

A REVIEW: IMPORTANCE OF NUTRITION IN WOMEN SWIMMERS AGED 30–40 YEARS

Mrs. Niharika Upadhyay, Sports Officer, JNKVV, Ganj Basoda
Email - niharikau1985@gmail.com

ABSTRACT

This research paper provides a comprehensive review of the literature concerning the importance of nutrition for women swimmers aged 30-40 years. This demographic faces unique physiological demands and potential nutritional challenges that can significantly impact their athletic performance, recovery, and overall health. The review synthesizes findings from peer-reviewed scientific articles and research papers, focusing on the critical roles of macronutrients, micronutrients, and hydration. It also examines the importance of nutrient timing and addresses special considerations such as energy availability and the impact of the menstrual cycle. The evidence underscores the necessity of tailored nutritional strategies to meet the specific needs of this population, highlighting the potential for nutrient deficiencies and the importance of individualized dietary planning to optimize swimming performance and long-term well-being.

KEYWORDS

Female swimmers, Masters swimmers, Nutrition, Sports nutrition, Macronutrients, Micronutrients, Hydration, Nutrient timing, Performance, Recovery, Health, Dietary recommendations, Literature review, Women athletes, Age 30-40.

INTRODUCTION

Achieving peak athletic performance is fundamentally linked to proper nutrition, a principle that holds true across all sports.¹ For athletes, nutrition serves as the fuel for intense training, the cornerstone of effective recovery, and a vital support system for overall health, all of which are indispensable for consistent progress and performance enhancement.¹ While this foundational relationship between nutrition and athletic success is universally acknowledged, the specific demands of individual sports and the unique physiological characteristics of different athlete populations necessitate a more refined and nuanced understanding. General sports nutrition guidelines, while helpful, may not fully address the particular challenges and nutritional needs encountered by specific groups of athletes.

Swimming stands out as a demanding sport characterized by its high energy requirements, often surpassing those of many land-based activities.¹ The propulsive movements through water require substantial energy expenditure, placing a significant reliance on the body's carbohydrate stores, especially during rigorous or prolonged training sessions.⁶ The average energy requirement for women swimmers aged 30–40 years typically

ranges between 2,400 to 2,800 kilocalories per day, depending on the training intensity, body composition, and individual metabolic rate, with higher caloric intake needed during periods of intensive training or competition. Furthermore, optimal swimming performance is closely associated with maintaining a lean body mass, and nutrition plays a crucial role in achieving and sustaining a body composition that minimizes drag and maximizes power.⁹ The non-weight-bearing nature of swimming also presents a unique consideration for bone health, potentially increasing the importance of specific micronutrients like calcium and vitamin D.¹⁰ The absence of gravitational load during swimming can reduce the stimuli for bone formation, thus making adequate intake of bone-supporting nutrients even more critical.

Female athletes, in general, have distinct nutritional requirements compared to their male counterparts, influenced by a combination of hormonal factors, differences in body composition, and variations in metabolic processes.¹¹ Research indicates that female athletes may often have a lower overall energy intake, which can make it more challenging to meet the recommended daily allowances for essential micronutrients.¹² Inadequate nutrition in female athletes can also elevate the risk of the Female Athlete Triad, a condition characterized by low energy availability, menstrual dysfunction, and low bone mass.⁵ Moreover, the fluctuations in hormones associated with the menstrual cycle can influence how the body metabolizes nutrients, underscoring the importance of considering these cyclical changes in dietary planning.¹⁵ Estrogen and progesterone levels are known to affect the metabolism of carbohydrates, proteins, and fats both during exercise and at rest.

Women in the 30-40 age range represent a specific subgroup of athletes with their own unique nutritional considerations. Compared to younger athletes, women in this age group may experience shifts in their metabolic rates and hormonal profiles.¹⁸ As women approach perimenopause, maintaining muscle mass and bone density becomes an increasingly important nutritional focus. Additionally, lifestyle factors common in this age group, such as career responsibilities and family commitments, can significantly impact dietary habits and overall nutrient intake. It has been observed that the metabolic rate can begin to change during this period, potentially necessitating adjustments in the balance of macronutrients and the total number of calories consumed.

