Austin Journal of Nutrition & Metabolism

Open Access

Austin Publishing Group

Review Article

Nutrition, Sports, and Covid-19 Lockdown Impact on Young Competitive Artistic Swimming Athletes

Russo MT[1], Fadda J[2] and Angioni A[2]*

[1]Department of Agricultural Science, Mediterranean University of Reggio Calabria, Reggio Calabria (RC), Mariateresa Russo, Italy

[2]Department of Life and Environmental Science, Chemical food Analysis Laboratory, University of Cagliari, University Campus of Monserrato S.S, Italy

***Corresponding author:** Alberto Angioni, Department of Life and Environmental Science, Chemical food Analysis Laboratory, University of Cagliari, University Campus of Monserrato S.S. 554 - Bivio Monserrato - Sestu. S.P. Monserrato - Sestu Km 0,700, Italy

Received: June 01, 2020; **Accepted:** June 23, 2020; **Published:** June 30, 2020

Abstract

Young artistic swimmers must face to a unique aquatic sport which requires a variety of athletic abilities, such as endurance, power, agility, acrobatics, and flexibility, together with a sense of rhythm and team spirit. This activity involves both aerobic and anaerobic metabolism, which requires high energy expenditure. Therefore, correct nutritional intake should be available.

However, nutritional needs for growth and training are in contrast with the contemporary attempt to achieve unrealistic body shape goals. The energy requirements of artistic swimmers are challenging and cannot be able to sustain healthy body function, causing a higher risk of developing disordered eating/eating disorders in young female athletes, or eating anxiety, fearing that eating appropriate foods and beverages negatively alter body composition and increase body mass. Moreover, female athletes can face some additional dietary challenges, including additional requirements such as iron and calcium.

COVID-19 lockdown has highlighted a worrying discrepancy among macronutrients intake during the training period and the suggested ratio of macronutrients for healthy nutrition, with an inverted ratio fat/protein, and lower energy intake in respect to the consumed.

Young artistic swimming athletes showed the absence of nutritional knowledge and the composition of the food. Moreover, families and coaches are not prepared to assist athletes in the problematic choice of foods that are important for growth and sports performance. Therefore, nutrition is committed to external inputs and social suggestions.

Adequate guidelines should be made available for athletes, families, and the technical environment to support food choices and possible alternatives.

Keywords: COVID-19; Diet; Young Athletes; Artistic Swimming

Introduction

A correct dietary intake is fundamental in maintaining health, and promoting growth and maturation, especially when sports are concerned. Healthy eating habits, supported by adequate nutrition education, during childhood and adolescence to adulthood, can reduce the risk of many lifestyle-related diseases, especially if accompanied by physical activity [1]. Many food preferences are also established early and are consolidated over time.

In the face of such evidence, athletes are often misinformed or have misconceptions about nutritional issues and food choice.

During sports practice, many different metabolic pathways are activated, depending on the sport and the training exercise [2]. Therefore, a dietary recommendation should follow the athlete before and after the performance. These nutritional needs vary between sex, and among the different sport are strictly related to the age of the athlete. Many studies are available on professional adult athletes, while only limited experimental researches have been done on young competitive athletes in the child or adolescent stage [3].

Young athletes are different from adults and nonathletic peoples of the same age, in physiological, metabolic, and biomechanical aspects affecting their nutritional needs [4].

Nutritional needs are also related to Body Composition (BC) related to sports performance. Therefore, the BC for the same athlete changes during the year within its training season (preseason, transition period, competitive period, and sometimes an injury period) [5].

Adult competitive athletes can control the BC, by BMI (Body Mass Index), DEXA (Dual-Energy X-ray Absorptiometry), BIA (bioelectrical, impedance analysis), and anthropometry. A different contest is found for young athletes where only seldom studies on BC are carried out, restricted to not adequate to the training performance or evident physical problems.

The requested certificate of competitive activity does not give any information relating BC and nutritional needs of the athlete.

