PAHF

HEALTH AND SAFETY PANEL

PAHF 2020

NUTRITION IN SPORT

PanAmHockey PanAmHockey panamhockey PAHFvideo

PREFACE

The implication of nutrition in sport has been manifesting itself more strongly in recent years.
We are pleased to support all those players who propose to excel, and for this reason the PAHF is committed to contributing to the improvement of their sports performance.
The development of this guide is part of the commitment.

Alberto "Coco" Budeisky
PAHF President

I feel a great responsibility for the task in structuring and developing this guide. It is devised as a friendly tool for use by colleagues and the correct understanding of the athlete. Understanding that each athlete requires individualization and adaptation according to the context in which he develops, I hope that it is the starting point for the development of this area on the continent.

Luciano Spena
PAHF Health and Safety Panel Nutritionist

As Chairman of the PAHF "Health and Safety Panel", the development of nutrition in sports practice seems relevant to me. For this reason, we have endeavored to configure a guide that we hope will be useful to all those who practice the sport.

Pablo Feijoo
PAHF Health and Safety Panel Chairman

Collaborators
Lic. Gemignani Alejandro, Lic. Sánchez Claudio, MSc. Jorquera Carlos.

SYLLABUS

INTRODUCTION

Field hockey is presented as a team sport that requires endurance, strength, speed, and agility, with a mixed performance of energy systems. Although the contribution of each of energy system is variable, the ATP-PC phosphagen system and the glycogen system are the main energy sources for this sport. It is also necessary to consider that individual biotype, position played and the type of game that each athlete presents (among others), are factors that may significantly affect the caloric requirement of each player.

In turn, the individual physiological response of each subject does not allow for specific recommendations to be established in a general way. In any case, the energy support for training and competition must be based on a diet comprised of mostly carbohydrates, moderate protein levels and small amounts of fat (always prioritizing the quality of this macronutrient). In the same way, it is essential to monitor the vitamin-mineral contribution and the consumption of liquids for each athlete.

This type of specificity and the demands that this sport presents in today's high-performance environment, "forces" us to think of an increasingly individual approach to nutritional prescription. However, despite the need for individual considerations, an attempt will be made to describe certain nutritional guidelines that could contribute to supporting training and / or competition loads.

From my humble experience, I have no doubt that improving sports performance is multifactorial and complex, therefore, I believe that just eating properly will not make the athlete a better player; However, incorporating correct variety, quantity and quality within a food consumption structure will allow the athlete to be supplied with energy so that the athlete can achieve better sports performance. In situations where physical exertion is daily and intense, offering adequate nutritional and hydration strategies will help delay fatigue, improve recovery times, and help prevent muscle injuries.

BODY COMPOSITION SUITABLE FOR SPORTS PRACTICE

An increasingly important aspect to consider for athletes is the work on their body composition and the biotype adjustment required by their sport discipline. Many players need to decrease body fat and weight to improve biomechanical aspects of their sport, while others need to increase muscle mass to improve issues associated with strength, power, etc.

A reference standard that discriminates by sport and playing position is increasingly necessary to achieve an accurate diagnosis of the athlete's body composition. Comparative traces are drawn from a series of data from a representative sample, and objectives are defined for the comprehensive improvement of the performance of each player. The great disadvantage of this diagnosis is that there is no direct method for evaluation, and the available methods present a certain degree of error when estimating body composition.

AVERAGE BODY COMPOSITION VALUES BY FA5C. MALE & FEMALE ARGENTINA NATIONAL TEAM (2014- 2018)

FEMALE				MALE			
Height 164 cm **Weight** 60,5 Kg				**Height** 178,9 cm **Weight** 77,3 Kg			
FRACTIONATION 5C				**FRACTIONATION 5C**			
Kg MM	26,3	**Kg MA**	18,1	**Kg MM**	39,1	**Kg MA**	15,6
IND M:O	4	**Sum 6 PI**	79,8 mm	**IND M:O**	4,5	**Sum 6 PI**	53 mm

(*) ISAK protocol. Rosscraft Argentina Tools y Holtain Caliber (female n = 41; male n = 37). Spena L. and cols.

Anatomic 5-component fractionation (FA5C) measures body dimensions: weight, height, length, perimeter, diameter, and skinfold. These anthropometric data are subsequently processed by applying different equations and statistical formulas that allow for the obtaining of information on body composition. The reliability of the anthropometric technique depends on the ability of the anthropometrist and the rigor and precision in taking measurements, always following the standardization determined for each variable that makes up this protocol. It is an extremely useful tool in daily practice since the portability of the tools gives a differential advantage in relation to other diagnostic methods.

AVERAGE BODY COMPOSITION VALUES BY DXA. MALE & FEMALE ARGENTINA NATIONAL TEAM (2018)

FEMALE	MALE
Height 165,1 cm **Weight** 52,8 Kg	**Height** 177 cm **Weight** 76 Kg
	
DXA	**DXA**
% Fat Mass 23,09 %	**% Fat Mass** 14,3 %

(*) Analyzed by densitometer Hologic Discovery Wi (female n = 23; male n = 27). Spena L. and cols.

On the other hand, the evaluation obtained by DXA (bone densitometry or dual X-ray absorptiometry) currently presents a greater number of variables analyzed and a greater number of international references compared to some years ago. It is fast, relatively cheaper than other modern methods, and exposes subjects to a minimal dose of radiation, thus allowing both regional and total body assessment. For all the aforementioned reasons, DXA is becoming the preferred reference method for assessment of athletes.

ENERGY CONCEPT

Enough calorie consumption that compensates for an athlete's energy expenditure, is considered the main component to optimize physical effort and performance. A sustained inadequate caloric intake can trigger a series of disturbances to sleep, recovery, hormonal fluctuations, resting heart rate etc.