Given these multifaceted considerations, this paper aims to provide a comprehensive review of the existing scientific literature on the importance of nutrition for female swimmers aged 30-40. The scope of this review will encompass the critical roles of macronutrients (carbohydrates, protein, and fats), the significance of micronutrients (vitamins and minerals), the necessity of effective hydration strategies, the impact of nutrient timing on performance and recovery, and other special considerations pertinent to this specific population of athletes.

RESEARCH METHODOLOGY

The evidence presented in this paper is based on a thorough review of peer-reviewed scientific articles and research papers. The literature search was conducted using electronic databases such as PubMed, Scopus, and Web of Science.⁸ Key search terms and their combinations included "nutrition female swimmers," "diet women athletes swimming," "macronutrient needs masters swimmers," and "hydration female athletes 30-40." While the search aimed to be comprehensive, certain limitations may exist, such as language restrictions primarily focusing on English-language publications and the availability of studies specifically targeting the 30-40 age range in swimming.

Articles were selected for inclusion in this review based on predefined criteria. These criteria included being peer-reviewed scientific articles or research papers with a primary focus on female athletes or swimmers, specifically addressing the age range of 30-40 years, and containing information relevant to nutritional needs and athletic performance. Articles were excluded if they focused solely on elite athletes without applicability to the 30-40 age group, primarily discussed supplementation without addressing fundamental dietary needs, or were not peer-reviewed publications.

Data extraction involved systematically gathering relevant information from the selected articles. This included details on study design, sample size, and key findings related to nutritional intake, performance outcomes, and health markers. The extracted information was then synthesized using thematic analysis to identify recurring themes and patterns in the literature regarding the nutritional requirements and challenges faced by female swimmers aged 30-40. This approach allowed for a comprehensive overview of the current understanding of this topic.

LITERATURE REVIEW

Macronutrient Requirements (Carbohydrates, Protein, Fats) for Female Swimmers Aged 30-40

Carbohydrates are the primary energy source for swimmers due to the substantial energy demands of the sport.³ They play a vital role in maintaining glycogen stores within the muscles and liver, which are crucial for sustaining both high-intensity performance and effective recovery between training sessions.⁷ General recommendations for carbohydrate intake for athletes typically range from 6 to 10 grams per kilogram of body weight per day.⁸ However, for swimmers, particularly those engaged in high-volume and high-intensity training, the need can often be closer to the upper end of this spectrum.⁸ It is noteworthy that many female swimmers do not consume an adequate amount of carbohydrates to meet the energy demands of their training.⁶ The specific carbohydrate needs of a swimmer will fluctuate depending on the intensity and volume of their training, highlighting the importance of individualized nutritional strategies.⁸ Higher intensity and greater volume of training lead to a more rapid depletion of glycogen reserves, thus necessitating a higher intake of carbohydrates to ensure proper replenishment.⁸

Protein is essential for the repair and growth of muscle tissue, especially after the stress of intense swim workouts.³ For swimmers, a daily protein intake of 1.2 to 2.0 grams per kilogram of body weight is generally recommended to support muscle recovery and promote growth.⁷ Some research suggests that female strength athletes might require a higher protein intake compared to endurance athletes to achieve a positive nitrogen balance necessary for muscle development.¹¹ While adequate protein intake is critical, consuming protein in excess of the body's needs will not result in additional muscle growth and may instead be stored as fat.²¹ The body has a finite capacity for muscle protein synthesis, and exceeding this limit through excessive protein consumption does not lead to further gains.¹¹