Whatever the sport, it is essential for an athlete's body to works at maximum efficiency and food choices meeting nutritional needs are an integral part of an athlete's regime. Essential differences in the nutritional needs in the different sports include the best foods, timing of food and liquid intake to achieve maximum energy production. Therefore, until an athlete does not understand the relationship

Angioni et al. © All rights reserved

Citation: Russo MT, Fadda J and Angioni A. Nutrition, Sports, and Covid-19 Lockdown Impact on Young Competitive Artistic Swimming Athletes. Austin J Nutr Metab. 2020; 7(3): 1085.

between nutrition and performance, he cannot effectively and consciously manage a fruitful dietary program to perceive a winning advantage.

Nutrition, in general, is a complicated issue strongly influenced by food habits and choices guided by cultural influence or specific knowledge. Additionally, rigorous food regimes involve athletes and their environment. When young athletes are exposed to diet and training regimens, the psychological impact could be too high for their age, level of maturation or individual limits. Moreover, environmental factor such family help (as the timing of food intake), or social issues (as school time) can drastically influence the benefits of sports participation that may be reduced or even deleterious [6].

In this regard, may help the food pyramid system for athletes developed by Mattler et al. with the Federal Office of Sports, the Swiss Society for Nutrition (NHS) and the Foundation for the Promotion of Nutritional Research in Switzerland [7]. The pyramidal system would allow athletes to adapt food regimes to the choices of specific foods in function of the intensity of the sports activity, distinguishing between the competitive phases and the rest phases.

Food-Based Dietary Guidelines for the Young Athlete

The changing patterns of growth and development during childhood and early adulthood in a busy lifestyle raise to individual nutritional needs based on Food-based dietary guidelines, significant social and psychological changes influences food choice and body image. In young athletes, the combination of these implications with daily training becomes a big challenge, including both the effect on energy and nutrient requirements.

Inadequate energy intake may affect stature, puberty, hormone developing and bone health [1], and it can be complicated by training changes competitions.

Young athletes have more significant protein needs per kilogram of body weight to satisfy their growth requirements and have higher calcium needs to support bone accretion [8]. Moreover, the metabolic cost of movement per kilogram of body mass is higher and increase levels of fat are used during exercise.

The primary energy substrates are carbohydrates and fat, while proteins are used in an extreme condition of training or competition.

Carbohydrates provide 4 Kcal/g of dry weight and are stored in muscles, liver as glycogen. However, glycogen reserve in children is lower than in adults [9], and enzymes are not fully developed. The non-oxidative or anaerobic pathways comprise phosphogenic and glycolytic reaction involved in very high intensity (1-10 sec), or high-intensity exercise (max 3 min, with the production of lactate). A decreased anaerobic capacity and lactate production were observed in children related to lower lactate dehydrogenase activity [10,11].

An adequate intake of whole grains, fruits, vegetables, and milk/yoghurt and other essential nutrients, including, vitamins, minerals, and dietary fibre, has been recommended by public health agencies worldwide due to their association with a reduced risk of disease. On the other hand, the use of high levels of carbohydrates can cause to children and adolescence obesity and dental caries/erosion.

Children appear to oxidize fat more than carbohydrate compared with adults, during and after exercise [12-15]. Preferential fat oxidation is also indicated by a more significant increase in plasma free glycerol [16] and free fatty acid concentrations during prolonged exercise [17].

Moreover, ingestion of high-fat foods before exercise may reduce (by 40%) the magnitude of growth hormone secretion during exercise [18].

Besides, young athletes aiming to reduce body mass or fat may overly restrict dietary fat intake, resulting in an insufficient intake of essential fatty acids and fat-soluble vitamins. Avocado and olive oil with their high content on monounsaturated fatty acids are less susceptible to oxidation and higher omega-3/omega-6 necessary for the pro-inflammatory character.

Branched amino acid (leucine, valine, and isoleucine) are essential to decreasing pain and muscle damage, less perceived exertion and mental fatigue, and more significant anabolic response in the recovery period and improved immune response.

In children and adolescents, adequate intakes of both energy and protein are essential to maintain a positive nitrogen balance [19]. Limited data are available on the protein requirements of young athletes. In most circumstances, protein intake is adequate if energy intake meets requirements, and even in studies of young athletes who typically restrict energy intake, protein intakes have usually been observed to be adequate [1].