For science, the "energy availability" (EA) concept is remarkably interesting, since it reflects the difference between energy intake and energy expenditure in exercise, in relation to fat-free mass (FFM). Values above 45 kcal/kg FFM/day for women and 40 kcal/kg FFM/day for men seem to be the threshold to guarantee optimal physiological functioning for athletes.

Example:

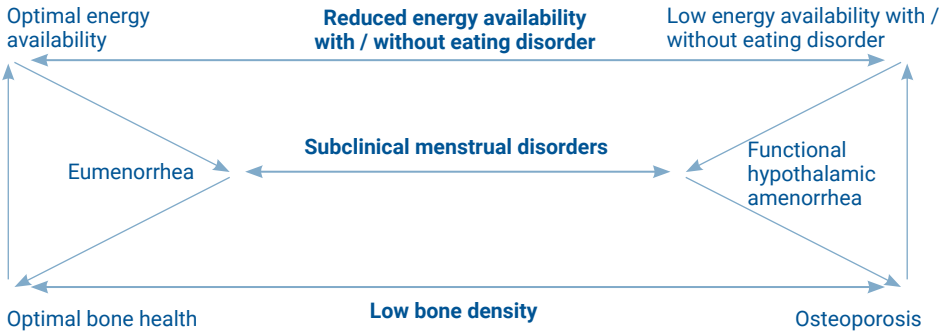
- Male hockey player
- Weight: 75 kg.
- Fat Mass (FM): 8 % = 6 Kg
- Fat-Free Mass (FFM): 75 Kg - 6 Kg = 69 Kg.
- Moderate to intense training 2.5h per day (energy expenditure 1500 Kcal)
- Kcal Ingested per day: 4000 Kcal.

EA = (4000 Kcal – 1500 Kcal) / 69 Kg = 36 kcal/kg MLG/día (*)

(*) EA below the recommended threshold. The athlete requires a higher consumption of Kcal.

An energy availability of less than 30 kcal/kg FFM/day negatively impacts testosterone levels in men and is the basis of "Athlete Triad" syndrome in women. In both sexes it affects recovery, muscle mass, neuromuscular function and increases the risk of injuries and diseases that impact sports performance (RED-S).

TRIAD OF FEMALE ATHLETE



Adapted from De Souza M, Nattiv A, Joy E, Misra M, Williams N, Mallinson R, et al. 2014.

Some studies indicate a total daily caloric consumption close to 2,500 Kcal/day for women and around 3,500 Kcal/day for men for sports performance. Of course, these are estimative values and require an adjustment based on the work stimulus. Consequently, it is important to reject calorie averages but rather to ensure that each athlete has a caloric intake of enough quantity and quality according to the individuality of their daily work.

IMPORTANCE OF CARBOHYDRATES

Carbohydrates (CHO) are nutrients whose primary function is to supply the body with energy quickly, to maintain adequate blood glucose and replenish muscle glycogen lost during activity. CHO is stored as glycogen in the liver and in muscle. Muscle glycogen can be used directly as fuel for contractile processes, whereas glucose obtained from liver glycogen must first be transported by the blood and taken up by the muscle before it can be oxidized. In addition, exogenous sources of carbohydrates (food) can also provide glucose for oxidative processes in the muscle, after being absorbed in the intestine and having entered the circulatory system.

IDEA OF CONTRIBUTION OF 20 TO 30 GR OF CHO FOR USE DURING TRAINING OR COMPETITION

	Oatmeal pillows	**20 gr CHO aprox.** handful 25-30 gr		Sports drinks	**30 gr CHO aprox.** in bottle 500 cc
	Banana	**30 gr CHO aprox.** in 150 gr of banana		Energy gel	**25 gr CHO aprox.** gel 32 gr
	Sport chews	**25 gr CHO aprox.** 5 units		Raisins	**30 gr CHO aprox.** handful 40-50 gr

Being essential as fuel in the central nervous system and muscle, early fatigue during exercise is associated with both glycogenic muscle depletion (as with hypoglycemia) and low CHO intake during sports effort. An inadequate availability of carbohydrates for the central nervous system affects factors that influence performance, such as rhythm, perception of fatigue, motor ability and concentration.

The high intensity and physical demand that hockey presents, requires an adequate periodization in CHO consumption to provide the necessary fuel for the practice of the discipline. A key strategy in the pursuit of optimal performance in competition or training would be to match body carbohydrate stores with session fuel demands. Strategies to promote CHO availability should be implemented before, during, and in recovery from each period of physical exertion.

The following is a brief summary of the recommendations regarding CHO consumption for hockey at different times:

"TIMING" IN THE CHO DISTRIBUTION

SITUATION	CHO OBJECTIVES	COMMENTS
Daily CHO needs for a training or hockey competition	**Activity days with slight to moderate intensities** 3-5 g CHO/Kg Body Weight **Activity days with moderate to high intensities** 4-6 g CHO / Kg Body Weight	CHO needs to be used during the day, as the situation or event warrants. Contemplate consumption according to gender (women near the lowest range of consumption and men close to the highest range) and according to the nutritional/physical periodization of each individual. It ensures an optimal muscle glycogen load during the week to use during game and/or training.
CHO needs about 2-4 hours before training or hockey competition	1 g CHO / Kg Body Weight	Avoid accompanying them with foods high in fiber /protein/ fat to decrease the risk of gastrointestinal discomfort. Ensures an optimal load for the brain and reserve as liver glycogen.
CHO needs during training	**Low intensity and volume Training (< 60´exercise)** CHO intake is not essential **Training of moderate intensity and volume (60 a 90´exercise)** CHO intake of 30 g (per hour) **High intensity and volume Training (90´ a 150´exercise)** CHO intake of 60 g (for every training hour)	CHO ingestion during competition and/or training provides a series of benefits through mechanisms that include glycogen saving, the provision of an exogenous muscle substrate, the prevention of hypoglycemia and the activation of reward centers in the central nervous system. Tolerance to food consumption during exercise is individual and adaptive. Exercise intensity during training may be less when compared to competition, but we must consider the adequate consumption of CHO since training duration will surely be longer.
CHO needs during hockey competition	CHO intake of 30 g (during the game)	It is recommended to divide the consumption. It can be of solid or liquid source. (Eg: sports gels or gummies, fruits, sports drink, etc.)
Need of CHO after training or hockey game	**During the first 4 hours after training or competition** 1 g CHO/Kg Body Weight **During the 24 hours after the game** 6-8 g CHO/Kg Body Weight	Use simple and complex CHOs, prioritizing the latter. Accompany, as much as possible, the consumption of CHO with about 20-25 g of proteins of high biological value during each meal.

