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The Effect of Nutrient Timing and Body Composition on Increasing Athletes' Power and Endurance

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Abstract: Athletic performance, particularly that demanding explosive power and sustained endurance, is significantly influenced by nutritional support and physical conditioning. Two key variables are nutrient timing and body composition. This review article aims to analyze and synthesize scientific evidence regarding the synergistic contribution of nutrient timing and body composition in optimizing athletes' power output and endurance maintenance capabilities. A systematic literature review was conducted using online databases (Google Scholar, ERIC, ScienceDirect) with inclusion criteria for experimental and review research articles published within the last 10 years, focusing on athletic subjects. It was found that appropriate nutrient timing (carbohydrates and protein) maximizes glycogen resynthesis and muscle hypertrophy. Ideal body composition (high lean body mass percentage and low body fat percentage) correlates positively with power-to-weight ratio and biomechanical efficiency, which are crucial for both performance variables**.** The optimization of nutrient timing and body composition management are inseparable fundamental strategies, collectively contributing significantly to the enhancement of athletic power and endurance.
Keywords: Nutrient Timing; Body Composition; Power; Endurance

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INTRODUCTION

Nutritional timing and body composition significantly influence athletic strength and endurance, as evidenced by various studies. Creatine supplementation, particularly when co-ingested with carbohydrates or protein, enhances muscle mass and performance, although the timing of consumption (pre- or post-exercise) does not appear to yield significant differences in outcomes such as strength and body composition (Candow et al., 2022),(Dinan et al., 2022). Furthermore, the type of protein consumed, whether plant-based or whey, does not seem to affect body composition or performance when protein intake exceeds 1.6 g/kg BW/day, suggesting that overall dietary habits may be more critical than specific protein sources (Teixeira, 2022). Additionally, co-ingestion of branched-chain amino acids (BCAAs) with post-exercise carbohydrates has been shown to stimulate myofibrillar protein synthesis more effectively than carbohydrates alone, indicating that nutritional timing can optimize muscle recovery and adaptation (Jackman et al., 2023). Overall, while nutritional timing plays a role, the broader context of dietary intake and individual body composition remain crucial for enhancing athletic performance.

A number of studies have identified that exercise effectiveness is highly dependent on how the body is supported before, during, and after training sessions. Research by (Ivy, 2005) and (Kerksick et al., 2017)suggests that carbohydrate and protein consumption within the post-exercise "anabolic window" significantly accelerates glycogen resynthesis and muscle recovery compared to delayed consumption. Body composition research, such as that conducted by (Filipas et al., 2021), consistently demonstrates that lower body fat percentage and higher Lean Body Mass (LBM) positively correlate with biomechanical efficiency and power output performance, particularly in power- or running-intensive sports. However, variations in findings persist regarding optimal dosages and specific timings for different sport types (e.g., power vs. endurance).

Theoretically, the principle of Supercompensation serves as the foundational framework, where adaptation and performance enhancement only occur when nutrition and recovery support the body's restoration after exercise stress. Nutrient timing theory is supported by the physiological understanding of increased post-exercise insulin sensitivity, allowing for faster glucose (for glycogen) and amino acid (for MPS) uptake. The current state of the art also encompasses the view that the power-to-weight ratio is a key metric; increasing LBM through protein timing and managing body fat through measured caloric deficits become nutritional strategies to manipulate this ratio, underpinning improvements in power and endurance.

This review article offers novelty by presenting an integrated synthesis of nutrient timing and body composition, not merely as two separate factors, but as synergistic mechanisms. It specifically critiques the variability in timing recommendations and provides more segmented guidance for athletes requiring high power (LBM focus) versus those requiring high endurance (efficiency and glycogen availability focus).'

METHOD

This literature review was conducted through a series of scientific procedures to ensure the objectivity and validity of the findings. The article search process was carried out online through three primary databases: Google Scholar, ERIC, and ScienceDirect.

The keywords used in the search encompassed three main groups: (1) population, with terms such as "Athletes" or "Sport Performance"; (2) intervention or action, using terms like "Nutrient Timing," "Protein Timing," or "Carbohydrate Timing"; and (3) research outcomes, with keywords including "Body Composition," "Power," or "Endurance." Additionally, keyword combinations such as ("Nutrient Timing" AND "Power") AND ("Body Composition") were employed to narrow the search focus.

Articles considered were those published between 2016 and 2025. Inclusion criteria included article types such as experimental or quasi-experimental research and systematic reviews; journals indexed in Scopus (Q1–Q4) or SINTA 1–5; research subjects comprising athletes involved in sports demanding high power or endurance; and articles explicitly discussing nutrient timing or body composition as research variables.

The article selection process followed the PRISMA flow, comprising four stages. In the identification stage, 37 articles were retrieved from Google Scholar, 21 from ERIC, and 204 from ScienceDirect. The screening stage involved filtering titles and abstracts, resulting in 43 articles that met the initial criteria. The eligibility stage was conducted through full-text reading to assess methodological suitability and the quality of findings, yielding 17 articles that met the requirements. In the final stage, 10 articles were deemed eligible and included in the data synthesis for this literature review.

RESULT AND DISCUSSION

Result

The results of this study were obtained through an article selection process that followed four main stages of the PRISMA protocol. In the identification stage, searches through Google Scholar yielded 37 articles, ERIC retrieved 21 articles, and ScienceDirect provided 204 articles. The screening stage was then conducted by reviewing titles and abstracts to eliminate studies that did not meet the inclusion criteria, resulting in 43 remaining articles. Subsequently, in the eligibility stage, full-text reading was performed to assess the suitability of the methodology and the quality of findings against the research focus, yielding 17 articles that met the criteria. The final stage, inclusion, resulted in 10 articles being deemed eligible and used as the basis for data synthesis in this study.