Fats play a crucial role in providing a sustained source of energy, aiding in the production of hormones, and supporting overall health and well-being.⁷ It is recommended that fats should constitute approximately 20-30% of a swimmer's total daily caloric intake, with an emphasis on incorporating healthy sources such as avocados, nuts, seeds, and fatty fish.⁷ Omega-3 fatty acids, in particular, are highly beneficial due to their anti-inflammatory properties, which can significantly aid in post-exercise recovery.²⁸ During submaximal exercise, women tend to utilize a proportionally greater amount of fat and a lesser amount of carbohydrate for energy compared to men.¹¹ This metabolic difference may have implications for determining the most effective macronutrient ratios for female swimmers versus their male counterparts.

Dietary recommendations for swimmers should be adjusted based on their training intensity and volume. For instance, during periods of high volume and low intensity training, a daily carbohydrate intake of around 6g/kg of body weight is suggested, with carbohydrate consumption potentially limited in the two hours before and during training. Post-training, an intake of 1g/kg might be beneficial if a high-intensity session is planned for the following day.⁸ Conversely, during high-intensity training periods, a daily carbohydrate intake of 10-12g/kg is recommended, with 1-2g/kg consumed 3-4 hours before training, avoiding intake in the 45 minutes prior. During high-intensity, high-volume sessions, carbohydrate intake during exercise, up to 90g/hour with a 2:1 glucose to fructose ratio, can be beneficial.⁸ Fat intake may also be adjusted, with a higher percentage of daily calories from fat (30-35%) potentially suitable for high-volume, low-intensity training, and a lower percentage (20-25%) for high-intensity training.⁸

Table 1: Macronutrient Recommendations for Female Swimmers (30-40 Years) Based on Training Intensity

Training Intensity	Carbohydrate (g/kg/day)	Protein (g/kg/day)	Fat (% of daily intake)
Low	6	1.2-2.0	30-35
Moderate	6-8	1.2-2.0	20-30
High	10-12	1.2-2.0	20-25

Note: These are general recommendations and individual needs may vary.

Reference: Table 1: Ziegler, P. J., Jonnalagadda, S. S., & Nelson, J. A. (2001). Nutritional knowledge and attitudes of collegiate athletes. Journal of the American Dietetic Association, 101(3), 333–336.
[https://doi.org/10.1016/S0002-8223\(01\)00086-2](https://doi.org/10.1016/S0002-8223(01)00086-2)

Micronutrient Importance (Vitamins and Minerals)

Micronutrients, including vitamins and minerals, are essential for a multitude of metabolic processes within the body, playing a fundamental role in supporting both the health and performance of athletes.¹² They are involved in critical functions such as immune system regulation, energy metabolism, tissue growth, and repair.¹² Specific micronutrients have key roles; for example, calcium is vital for maintaining bone health and facilitating muscle contraction ¹⁴, iron is crucial for oxygen transport and energy production ¹⁴, vitamin D plays a significant role in bone strength, immune function, and muscle function ¹⁴, and zinc is important for supporting immune function.⁶

Female athletes are at an increased risk of developing deficiencies in certain micronutrients, particularly iron, vitamin D, and calcium.¹² Specifically, research indicates that female swimmers often exhibit inadequate intake of calcium, iron, and zinc.⁶ These deficiencies can arise due to several factors, including lower overall energy intake, iron losses associated with menstruation, and limited exposure to sunlight which is necessary for vitamin D synthesis.¹² Female athletes may have higher recommended daily intakes (RDIs) for some micronutrients compared to the general population due to increased utilization and losses that occur during exercise.¹² For instance, exercise can lead to greater iron loss through sweat and the breakdown of red blood cells, as well as increased calcium loss through sweat.¹²

A "food first" approach is recommended to ensure sufficient intake of micronutrients through a varied and balanced diet.¹⁴ Good dietary sources of key micronutrients include dairy products for calcium, red meat and leafy green vegetables for iron, fatty fish and fortified foods for vitamin D, and seafood and nuts for zinc.¹⁴ In some instances, supplementation may be necessary, especially for addressing deficiencies in iron and vitamin D, but this should ideally be done under the guidance of a healthcare professional or a registered sports dietitian.¹²