IMPORTANCE OF PROTEIN

If we analyze hockey in terms of the physical effort, we usually find a series of intermittent sprints separated by less intense periods of running, added to a substantial number of high load eccentric contractions, such as jumps or decelerations. This is like strength exercise sessions in which a large number of eccentric or plyometric exercises are used, and which usually cause muscle pain or discomfort at 12-72 h post-exercise. These Delayed Onset Muscle Soreness (DOMS) are the result of inflammation of the muscles following exercise-induced injury to some muscle fibers.

Adequate protein consumption facilitates the recovery of muscle function through its proper synthesis, reduces the intensity of the secondary DOMS to exercise and also favors structural changes in non-muscle tissues such as tendons and bones. Current recommendations suggest that the protein intake necessary to allow metabolic adaptation, repair, remodeling and protein turnover, adapted to intermittent sports (such as hockey), should be approximately 1.5 to 1.8 g protein/kg body weight/day. A dose of 20-40 g every 3-4 h, which includes about 3 g of leucine and 10-12 g of essential amino acids (EAA) for each consumption block, favors the synthesis of muscle proteins and is associated with improvements in sports performance.

Proteins can be obtained from foods of animal or plant origin, and also synthetically. Those of animal origin (egg white, dairy, meat), since they contain all essential AA (EAA) in the adequate quantity, have a higher biological value, but depending on the food source, they can also be associated with a high intake of saturated fats and cholesterol. Vegetable proteins (legumes, nuts, cereals) may lack a sufficient amount of some EAA (limiting AA), but when combined they provide a high-quality contribution and allow a reduction in the intake of saturated fats while favoring the inclusion of some essential fatty acid (Omega-6). This is why factors such as the type, quality and quantity of protein must be taken into account, since the speed of digestion and absorption for its subsequent use differs depending on the consumption made.

FATS DURING EXERCISE

Fats are considered the energy nutrient of excellence since they contain more than twice the energy per gram of CHO.

Fat deposits are very abundant and theoretically could provide energy to a human being for several days, since in terms of stored energy an 80 kg man and a 60 kg woman could obtain about 135,000 kcal and 110,000 kcal from their deposits, respectively. This in the sports field could correspond to about 119 hours of continuous marathon running using the energy derived from these storage tanks.

The great drawback lies in the metabolic process that fats require to supply energy to the athlete. The amount of ATP (Adenosine Triphosphate, which is the fundamental nucleotide in obtaining cellular energy) derived per unit time is substantially less than that of CHO. For this reason, this last nutrient becomes the dominant substrate in sports such as hockey.

However, considering that fats are involved in various anti-inflammatory, immunological and structural functions as well as the transport of certain vitamins (fat-soluble), they are considered essential. The dietary recommendation for athletes is 25 to 30% of their daily caloric intake, prioritizing the consumption of unsaturated fats (monounsaturated and polyunsaturated).

FOOD SOURCES OF DIFFERENT TYPES OF FATS

Some foods source of HEALTHY FATS (Mono and Polyunsaturated)		**Some foods source of UNHEALTHY FATS (Saturated and Trans)**	
Fish Avocado Seeds Dried fruits Vegetable oils		Butter and margarine Whole dairy Ice cream Fatty meat cuts Bakery products	

HYDRATION AND THERMOREGULATION

Hydration during sports effort is one of the factors that many athletes tend to overlook and yet it presents great scientific evidence on its impact on performance. In a prolonged event, fatigue can be generated by the depletion of nutritional substrates, as well as by the dehydration (DH) of the subject. DH levels higher than a 2% loss of body weight begin to reflect a decrease in the physical and cognitive performance of athletes, which are exacerbated as DH increases.

Water deficit, without the proportional loss of sodium chloride, is the most common form of dehydration during exercise. In any case, the presence of sodium / sodium chloride in the diet (from food or liquids) helps to retain ingested fluids, especially extracellular fluids, including plasma volume. Therefore, unless medically indicated, athletes should not restrict sodium in their diet as it can be an ally against "eventual" future losses.

A hydration plan that adapts to most hockey athletes usually contemplates an average intake of 0.8 l /hour, although in different exercises they can vary from 0.3 to 2 lt/hour depending on the intensity and duration of exercise, the athlete's physical fitness, acclimatization to heat, altitude and other environmental conditions (heat, relative humidity, etc.).

Due to the harmful effects of DH on hockey performance, it is recommended that players start training well hydrated (reinforcing the intake during exercise), in order to avoid losses greater than 2 % of the initial body weight (Ex.: An 80 kg individual should not experience a decrease greater than 1.6 kg during their training / competition session).