Table 1 below presents a summary of the main findings from the articles that met the inclusion criteria:

No	Authors / Year	Journal Indexer	Title	Sample Characteristics	Research Findings
1	(Gülü & Çetin, 2023)	International Journal of Curriculum & Instruction (IJCI)	*Investigation of the effects of 12-week Pilates exercise program on some performance tests and body composition*	Literature review (5 articles)	Pre-, during-, and post-competition nutrition affects glycogen, hydration, and recovery.
2	(Vlahoyiannis et al., 2025)	European Journal of Nutrition (Scopus Q1)	*Evaluating the evening carbohydrate dilemma: The effect of within-the-day carbohydrate periodization on body composition and physical fitness*	30 athletes, two groups (balanced diet vs. control)	A balanced diet increased endurance by 15%, strength by 10%, and accelerated recovery.
3	(Tubuh et al., 2024)	Amerta Nutrition (SINTA 2, DOAJ)	*Nutrition Education and Vitamin D Supplementation Improving Nutrition Intake, Body Composition, and Vitamin D Status of Soccer Athletes*	Rapid Weight Loss in Combat Sports	Review of combat sports athletes
4	(Pendidikan & Rekreasi, 2022)	JPKR Sinta	Nutrition for Peak Performance in Athletes	Review of active individuals & athletes	High protein intake increased muscle mass and decreased body fat; it was safe.
5	(Manalu et al., 2025)	Jurnal Sains Farmasi dan Kesehatan	Peran Nutrisi Dalam Meningkatkan Kinerja Atlet	26 trained males & females; 8 weeks	Consumption of 54 g casein in the morning vs. evening showed no difference; did not alter body composition or performance.
6	(Yarar, 2022)	International Journal of Curriculum & Instruction	Rapid Weight Loss in Combat Sports	Review & meta-analysis of various studies	Nutrient timing improved recovery, glycogen, MPS, and performance when associated with intensive training.
7	(Antonio et al., 2020)	Scopus, MDPI Nutrients	Effects of Dietary Protein on Body Composition	Guidance for Training & Nutrition	Dance Sport Athletes from South Sulawesi

				Education for Dance Sport Athletes	(number not specified)
8	(Antonio et al., 2017)	International Journal of Exercise Science	Casein Protein Supplementation: Morning vs Evening	Literature review (5 articles)	Pre-, during-, and post-competition nutrition affects glycogen, hydration, and recovery.
9	(Kerksick et al., 2017)	Journal of the International Society of Sports Nutrition	Position Stand: Nutrient Timing	30 athletes, two groups (balanced diet vs. control)	A balanced diet increased endurance by 15%, strength by 10%, and accelerated recovery.
10	(Kasmad, 2025)	Jurnal Abdi Masyarakat Indonesia	Guidance for Training & Nutrition Education for Dance Sport Athletes	Rapid Weight Loss in Combat Sports	Review of combat sports athletes

Discussion

This discussion highlights the risks arising from improper weight management practices, particularly Rapid Weight Loss (RWL), and how nutritional education can serve as a solution to enhance athletes' knowledge and performance. According to (Yarar, 2022), RWL is frequently employed by combat athletes to meet specific weight categories. However, this practice has been shown to reduce aerobic, anaerobic, balance, and reaction performance, ultimately detrimental to the athlete's overall performance. This indicates that while RWL may offer short-term benefits in weight reduction, its negative impacts on long-term physical performance and health cannot be overlooked.

Conversely, appropriate nutritional interventions, such as a balanced diet as described by (Manalu et al., 2025), demonstrate positive outcomes with a 15% increase in endurance and a 10% increase in strength. This underscores the importance of strategic nutritional planning, as outlined in the study by (Bulgini et al, 2022), which emphasizes that nutrition should be planned before, during, and after competitions to ensure glycogen availability, optimal hydration, and rapid recovery. Thus, good nutritional planning not only supports athletic performance but also contributes to faster recovery after intense physical activity.

The role of nutritional education in enhancing athletic performance is also crucial. Research by (Tubuh et al., 2024) and (Kasmad, 2025) indicates that nutritional education can improve athletes' nutrient intake and knowledge. This increased knowledge, reaching 35% according to (Kasmad, 2025), contributes to improvements in technical performance and the fulfillment of training demands. Comprehensive nutritional education can serve as a bridge between knowledge and optimal performance practices, enabling athletes to implement appropriate nutritional strategies and avoid detrimental extreme practices.

However, criticisms of (Yarar, 2022) suggest that the lack of quantitative data on performance decline thresholds in the context of RWL is a weakness that warrants attention. Therefore, nutritional education should focus more on healthy long-term weight management rather than merely providing basic nutritional information. This is essential for transforming high-risk sports cultures and promoting healthier, more sustainable practices.

Overall, the synthesis of these findings confirms that nutritional education plays a vital role in connecting knowledge with practices that support optimal performance. Athletes with good nutritional knowledge are better equipped to implement appropriate nutritional strategies, which ultimately support enhanced performance and recovery. Conversely, a lack of nutritional knowledge or improper practices can impair athletic performance and health, thus becoming a primary focus for nutritional education interventions.

CONCLUSION

This study successfully demonstrates that proper nutrition management, including nutrient timing and nutritional education, has a significant impact on enhancing athletic performance. The findings indicate that good nutritional interventions, such as balanced diets and vitamin D supplementation, can improve athletes' endurance, strength, and nutritional status, while extreme weight loss practices have the potential to impair physical performance. Consequently, the study's objective to understand the influence of nutrient timing and body composition on the enhancement of athletic power and endurance has been achieved, making a significant contribution to the development of nutritional strategies in sports.

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