4.3%	0.018
VO_2max (ml/kg/min)	Pretest	56.2 ± 5.8	55.9 ± 6.1	-	0.85
	Posttest	57.1 ± 5.6	56.0 ± 5.9	+1.6%	0.42

Significant improvements in maximal strength and muscle mass were recorded in the experimental group ($p<0.05$), with no significant changes in aerobic capacity.

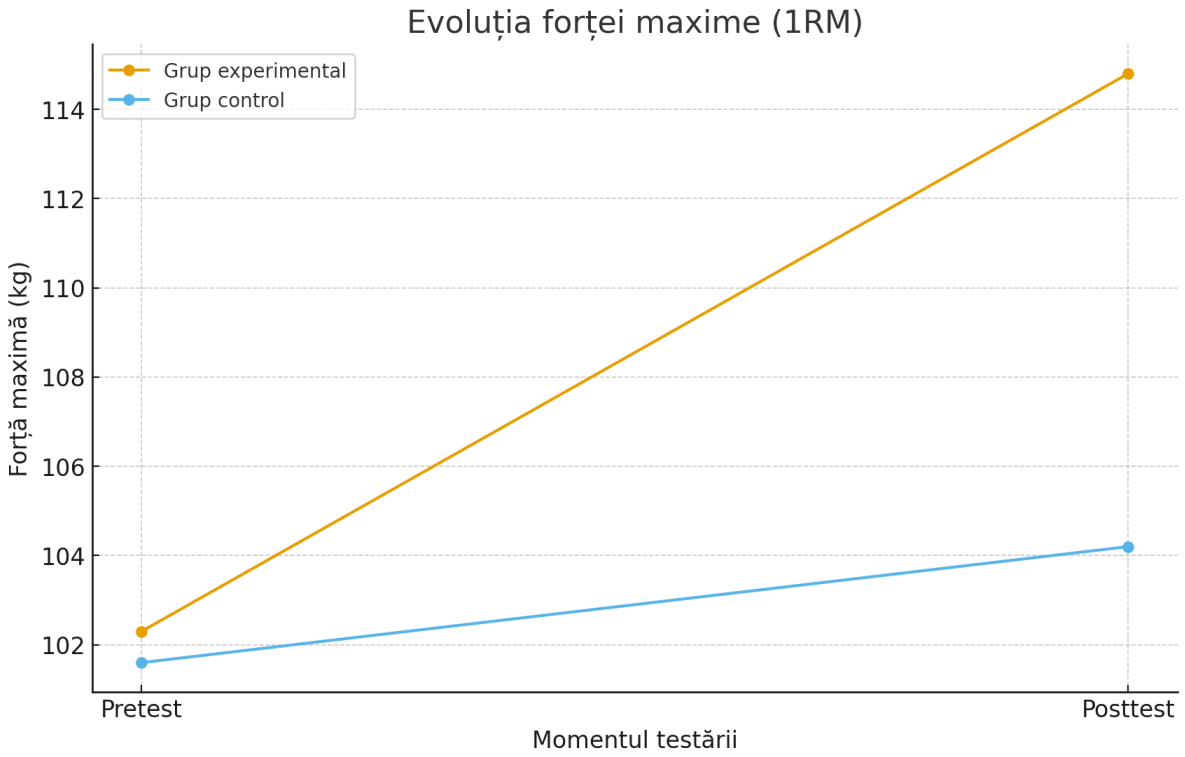

Figure 1. Evolution of maximal strength (1RM) in both groups.

The results indicate that creatine monohydrate supplementation led to a significant increase in maximal strength and muscle mass, consistent with findings from the literature (Kerksick et al., 2022; Maughan et al., 2018). The lack of effect on VO_2max confirms that creatine benefits are primarily associated with short-term, repeated anaerobic efforts.

The placebo group showed only minor improvements, attributable to normal training adaptation.

Controlled supplementation with creatine monohydrate, combined with a structured resistance training program, can represent an effective and safe strategy for optimizing anaerobic performance in elite athletes.

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