Dehydration is more detrimental to children than to adults, and sweat electrolyte losses differ between children, adolescents, and adults.

Children have lower sweat rates than adults, and prolonged or intense, intermittent exercise can present with dehydration (more significant sweat loss than fluid intake), which may affect performance and health (20). Their higher relative body surface area causes them to acclimate to heat more slowly. The age of the athletes also influences sweat loss.

In children, and athletes, the sensation of thirst is altered, appearing when 2% dehydration is achieved, and liquid should be ingested before presenting the thirst sensation. However, amateur athletes usually increase their water intake above their needs suffering of dilutional hyponatremia.

Nowadays, competitive athletes began at earlier ages, increasing the concern about the correct nutritional maintenance and the energy demand to avoid adverse effects on growth and maturation. Monitoring growth, body mass, and other anthropometric variables can help health professionals to assess if energy intake is adequate for a given young athlete to maintain growth, health, and performance.

Based on these considerations, it isn't easy to establish a Dietary Reference Intake (DRI) for energy in young athletes, and low dietary Energy Intake (EI) relative to total Energy Expenditure (EE), can lead to RED-S (Relative Energy Deficiency Syndrome) [21].

Female Athletes

Female athletes can face some additional dietary challenges, including, additional requirements for some nutrients such as iron

[22,23] and calcium, even if studies showed that a low intake during childhood and adolescence, is partially compensated by higher calcium retention efficiencies up to 50% [24]. Female adolescents participating in distance running, walking, jumping or artistic swimming may be at an increased risk of inadequate energy intake concerning their pursuit of a lighter and leaner physique [25].

The attempt to achieve unrealistic body composition goals, to levels that are not able to sustain healthy body function, cause a higher risk of developing disordered eating/eating disorders in young female athletes.

The lower energy availability can lead to menstrual disturbances (interruption or irregularity to a regular menstrual cycle), reduced basal metabolic rate, immunity impairment, poor hormonal function, impaired bone density, impaired training adaptation leading to reduced performance.

The "Female Athlete Triad" describes a medical condition comprising Low Energy Availability (LEA) and Bone Mineral Density (BMD), Menstrual Dysfunction (MD) [26], and altered functional characteristics [27,28].

Artistic Swimming

Aquatic sports require a serious commitment from their participants at a young age, swimming and diving request early age starting since elite levels of performance are in their early-mid teen years after many years of training. The needs of sport are superimposed on top of social and psychological changes. Synchronized or artistic swimming is unique among aquatic sports requiring a variety of athletic abilities, such as endurance, power, agility, acrobatics, and flexibility, together with a sense of rhythm and team spirit [29]. Athletes train for several hours in a variety of exercise modalities, mostly upside down, underwater and undertaking exercise while breath-holding [30], with limited breaks, leads to consuming adequate energy and fluid during the session. Underwater and upside-down manoeuvres may cause discomfort following food/drink intake, and athletes can experience gastrointestinal upset.

Volume/intensity/goal represents the parameters for carbohydrate intake (fuel) according to training needs; also, high-quality protein should be spread during the day, before and after workouts.

The energy requirements of artistic swimmers are challenging to assess due to the contributions of aerobic and anaerobic metabolism [31]. A study on Japanese artistic swimmers showed that total EE was 11.5 ± 2.8 MJ/day, changing drastically during intense training [32].

Artistic swimming athletes have a high risk for Disordered Eating (DE) or Eating Disorders (ED) [33,34]. Impaired bone health, together with ED, MD and distorted body image with dissatisfaction were reported on college-level artistic swimmers [35].

Moreover, psychological consequences, including depression, anxiety, and suicide, may appear [21,33,35].

Routines exercises may last 2 to 5min in length, mixing aerobic endurance with anaerobic spots of max 1 min requiring exceptional breath control (Robertson et al., 2014), and complex, high-intensity movements with precise synchronization must be performed with perfection requiring a full range of cardiovascular and musculoskeletal strength [30].