Below is a basic hydration scheme that could be carried out by any player, respecting the quantity and quality of the liquids ingested, and considering which phase of exercise the athlete is in:

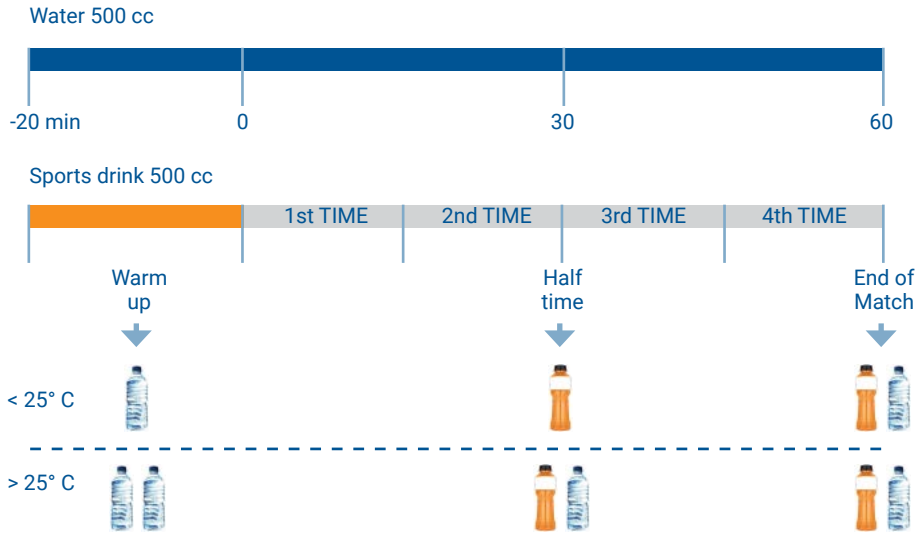
"TIMING" REGARDING THE REDISTRIBUTION OF LIQUIDS

SITUATION	DESCRIPTION
Before Exercise	Drink 5 cc per Kg of Body Weight in the 4 hours pre-exercise. If the urine is dark, the intake should be increased, consuming approximately cc per Kg of Body Weight. Drinks with 20-50 mmol / L sodium and foods with enough salt can help stimulate thirst and retain consumed fluids. In hot and humid environments, it is advisable to drink about 500-600 cc of liquid with mineral salts during the hour prior to the start of the competition and / or training, divided into 3 to 4 doses every 15 minutes. In exercises longer than one hour, it is recommended to add CHO to the drink in the last two doses.
During Exercise	After 20 minutes of sustained effort, it becomes necessary to compensate for fluid loss. It is recommended to drink 6 to 8 cc of liquid per kg of body weight per hour of exercise (approximately 150 to 200 cc every 20 minutes). After 60 minutes of exercise, it is necessary to compensate for the loss of liquids with sports drinks which will also compensate for electrolyte loss. The ideal temperature of liquids should average 15º C. Cooler drinks slow down absorption and can sometimes cause fainting.

SITUATION	DESCRIPTION
Post Exercise	Rehydration should start as soon as the exercise ends. It is recommended to ingest at least 150 % of the loss of body weight in the first 6 hours post exercise, to cover the eliminated liquid by both sweat and urine and thus regain water balance

Sports drinks are usually a good ally for athletes. Firstly, because the presence of flavorings in a drink can increase palatability and the voluntary intake of liquids. Secondly, because the consumption of 500-1000 cc of sports drink (with 6-8% of CHO), contributes 30 to 60 grams of CHO together with the contribution of liquids, which can avoid to eventual DH and in turn super compensate the glycogenic vacuum that occurs during activity.

GENERAL HYDRATION MODEL DURING A COMPETITION FOR A 70 KG INDIVIDUAL. APPROX.



(*) Suggestion of approximate minimum quantities that may vary at the individual level.

Athletes that end physical exercise with a fluid deficit must restore normal levels of hydration during the recovery period. Water balance is recovered when liquid eliminated by sweat and urine is replenished.

DISTRIBUTING NUTRIENTS THROUGHOUT THE DAY... HOW DO WE ASSEMBLE THE DISH?

The distribution of nutrients and the frequency of different meals throughout the day should be closely related to the training and competition schedules carried out by athletes. For example, a correct breakfast will offer quality nutrients to cover the "night caloric gap" and thus prepare the athlete for the first physical stimulation of the day.

Regarding lunch, the main function differs if it is done prior to a physical effort (energy supply) or after exercise (recovery). Being one of the meals with the highest daily caloric intake, and due to the importance, it must be directly related to the times and needs of training or competition.

On the other hand, the snack contributes to covering two relevant objectives for the athlete: to allow a symmetrical distribution of calories, avoiding "bumps" of more than 4 hours between meals, and to provide energy prior to the physical effort in the afternoon-night.

Dinner can serve as a "recovery" if it is after a training or night competition, or it can be the meal that modulates the total caloric intake that the athlete requires.

As stated at the beginning of this document, it is impossible for a global model to fit all players individually, but part of the tentative distribution of meals that will be presented below has to do with the possibility of selecting food according to their training and / or competition times.

We will begin by recognizing the different foods of each group and their main contribution as appropriate:

- **STARCHES**

  Priority function: Energy contribution.
  Simple Pasta (preferably wholegrain), Stuffed Pasta, White or Brown Rice, Quinoa, Pearl Barley, Lentils, Various Beans, Chickpeas, Bulgur Wheat, Legumes and/or Cereals Medallion, Whole meal Bread, Polenta, Potato, Sweet Potato, Corn, Cassava.

- **MEATS (LEAN MEAT)**

  Priority function: Tissue repair.
  Beef, Chicken, Pork, Fish, Seafood, Rabbit, Lamb, Goat, Canned Tuna.

- **VEGETABLES**

  Priority function: Source of fibers, vitamins, and minerals.
  Vegetables of all kinds and colors (except potatoes, sweet potatoes, corn and cassava).

- **SUGGESTED DRESSINGS**

  Raw oils (preferably olive), lemon, vinegar, balsamic aceto, salt and pepper.

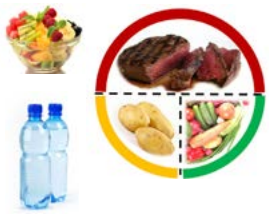
- **COMPLEMENTARY FOODS**

  Some foods, such as eggs, cheese, etc., can be consumed both alone and in preparations according to the taste and habit of each athlete.