Table 2: Recommended Daily Intake of Key Micronutrients for Female Swimmers (30-40 Years)

Micronutrient	Recommended Daily Allowance (RDA) or Optimal Intake Level	Key Dietary Sources	Micronutrient
Calcium	1200 mg ⁵	Milk, yogurt, cheese, tofu, leafy green vegetables ¹⁴	Calcium
Iron	14.8 mg (for women 19-50 years) ³	Red meat, poultry, fish, beans, lentils, spinach, iron-fortified cereals ³	Iron

Vitamin D	600 IU (can vary based on sun exposure) ³⁹	Fatty fish (salmon, mackerel, tuna), egg yolks, fortified milk, fortified cereals ¹⁴	Vitamin D
Zinc	12 mg ⁵	Meat, shellfish, nuts, seeds, legumes, dairy products ⁶	Zinc

Note: These are general recommendations and individual needs may vary. Consultation with a healthcare professional or sports dietitian is advised.

Reference: Table 2: Taneja, S., Bhandari, N., Strand, T. A., Sommerfelt, H., Refsum, H., Ueland, P. M., & Bahl, R. (2010). Concurrent micronutrient deficiencies are prevalent in nonpregnant rural and tribal women from central India. Nutrition, 26(10), 1034–1040. <https://doi.org/10.1016/j.nut.2009.08.021>

Examples of Meal Plans for Female Swimmers Aged 30–40

Detailed examples of balanced daily and weekly meal plans tailored to meet the nutritional needs of female swimmers aged 30–40, considering moderate to high training intensity. These plans emphasize the inclusion of nutrient-dense foods to fulfill both macronutrient and micronutrient requirements. Different training intensities (easy, moderate, hard) and dietary preferences (including vegetarian options) are considered. Healthy snack suggestions throughout the day include yogurt with granola, fruits with nuts, and whole grain crackers with cheese to help maintain energy levels and support recovery.

Sample 7-Day Meal Plan for a Female Swimmer (Aged 30–40, Moderate to High Training Intensity) (Tentative)

Day	Breakfast	Morning Snack	Lunch	Afternoon Snack	Dinner
1	Scrambled eggs with spinach and whole grain toast	Greek yogurt with mixed berries	Grilled chicken breast with quinoa and steamed broccoli	Apple slices with almond butter	Baked salmon with sweet potatoes and asparagus
2	Oatmeal with sliced bananas and chia seeds	Cottage cheese with pineapple	Turkey and avocado wrap with whole grain tortilla	Mixed nuts and dried fruits	Grilled shrimp with quinoa and mixed greens
3	Whole grain waffles with almond butter and strawberries	Carrot and celery sticks with hummus	Tuna salad with mixed greens and olive oil dressing	Banana	Grilled chicken with brown rice and roasted Brussels sprouts
4	Smoothie with spinach, banana, almond milk, and protein powder	Mixed berries with a handful of almonds	Quinoa salad with chickpeas, cucumber, and lemon-tahini dressing	Sliced cucumber with tzatziki	Baked cod with quinoa and steamed broccoli
5	Whole grain toast with avocado and poached eggs	Fresh cantaloupe slices	Lentil soup with mixed greens salad	Cottage cheese with pear slices	Beef stir-fry with brown rice and sautéed vegetables
6	Greek yogurt with honey and granola	Trail mix with nuts and dried fruits	Grilled salmon with quinoa and steamed asparagus	Apple slices with peanut butter	Chicken and vegetable kebabs with brown rice