The judging system is complex and evaluates technical skill, synchronization, and artistic impression. The body shape is not among judging components; however, the aesthetic appearance of the athletes can influence the overall judgment of the performance. Individuals are required to achieve a uniform 'ideal' shape to achieve competitive success.

Many artistic swimmers have eating anxiety, fearing that eating appropriate foods and beverages negatively alter body composition and increase body mass [36-38].

Impact of COVID-19 Lockdown on Young Competitive Artistic Swimming Athletes

COVID-19 has forced every athlete to reassess their immediate sports goals. Aquatic athletes and artistic swimmers carry out 90% of their activity in the water medium. Therefore, their physic is not used to train out of the water. The closure of the swimming pools and the impossibility of training at sea, has caused a rise of doubt and negativity among many athletes and dry training exercisers suggested initially from coaches have been soon discharged to avoid muscular and physical injuries.

The impact of COVID-19 lockdown was observed on a group of 25 female, young artistic swimming athletes between 10 and 15 years old.

The selected athletes were all part of a competitive team at the regional and national level. Height ranged from 1.45 to 1.65 m., and weight ranged from 35 to 55 Kg. The estimate basic metabolism (BMI) of the athletes studied ranged from 1207 to 1416 Kcal/day [39].

The training activities, before the lockdown, include a daily session of two hours, divided in the warm-up, swimming training and technique session, followed by practicing sections to music or taps, practicing with a partner, working on one specific figure or arm until perfect. Training activities vary significantly in difficulty and requirements depending on the objective of the athletes during the season.

However, young athletes have similar objectives, and average energy consumption can be calculated. As follows: warm-up session from 293.63 to 433.01 Kcal, swimming training and technique session from 147 to 231 Kcal, practicing session from 294 to 462 Kcal. Total energy needs for a 2-hour training session ranging from 734.5 to 1126.01 Kcal. Therefore, the total energy need obtained from the sum of BMI and energy training needs ranges from 1941.63 to 2542.01 Kcal.

Food intake during the day considering breakfast, morning snack, lunch, afternoon snack and dinner account for 1629–1952 Kcal, for a healthy diet of the studied group, and macronutrients accounted for 45.5% carbohydrates, 50.9% protein, 3.5% fat. The percentual breakdown of macronutrients should follow carbohydrates 45-55%, protein 15%, and lipids 30-35%.

An apparent discrepancy was evidenced between macronutrients intake during the training period and the suggested ratio of macronutrients for healthy nutrition [40], with an inverted ratio of fat/protein. This fact is related to an erroneous knowledge on the nutritional needs of young artistic swimming athletes and research of ideal body shape.

During the COVID-19 lockdown phase, the young athletes had to stop swimming training; moreover, the contemporary stop of schools and a more strict contact with the families, led to better control of nutrition, with a higher intake of fruit and vegetables and a better distribution of the food during the day, favoured by the absence of social commitments.

A similar amount of food intake together with an inversion of the fat-protein ratio has led to a slight increase in weight, but also a positive effect in the ideal ratio between macronutrients following the Italian guidelines for healthy nutrition for young people up to 17 years old [40].

The present paper highlighted the extreme lack of adequate forms of food education both among athletes and families which play a strategic role, moreover, coaches and technical staff assisting the teams do not take charge of filling this gap at young athlete level. Family, coaches, and technical staff represent the environment that, in fact, influences athletes at the crucial moment of their growth, both physical and psychological.

The observations revealed the lack of adequate awareness in food choices by athletes who, in the absence of guidelines, are confused, and this could undoubtedly influence aspects such as disordered eating and eating disorders as well as psychological aspects observed in artistic swimming athletes including depression and anxiety.

Conclusion

Young artistic swimming athletes showed the absence of nutritional knowledge and the composition of the food. Moreover, families and coaches are not prepared to assist athletes in the problematic choice of foods that are important for growth and sports performance. Therefore, nutrition is committed to external inputs and social suggestions.

Adult athletes are assisted by a nutritionist who built an ad hoc diet, and it is not the same for young athletes. Therefore, we believe that adequate guidelines should be made available for athletes, families, and the technical environment to support food choices and possible alternatives.