Once the colors of each group have been identified, a standard distribution is shown below according to the stimuli that athletes may present, adjusting the main meals of the day:

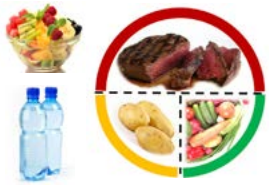
TENTATIVE DISTRIBUTION WITH PHYSICAL EFFORT IN THE MORNING

Physical effort

BREAKFAST	LUNCH	SNACK	DINNER
• Infusion • Fruit, sliced fruit, squeezed • Handful of dried fruit • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and egg Low-fat cheese and lean loin	 ○ DRESSINGS  ● LEAN MEAT Chicken, fish, beef, pork ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, polenta, soy Quinoa, bulgur wheat, corn Lentil, chickpea, beans ● VEGETABLES Boiled, grill, roasted Salads, woks Tortilla, pudding, soufflé	• Infusion • Handful of dried fruit • Fruit, sliced fruit, squeezed • Scrumbled egg, omelette • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and lean loin	 ○ DRESSINGS  ● LEAN MEAT Chicken, fish, beef, pork ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, polenta, soy Quinoa, bulgur wheat, corn Lentil, chickpea, beans ● VEGETABLES Boiled, grill, roasted Salads, woks Tortilla, pudding, soufflé

TENTATIVE DISTRIBUTION WITH PHYSICAL EFFORT IN THE AFTERNOON

Physical effort

BREAKFAST	LUNCH	SNACK	DINNER
• Infusion • Yogurt, low-fat milk • Fruit, sliced fruit, squeezed • Handful of dried fruit • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and egg Low-fat cheese and lean loin	 ○ DRESSINGS  ● LEAN MEAT Chicken, fish ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, soy, polenta Quinoa, bulgur wheat, corn	• Infusion • Fruit, sliced fruit, squeezed • Handful of dried fruit • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and egg Low-fat cheese and lean loin	 ○ DRESSINGS  ● LEAN MEAT Chicken, fish, beef, pork ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, soy, polenta Quinoa, bulgur wheat, corn Lentil, chickpea, beans ● VEGETABLES Boiled, grill, roasted Salads, woks Tortilla, pudding, soufflé

TENTATIVE DISTRIBUTION WITH PHYSICAL EFFORT IN THE AFTERNOON / EVENING

Physical effort

BREAKFAST	LUNCH	SNACK	DINNER
• Infusion • Yogurt, low-fat milk • Fruit, sliced fruit, squeezed • Scrambled egg, omelette • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and lean loin	 DRESSINGS  ● LEAN MEAT Chicken, fish ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, polenta, soy Quinoa, bulgur wheat, corn VEGETABLES Boiled, grill, roasted Salads, woks Tortilla, pudding, soufflé	• Infusion • Fruit, sliced fruit, squeezed • Hanful of dried fruit • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and egg Low-fat cheese and lean loin	 DRESSINGS  ● LEAN MEAT Chicken, fish, beef, pork ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, polenta, soy Quinoa, bulgur wheat, corn Lentil, chickpea, beans VEGETABLES Boiled, grill, roasted Salads, woks Tortilla, pudding, soufflé

TENTATIVE DISTRIBUTION WITH PHYSICAL EFFORT IN THE MORNING AND IN THE AFTERNOON (DOUBLE SESSION)

Physical effort

Physical effort

BREAKFAST	LUNCH	SNACK	DINNER
• Infusion • Fruit, sliced fruit, squeezed • Handful of dried fruit • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and egg Low-fat cheese and lean loin	 Duplicate starches ○ DRESSINGS  ● LEAN MEAT Chicken, fish ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, polenta, soy Quinoa, bulgur wheat, corn	• Infusion • Yogurt, low-fat milk • Fruit, sliced fruit, squeezed • Scrambled egg, omelette • Whole wheat bread or rice crackers accompanied by: Low-fat cheese and jam Low-fat cheese and honey Low-fat cheese and avocado Low-fat cheese and egg Low-fat cheese and lean loin	 ○ DRESSINGS  ● LEAN MEAT Chicken, fish, beef, pork ● STARCH Brown rice, white rice Simple pasta (preferably wholegrain) Potato, sweet potato, polenta, soy Quinoa, bulgur wheat, corn Lentil, chickpea, beans ● VEGETABLES Boiled, grill, roasted Salads, woks Tortilla, pudding, soufflé

SPORTS SUPPLEMENTS

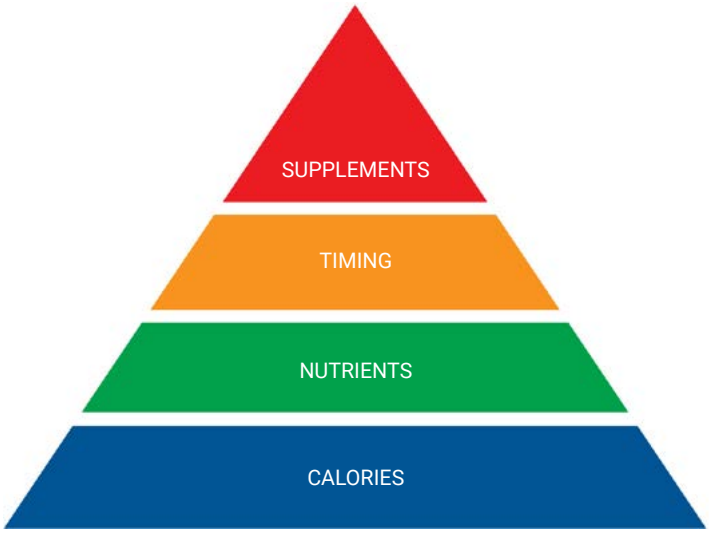
For any athlete it is essential to be able to train and compete without falling into fatigue, injury or illness. As we saw earlier, consuming adequate amounts of energy, nutrients and liquids, adapted to the schedules of training and competitions, would be the priorities to follow. There are times when all these recommendations are not enough and the athlete resorts to the consumption of supplements in order to:

- Improve body composition.
- Promote adaptation to training.
- Increase the energy contribution.
- Allow better recovery after work sessions.
- Delay the onset of fatigue during training / competition.
- Be practical in providing nutrients ahead of availability difficulties.