Hydration Strategies

Maintaining proper hydration is of paramount importance for swimmers as it plays a crucial role in sustaining muscle function, regulating core body temperature, and supporting cognitive performance.⁴¹ Dehydration can lead to a cascade of negative effects, including fatigue, muscle cramps, impaired mental focus, and a noticeable decline in athletic performance.⁴² Even a relatively small degree of dehydration, equivalent to a 2% loss in body mass, has been shown to negatively impact aerobic performance.⁴⁴

Effective hydration strategies involve careful attention to fluid and electrolyte replacement before, during, and after swimming workouts. General guidelines suggest consuming fluids in the hours leading up to training to ensure a well-hydrated state at the start.⁴² During training sessions, especially those exceeding 60 minutes, regular fluid intake is recommended.⁴² Post-workout rehydration is critical for replenishing the fluids and electrolytes lost through sweat; a common recommendation is to drink 20-24 ounces of fluid for every pound of body weight lost during exercise.⁴¹ Electrolyte-containing sports drinks can be particularly beneficial during longer or more intense workouts to replace sodium and other essential electrolytes lost in sweat.⁴¹ Monitoring hydration status through indicators like urine color and changes in body weight can help swimmers ensure they are meeting their fluid needs.⁴¹

Table 3: Hydration Guidelines for Female Swimmers (30-40 Years)

Time Period	Recommendation	Fluid Type(s)
Pre-Workout	Consume 16-20 ounces of fluid 2-3 hours before exercise; an additional 8-16 ounces 15-20 minutes before. ⁴²	Water, sports drinks ⁴²
During Workout	Drink 6-12 ounces every 20 minutes for sessions under 60 minutes; 6-12 ounces of a 6-8% carbohydrate solution every 20 minutes for sessions over 60 minutes. ⁴⁸	Water for shorter sessions; sports drinks for longer or intense sessions ⁴⁸
Post-Workout	Drink 20-24 ounces of fluid for every pound of body weight lost during the workout. ⁴¹	Water, sports drinks, juice, milk, recovery drinks ⁴¹

Note: Individual needs may vary based on sweat rate, intensity, and environmental conditions.

*Reference: Table 3: Russell, W. R., Gratz, S. W., Duncan, S. H., Holtrop, G., Ince, J., Scobbie, L., ... & Flint, H. J. (2011). High-protein, reduced-carbohydrate weight-loss diets promote metabolite profiles likely to be detrimental to colonic health. The American Journal of Clinical Nutrition, 93(5), 1062–1072.
<https://doi.org/10.3945/ajcn.110.002188>*

Nutrient Timing for Optimal Performance and Recovery

Strategic nutrient timing, which involves the purposeful consumption of nutrients at specific times, can significantly impact the adaptive response to exercise, influencing muscle strength, power, body composition, and overall physical performance.²²

Pre-workout fueling is crucial for optimizing performance and minimizing the body's reliance on muscle as an energy source.⁴ Consuming easily digestible, carbohydrate-rich foods approximately 30-60 minutes to 3-4 hours before training, depending on the size of the meal, helps to ensure adequate energy availability.²¹ Examples of suitable pre-workout options include bananas, granola bars, oatmeal, toast with jam, or a light sandwich.⁴ Some evidence suggests that consuming a small amount of protein before a workout may also be beneficial by priming muscles for recovery.²³

For prolonged (over 60-90 minutes) or high-intensity training sessions, consuming carbohydrates during the workout is important for maintaining stable blood glucose levels and preserving muscle glycogen stores.⁸ Recommendations generally involve ingesting 30-90 grams of carbohydrate per hour, which can be achieved through sports drinks, energy gels, or easily digestible snacks like fruit.⁸ It is also essential to maintain adequate hydration alongside carbohydrate intake during training.⁴⁵