The Swiss athlete's approach based on a pyramid structure could be replicated and adapted to different sports activity of young athletes. The infographic can immediately guide food choices both by guaranteeing the correct relationship between macronutrients and the adequate intake of micronutrients and by providing the necessary information on individual food products and on the possibility of choosing, for the same nutritional value, of different foods based on indices ranging from bioavailability to digestibility.

The COVID-19 lockdown has forced athletes to stay in touch with families by restoring a balance in nutrition, both as regards the quality of the food used and the timing of intake.

Bibliography

1. Bass S, Inge K. Nutrition for special population: children and young athletes. In Burke LM, Deakin V (Eds). Clinical sport Nutrition, Sydney, Mc Grawn-Hill. 2006; 589-632.
2. Poortmans JR, Carpentier A. Metabolic regulation during sport events: factual interpretations and inadequate allegations. Revista Brasileira de Educação Física e Esporte. 2013; 27, 3: 493-506.
3. Meyer F, O'Connor H, Shirreffs SM. Nutrition for the young athlete. Journal of Sports Sciences. 2007; 25: S73-S82.
4. Bar-Or O. Nutritional consideration for the child Athlete. Can J Appl Physiol. 2001; 186-191.
5. Francis P, Mc CORMACK W, Caseley A, Copeman J, Jones G. Body composition changes in an endurance athlete using two different training strategies. J Sports Med Phys Fitness. 2017; 57: 811-815.
6. American Academy of Pediatrics. Organized sports for children and preadolescents. Committee on Sports Medicine and Fitness and Committee on School Health. Pediatrics. 2001; 107: 1459-1462.
7. Mettler S, Mannhart C, Colombani PC. Development and validation of a food pyramid for Swiss athletes the International Journal of Sport Nutrition and Exercise Metabolism. 2009; 19: 504-518.
8. Phillips SM, Van Loon LJC. Dietary protein for athletes: From requirements to optimum adaptation, Journal of Sports Sciences. 2011; 29: S29-S38.
9. Boisseau N, Delamarche P. Metabolic and hormonal responses to exercise in children and adolescents. Sports Med. 2000; 30: 405-422.
10. Berg A, Kim SS, Keul J. Skeletal muscle enzyme activities in healthy young subjects. Int J Sports Med. 1986; 7: 236-239.
11. Kaczor JJ, Ziolkowski W, Popinigis J, Tarnopolsky MA. Anaerobic and aerobic enzyme activities in human skeletal muscle from children and adults. Pediatr Res. 2005; 57: 331-335.
12. Martinez IR, Haymes EM. Substrate utilization during treadmill running in prepuberal girls and women. Medicine and Science in Sports and Exercise. 1992; 24: 975-983.
13. Riddell MC, Bar-Or O, Wilk B, Parolin ML, Heigenhauser GJF. Substrate utilization during exercise with glucose and glucose plus fructose ingestion in boys ages 10-14 yr. J Apll Physiol. 2001; 90: 903-911.
14. Timmons BW, Bar-Or O, Riddell MC. Oxidation rate of exogenous carbohydrate during exercise is higher in boys than in men. J Appl Physiol. 2003; 94: 278-284.
15. Hebestreit H, Mimura K, Bar-Or O. Recovery of muscle power after high-intensity short-term exercise: comparing boys and men. J Appl Physiol. 1993; 74: 2875-2880.
16. Macek, M, Vavra, J. Prolonged exercise in 14-year-old girls. International Journal of Sports Medicine. 1981; 2: 228-230.
17. Delamarche PM, Monnier A, Gratas-Delamarche HE, Koubi MH, Favier R. Cathecolamine responses. European Journal of Applied Physiology and Occupational Physiology. 1992; 65: 66-72.
18. Galassetti P, Larson J, Iwanaga K, Salsberg SL, Eliakim A, Pontello A. Effect of a high-fat meal on the growth hormone response to exercise in children. Journal of Pediatric Endocrinology and Metabolism. 2006; 19: 777-786.
19. Tipton KD, Jeukendrup AE, Hespel P. Nutrition for the sprinter. Journal of Sports Sciences. 2007; 25: S5-S15.
20. Sawka MN. Physiological consequences of hypohydration: Exercise performance and thermoregulation. Medicine and Science in Sports and Exercise. 1992; 24: 657-660.
21. Mountjoy M, Sundgot-Borgen J, Burke L, Carter S, Constantini N, Lebrun C, et al. The IOC consensus statement: beyond the Female Athlete Triad-Relative Energy Deficiency in Sport (RED-S). Br J Sports Med. 2014; 48: 491-497.
22. Deakin V. Iron depletion in athletes. In Burke L., Deakin V (Eds). Clinical Sports nutrition. 3rd. ed. Sydney: McGraw-Hill. 2006; 263.312.
23. Rowland TW, Stagg L, Kelleher JF. Iron deficiency in adolescent girls. Are athletes at increased risk? J Adolesc Health. 1991; 12: 22-25.
24. Abrams SA, Grusak MA, Stuff J, O'Brien KO. Calcium and magnesium