The problem usually lies in that not everyone knows the product they are taking, and they are not supervised by suitable health professionals.

Using a nutritional supplement can provide a differential advantage as long as its use makes any sense. Within the comprehensive development of the athlete and in the search for a specific goal (timely recovery, improvement in body composition, etc.), the decision to incorporate a nutritional supplement into the diet of an athlete should be a response to cover issues such as those that we can see in the following drawing:

DECISION-MAKING PYRAMID FOR A CORRECT FOOD MODEL



Adapted from E. Helms.

Whoever prescribes or decides to take a nutritional supplement must be sure that the term “supplement” refers to solving a deficit or situation, based on a correct dietary model. For its use, an individual and complete nutritional assessment of each athlete and the correct prescription by a health professional is recommended. There are multiple variables that may be evaluated (type of sport, objective, time of season, anti-doping regulations, etc.).

Several of these products may be supported by scientific evidence as effective and safe, but others are clearly ineffective or even harmful. Supplements must be of maximum safety and quality, and of course, exempt from any substance prohibited in

sports. There is always a risk of "unintentional doping", since not following the guidelines of a safe nutritional prescription can lead to the use of some supplements that contain prohibited substances. Doping substances may be masked on the labels with another name allowed by the legislation of the World Anti-Doping Agency (WADA), and their derivatives may be the causal agent of positive doping (e.g. some herbaceous plants). The regulation of dietary supplements depends on the legislation of each country, which is why the laboratory control of these products is not the same in all parts of the world. Some make supplements that do not contain the effective dose of each ingredient that their labeling proposes or that contain a higher level of impurities than allowed. Healthcare professionals should check that the substances on the label are not included in the WADA list of prohibited substances and methods. There are some mobile apps or websites dedicated to assessing the purity and reliability of supplements (ASADA mobile app, NSF Certified for Sport or Informed-Choice).

There is a lot of information available through social networks and different communication platforms, but at the same time it can be dangerous what one can review without professional judgment. For this reason, WADA provides an online training platform against doping (www.adel.wada-ama.org) and offers access to all topics related to their fight for clean sport.

It is not recommended that the athlete consult with their coach or physical trainer about the consumption of these substances and if so, it is the athlete's total responsibility to decide on their use.

It is also recommended that the athlete can keep the purchase invoice and a sealed container of the same batch of the product to be consumed. Given an adverse analytical finding, it could be verified that the consumed product contained the substance indicated on the label (if it is sealed, and its purchase is legal). These measures, if the taking of the supplement determines an adverse anti-doping result, does not exempt the athlete from his responsibility, but could eventually lead to a reduction in the sanction.

The World Anti-Doping Agency advises: "If you are not sure of the content of a product, do not take it. Ignorance is never an excuse ... As you will be objectively responsible for the consequences of a positive test caused by a mislabeled supplement, the best advice is to avoid taking the supplement if you have any doubts about what it may contain".

GENERAL CONSIDERATIONS IN A VEGETARIAN ATHLETE

The proliferation of information through social networks, documentaries and other media regarding vegetarian food, based on ethical and environmental considerations, different studies with a good impact on health, added to the individual subjectivity of each athlete in improving performance by varying their diet, has directed many athletes to change their consumption pattern. Considering that the nutrition of an athlete has different needs and adequate supplementation, nutritional needs can be satisfactorily covered. In any case, it is important to note that the variability in dietary preferences, the eating patterns of each subject and the intensity / volume of the exercise to be carried out, leads to the fact that some vegetarian athletes consume suboptimal amounts of Kcal and certain "critical" nutrients such as: proteins, omega-3 fatty acids, calcium, vitamin D, iron, zinc, iodine and vitamin B-12. In parallel, it is common to find a consumption of carbohydrates, fiber, micronutrients, phytochemicals, and antioxidants above the average. Since there are several types of vegetarian diets, exposure to different nutrients may vary. For example, it could be expected that a lacto-ovo-vegetarian diet (excludes all kinds of meat) can provide a better amount of protein, calcium and phosphorus than a vegan diet (excludes all kinds of animal products).

In previous sections we reviewed issues that have to do with the amount and time of protein intake and its direct relationship with the repair and recovery process along with the adaptive response to exercise. Although the selection of foods regarding protein quality is important in all athletes, it is considered decisive in this type of diet.

VEGETABLE PROTEIN-RICH FOODS

FOODS	PROTEIN IN 100 GR
Textured soy	48
Pumpkin seeds (dried, uncooked)	30,2
Peanut	26,5
Wheat Germ	26
Lentils (red, split, uncooked)	24,6
Black beans (uncooked)	21,6
Almonds	21,2
Chickpeas	20,4
Tempeh	20,3
Tofu	17,3
Rolled oats	16,9
Quinoa (uncooked)	14,1

(*) USDA Food Chemical Composition.