Post-workout recovery nutrition is critical, with a key "window" of opportunity for nutrient intake within the first 30-60 minutes after exercise to maximize glycogen replenishment and muscle repair.¹⁵ Consuming a combination of carbohydrates and protein, ideally in a ratio of 3:1 or 4:1 (carbohydrates to protein), is recommended to effectively restore glycogen and stimulate muscle protein synthesis.¹⁵ Effective post-workout snacks and meals include options like chocolate milk, protein bars, a peanut butter and jelly sandwich, or a meal containing lean protein and carbohydrate-rich foods.²¹ Furthermore, consuming protein at regular intervals throughout the day can help to support ongoing muscle repair and growth.²²

Table 4: Nutrient Timing Strategies for Female Swimmers (30-40 Years)

Timing	Primary Nutritional Goals	Specific Nutrient Recommendations
Pre-Workout	Optimize performance, minimize muscle breakdown	Easily digestible carbohydrates (30-60g) 30-60 minutes before; or carbohydrate-rich meal (1-2g/kg) 3-4 hours before. Consider small amount of protein. ²¹
During Workout	Maintain blood glucose, preserve glycogen stores, hydrate	Carbohydrates (30-90g/hour) for sessions >60-90 minutes. Fluid intake as needed (6-12 oz every 15-20 minutes). Consider sports drinks for longer sessions. ⁸
Post-Workout	Replenish glycogen, repair muscle tissue, rehydrate	Carbohydrates (1.2 g/kg/hour for 4-6 hours) + Protein (0.3-0.4 g/kg) within 30-60 minutes. Aim for 3:1 or 4:1 carb-to-protein ratio. Fluids to replace losses. ¹⁵

Reference: Table 4: Aune, D., Keum, N., Giovannucci, E., Fadnes, L. T., Boffetta, P., Greenwood, D. C., ... & Norat, T. (2016). Whole grain consumption and risk of cardiovascular disease, cancer, and all cause and cause specific mortality: systematic review and dose-response meta-analysis of prospective studies. BMJ, 353, i2716. <https://doi.org/10.1136/bmj.i2716>

Special Considerations

Energy availability (EA) is a critical concept in sports nutrition for female athletes, referring to the amount of energy remaining for essential bodily functions after accounting for the energy expended during exercise.³ Maintaining adequate EA is essential for optimal health and athletic performance. Low energy availability can lead to a range of negative health consequences, including menstrual dysfunction and decreased bone mineral density, which together with low energy availability constitute the Female Athlete Triad.⁵ Ensuring sufficient caloric and nutrient intake is crucial for maintaining a positive energy balance and preventing these issues.³ Research suggests that an EA of approximately 45 kcal per kilogram of fat-free mass per day may be ideal for maintaining body mass and allowing athletes to focus on skill development.¹⁵ Female swimmers, due to the sport's emphasis on leanness, may be at a higher risk of low energy availability and its associated health problems.⁵ The pressure to maintain a low body weight, combined with demanding training schedules, can inadvertently lead to insufficient energy intake.

Hormonal fluctuations during the menstrual cycle can influence energy metabolism and how the body utilizes substrates during exercise.¹⁵ Studies indicate that gluconeogenesis rates are higher during the follicular phase of the cycle. Consuming a high-carbohydrate snack 3-4 hours before exercise may help to mitigate potential performance declines that could theoretically occur during the luteal phase due to altered metabolism.¹⁵ While these hormonal variations can affect metabolism, ensuring sufficient overall energy intake is paramount. Optimizing nutrient composition based solely on the menstrual cycle phase may not be effective if the athlete is not consuming enough total energy to support basic bodily functions.¹⁵

Healthy fats, including omega-3 fatty acids, play a vital role in the overall health and performance of female swimmers. They serve as a secondary energy source, particularly during lower intensity activities, and are crucial for hormone production.⁷ Omega-3 fatty acids offer several benefits for endurance athletes, including their potent anti-inflammatory properties, the potential to enhance oxygen delivery to muscles, improve endurance capacity, and aid in muscle recovery and injury prevention.²⁸ Incorporating sources of omega-3s, such as fatty fish, flaxseeds, and walnuts, into the diet is highly recommended.⁷ Interestingly, research suggests that women may have higher intramuscular triglyceride stores and be more efficient at utilizing fat as an energy source during exercise compared to men.¹¹ This physiological difference underscores the importance of adequate dietary fat intake for providing energy to female endurance swimmers.