balance in 9-14-y-old children, The American Journal of Clinical Nutrition. 1997; 66: 1172-1177.

25. Manore MM, Kam LC, Loucks AB. 'The female athlete triad: Components, nutrition issues, and health consequences'. Journal of Sports Sciences. 2007; 25: S61-S71.

26. Nattiv A, Loucks AB, Manore MM, et al. American College of Sports Medicine position stand. The female athlete triad. Med Sci Sports Exerc. 2007; 39: 1867-1882.

27. Loucks AB. Energy balance and body composition in sports and exercise. J Sports Sci. 2004; 22: 1-14.

28. Loucks AB, Kiens B, Wright HH. Energy availability in athletes. J Sports Sci. 2011; 29: S7-S15.

29. Robertson S, Benardot D, Mountjoy M. Nutritional Recommendations for Synchronized Swimming. International Journal of Sport Nutrition and Exercise Metabolism. 2014; 24: 404-413.

30. Mountjoy M. Injuries and Medical Issues in Synchronized Olympic Sports Current Sports Medicine Reports. 2009; 8: 255-261.

31. Bante S, Bogdanis GC, Chairopoulou C, Maridaki M. Cardiorespiratory and metabolic responses to a simulated synchronized swimming routine in senior (>18 years) and comen (13-15 years) national level athletes. J Sports Med Phys Fitness. 2007; 47: 291-299.

32. Ebine N, Feng JY, Homm M, Saitoh S, Jones PJH. Total energy expenditure of elite synchronized swimmers measured by the doubly labeled water method. European Journal of Applied Physiology. 2000; 83: 1-6.

33. Melin A, Tornberg AB, Skouby S, Faber J, Ritz C, Sjodin A, et al. The LEAF questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad. Br J Sports Med. 2014; 48: 540-545.

34. Rosendahl J, Bormann B, Aschenbrenner K, Aschenbrenner F, Strauss B. Dieting and disordered eating in German high school athletes and non-athletes. Scand J Med Sci Sports. 2009; 19: 731-739.

35. Melin A, Tornberg ÅB, Skouby S, Møller SS, Sundgot-Borgen J, Faber J, et al. Energy availability and the female athlete triad in elite endurance athletes. Scand J Med Sci Sports. 2015; 25: 610-622.

36. Haase AM, Prapavessis H, Owens RG. Perfectionism, social physique anxiety and disordered eating: A comparison of male and female elite athletes. Psychology of Sport and Exercise. 2002; 3: 209-222.

37. Krane V, Waldron J, S7tiles-Shipley JA, Michalenok J. Relationships among body satisfaction, social physique anxiety, and eating behaviors in female athletes and exercisers. Journal of Sport Behavior. 2001; 24: 247-265.

38. Vardar E, Vardar SA, Kurt C. Anxiety of young female athletes with disordered eating behaviors. Eating Behaviors. 2006; 8: 143-147.

39. Harris JA, Benedict FG. A Biometric Study of Human Basal Metabolism. Proc Natl Acad Sci U S A. 1918; 4: 370-373.

40. LARN. Livelli di Assunzione di Riferimento di Nutrienti ed Energia. 2018.