The main differentiation in the omnivorous athlete compared to the vegetarian is focused on protein consumption. They are made up of 20 amino acids (AA) of which 9 of them are considered essential (EAA), since they cannot be synthesized by our body and must be incorporated into the diet. Because they lack EAA in its chemical composition or present EAA levels below optimal (according to the FAO 2007 recommendation), plant proteins are considered "incomplete"; at the same time they present a series of factors that alter their digestibility (antitrypsin, fiber, tannins). However, a vegan diet may supply all EAAs if the food variety is correct. Example: Consume high-quality Whole Food Plant-Based (WFPB) proteins (soy, tofu, tempeh, textured vegetable protein) and other protein sources with complementary EAA profiles, such as beans on toast, lentils and rice, beans and potatoes, muesli with oats, nuts and seeds. The combination of foods from any of these two categories guarantees an adequate intake of all EAAs.

Another determining issue to consider in this type of diet is to contemplate the consumption of certain potentially deficient nutrients such as:

IRON

It is perhaps the most important trace element related to physical performance given the multiple functions that this nutrient performs, among which those related to the transport and storage of oxygen (being a constituent of myoglobin and hemoglobin) stand out. A nutritional deficit of this mineral and its subsequent impact on the levels of red blood cells will lead to a decrease in sports performance.

The bioavailability of iron in plant foods, its reserves, and the absorption of non-heme iron versus heme iron is the major drawback for vegetarian athletes (especially women of childbearing age). In some instances, the total consumption of iron is even higher than that of an omnivorous diet, but certain inhibitors such as phytates and fiber (abundant in plant foods) reduce its absorption. An adequate soaking of cereals and legumes (decrease the presence of some inhibitors) and the incorporation of a food source of vitamin C (about 25 to 75 mg) together with a food rich in iron, are two common practices that help to considerably improve the absorption of this mineral.

Beyond the probable deficit that can be foreseen, the consumption of iron supplements should not be carried out without a correct assessment of its state since excessive intake can interfere with the absorption of other minerals and lead to excess reserves in people at risk of hemochromatosis. It is common for vegetarian / vegan athletes to have a lower reserve (low ferritin), which is why it is prudent to dose it biochemically and adjust it if required.

B12 VITAMIN

It is essential for the proper function of the nervous system and the metabolism of homocysteine. In terms of sports performance, B12 deficiency is associated with reduced oxygen transport, and therefore impaired aerobic performance. Its deficiency can develop slowly in individuals who follow a vegan diet since it is found exclusively in foods of animal origin. Although the consumption of fortified foods is recommended, supplementation with this vitamin (about 2000 ug/week), contributes to the solution of the problem that this nutrient presents in vegan athletes.

SOURCES OF CRITICAL NUTRIENTS IN VEGETARIAN FOOD

CALCIUM

Chinese cabbage, kale, broccoli, cauliflower, sesame, poppy seed

IRON

Beans, peas, lentils, edamame, walnuts, quinoa, pistachios

OMEGA 3

Nuts, flax, chia, hemp, microalgae oil

VIT D

Fruit juices or fortified milk, fermented soy supplements

ZINC

Beans, peas, lentils, nuts, seeds, oats, wheat germ

VIT B 12

Milks, yogurts, cheeses and fortified foods. Always consider your supplemention

CALCIUM AND VITAMIN D

Calcium plays an important role in maintaining strong bones and teeth. It is also involved in muscle contractility and transmission of the nerve impulse. The consumption of fortified vegetable sources, added to an adequate selection of source foods, would allow maintaining the balance of the mineral.

Food sources can be grouped according to calcium bioavailability:

- **High (> 50 %):** Chinese cabbage, broccoli, cauliflower, turnip greens, textured vegetable protein, black molasses.
- **Average (~ 30 %):** Milk, yogurt, cheese, tofu, fortified orange juice (with calcium citrate malate).
- **Low:** Fortified soy milk, nuts, seeds, legumes, fortified orange juice (with tricalcium phosphate / calcium lactate).

Regarding vitamin D (which is vital in the absorption of calcium), although vegans have an additional risk due to a lower intake of food sources, the factor to consider par excellence is sun exposure. Players are encouraged to train outdoors during times where sunlight is optimal and with sports equipment that does not totally restrict sunlight (to be considered mostly by goalkeepers because of their clothing).

ZINC

Low zinc levels can negatively affect physical performance, muscle strength, and endurance through its effect on thyroid hormone levels, basal metabolic rate, and protein use.

As with iron, the drawback of this mineral lies in its bioavailability and the different factors involved in its absorption. For example, a common “incorrect” practice is to consume dried pulses with the water from the previous soaking. We must consider that the content of phytates present in the soaking water considerably limits the absorption of the mineral, being its main inhibitor. On the other hand, acids such as citric, malic and lactic contribute to its correct absorption.

OMEGA 3

Omega 3 fatty acids are polyunsaturated fatty acids found in three main forms in food: eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and alpha linolenic acid (ALA). A major source of DHA and EPA for vegetarians is seaweed. As for the ALA form, it can be found in some vegetable oils, chia, walnuts, and flax. As they are essential fatty acids that the body does not synthesize and must be ingested through food, their consumption becomes relevant. Vegans have lower levels of serum n-3 fatty acids than omnivores for not consuming seafood. This could have important health and performance implications since n-3 fatty acids play an important role in cardiovascular health, inflammatory diseases, and immunity.

In this scenario, microalgae oil could be a useful supplement for vegans since it has been shown to increase the levels of EPA and DHA in the blood. Currently, recommendations of 1 to 2 g of EPA and DHA combined in a 2:1 ratio are suggested for athletes. To achieve a DHA dose of 500 to 1000 mg a day this would be equivalent to 1 to 2 g of microalgae oil (or about 2-3 capsules in most commercial products).

EXAMPLE OF DISTRIBUTION OF A VEGAN DIET OF 3000 KCAL APPROX.