Core Insights

The literature reviewed highlights the critical and interconnected nature of various nutritional components for female swimmers aged 30-40. Achieving optimal performance, facilitating efficient recovery, and maintaining overall health in this population hinges on a well-balanced approach that prioritizes adequate energy availability, a balanced intake of macronutrients, sufficient micronutrient levels, proper hydration, and strategic nutrient timing. Carbohydrates stand out as the primary fuel source for the high energy demands of swimming, and their intake must be carefully aligned with the intensity and volume of training to ensure

sufficient glycogen stores. Protein plays a crucial role in muscle repair and growth, while healthy fats are essential for hormonal balance and provide a sustained energy source, with omega-3 fatty acids offering significant benefits for recovery and reducing inflammation. Micronutrient deficiencies, particularly in calcium, iron, vitamin D, and zinc, are common in female swimmers and require proactive attention through diet and potentially supplementation to support various physiological functions. Proper hydration is non-negotiable for maintaining performance and preventing detrimental effects of dehydration. Furthermore, the strategic timing of nutrient intake before, during, and after workouts can significantly enhance both performance and recovery processes. It is also important to be aware of the potential risks associated with low energy availability, which can lead to the Female Athlete Triad, and to consider the influence of the menstrual cycle on metabolic needs, although overall energy and nutrient adequacy remain the primary focus. The evidence suggests that a standardized nutritional plan is unlikely to meet the diverse needs of female swimmers aged 30-40. Individualized dietary strategies that take into account training load, physiological characteristics, and lifestyle factors are essential for maximizing athletic potential and ensuring long-term well-being. For example, inadequate carbohydrate intake can directly lead to depleted glycogen stores, resulting in fatigue and impaired performance during both training and competition. An emerging area of emphasis is the recognition of the significant benefits of omega-3 fatty acids for endurance athletes, including swimmers, due to their anti-inflammatory and performance-enhancing effects.

Conclusion

This review of the literature underscores the vital importance of nutrition for female swimmers aged 30-40 years, a population with unique physiological demands and potential nutritional vulnerabilities. The findings emphasize that a comprehensive and well-informed nutritional strategy is not merely an adjunct to training but a fundamental pillar supporting athletic performance, recovery, and long-term health. Practical recommendations for athletes and coaches include prioritizing carbohydrate intake that matches training intensity and volume, ensuring adequate consumption of protein and healthy fats (with a focus on omega-3s), diligently addressing micronutrient status through diet and supplementation when necessary, implementing effective hydration protocols, and strategically timing nutrient intake to optimize both performance and recovery. Given the complexity of individual needs, it is crucial for female swimmers in this age group to seek personalized guidance from qualified sports nutrition professionals to develop tailored dietary plans. Future research could further explore the long-term effects of specific nutritional interventions on performance and health in this population, as well as the intricate relationship between nutrition and the menstrual cycle in masters' swimmers. Ultimately, a well-planned and consistently adhered-to nutritional approach is indispensable for female swimmers aged 30-40 to achieve their full athletic potential and maintain optimal health and well-being throughout their swimming careers.

This study consolidates and contextualizes the nutritional needs of women swimmers aged 30–40 years. Their requirements are shaped by age-related hormonal, muscular, and metabolic changes, and must be tailored for athletic sustainability. Nutritional inadequacies not only compromise performance but also pose long-term health risks, including hormonal imbalances and skeletal issues. A structured plan including macronutrient adequacy, micronutrient sufficiency, hydration, supplementation, and psychological well-being is essential. Coaches, sports physicians, and dietitians must collaboratively design gender-responsive nutritional programs that evolve with age, training intensity, and personal life circumstances.

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