BREAKFAST	SNACK	DESSERT
Tofu stir fried, pumpkin seed rawmesan on avocado and tomato toast 120 gr tofu Rawmesan (1 tablespoon) Chia oil (1 dessert spoon) Whole grain bread (3 slices) Avocado (1/2 unit) 1 Orange 2 microalgae oil capsules or krill	**Almond milk with cereals and fruits** 200 ml almond and coconut milk Puffed quinoa with carob (30 gr) Apple (1/2 unit) Blueberry raisins (1 handful) Peas protein (1 scoop) Cinnamon Vanilla	**Forest fruits with grated chocolate and honey** 150 gr blueberry, raspberries, mulberry Honey (1 tablespoon) Cacao 80% or more (10 gr) Chia flour (1 tablespoon) Ground flax (1 tablespoon)

LUNCH	DINNER
Barely risotto with seitan curry 80 gr seitan 1 cup of hydrated barley Red onion (small unit) White cabbage (1 cup) Green pepper (1/2 unit) Olive oil (2 tablespoons) Curry (1 dessert spoon)	**Legume noodles with fileto sauce** 150 gr legume noodles Tomato sauce: 1 garlic clove Onion (small unit) Spinach (70 gr) Olive oil (1 scoop) Cheesy nutritional yeast (1 tablespoon)

OTHER CONSIDERATIONS...

Creatine is an organic nitrogenous acid synthesized endogenously from arginine, glycine and methionine, whose properties to improve performance are evidenced in the scientific literature greatly (especially in high intensity short-term exercises, muscle hypertrophy and maximum strength). As the source foods are exclusively from animals (such as red meat, fish, and poultry), vegetarian athletes may find their muscle reserve reduced. Contemplating that several studies indicate that supplementation could be more beneficial in athletes with low pre-existing muscle creatine reserves, we should consider its use in elite vegetarian athletes. It is estimated that with a protocol that provides a dose of synthetic creatine powder of 3 to 5 g/day over a period of 4 weeks, they would achieve optimal muscle creatine stages.

Something similar occurs with Beta-Alanine since red meat and poultry are its main sources and therefore vegetarian athletes have lower levels of muscle carnosine compared to omnivores. In relation to this problem, supplementation with Beta-Alanine in vegetarian athletes has been gaining popularity (especially in those who perform high intensity exercises), since its functions related to muscle contractility, the improvement of calcium sensitivity in muscle fibers and pH regulation contribute to improved sports performance.

REFERENCES

Aragon AA (2017). International society of sports nutrition position stand: diets and body composition. J Int Soc Sports Nutr. Jun 14;14:16.

Burke L.M., Hawley J.A., Wong S.H., Jeukendrup A.E. (2011). Carbohydrates for training and competition. Journal of Sports Sciences. 29(Suppl 1):S17–27.

Cermak N.M., van Loon L.J. (2013). The use of carbohydrates during exercise as an ergogenic aid. Sports Medicine. 43(11):1139–1155.

De Souza M, Nattiv A, Joy E, Misra M, Williams N, Mallinson R, et al (2014). Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad. Br J Sports Med. 48(4): p. 289.

Deakin V., Kerr D., Boushey C. (2015). Measuring nutritional status of athletes: clinical and research perspectives. In: Burke L, Deakin V, eds. Clinical Sports Nutrition. 5th eds. North Ryde, Australia: McGraw-Hill;27–53

Holway F. (2011). Sport-specific nutrition: Practical strategies for team sports. Journal of Sports Sciences 29 Suppl 1 (sup1):S115-25.

Hudson, J.L.; III, R.E.B.; Campbell, W.W. (2020) Protein Distribution and Muscle-Related Outcomes: Does the Evidence Support the Concept? Nutrients 2020, 12, 1441.

Jäger R (2017). International Society of Sports Nutrition Position Stand: protein and exercise. J Int Soc Sports Nutr. Jun 20;14:20.

Jeukendrup A (2014). A Step Towards Personalized Sports NutriEon: Carbohydrate Intake During Exercise. Sports Med.

Jeukendrup A., Carter J., Maughan R.J. (2015). Competition fluid and fuel. In: Burke L., Deakin V., eds. Clinical Sports Nutrition. 5th ed. North Ryde NSW, Australia: McGraw-Hill Australia Pty Ltd:377–419.

Kerksick CM (2017). International society of sports nutrition position stand: nutrient timing. J Int Soc Sports Nutr. Aug 29;14:33.

Larson-Meyer, D. (2018). Vegetarian and Vegan diets for athletic training and performance. Sports Science Exchange, Vol. 29 No. 188, 1-7.

Loucks A.B. (2013). Energy balance and energy availability. In: Maughan RJ, ed. Sports Nutrition, The Encyclopaedia of Sports Medicine, an IOC Medical Commission Publication. West Sussex, UK: John Wiley & Sons, Ltd.:72–87.

Maughan R and cols (2018). IOC consensus statement: dietary supplements and the high-performance athlete. Int J Sport Nutr Exerc Metab. Mar 1;28(2):104-125.

Mountjoy M, Sundgot-Borgen J, Burke L, Ackerman K, Constantini N, Lebrun C, et al. (2018). IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update. Br J Sports Med. 52: p. 687-97.

Nana A (2016). Importance of Standardized DXA Protocol for Assessing Physique Changes in Athletes. Int J Sport Nutr Exerc Metab. Jun;26(3):259-67.

Phillips S.M., Van Loon L.J. (2011). Dietary protein for athletes: from requirements to optimum adaptation. Journal of Sports Sciences. 29 (Suppl 1) :S29–38.

Rogerson D (2017). Vegan diets: practical advice for athletes and exercisers. Journal of the International Society of Sports Nutrition. Sep 13;14:36.

Sawka M.N., Burke L.M., et al. (2007). American College of Sports Medicine position stand. Exercise and fluid replacement. Medicine and Science in Sports and Exercise. 39(2):377–390.

Stellingwerff T, Morton J, Burke LM. (2019). A Framework for Periodized Nutrition for Athletics. Int J Sport Nutr Exerc Metab. Mar 1;29(2):141-15.

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