Tina Tadić1 and Irzada Taljić[1]

DIET AS A SIGNIFICANT SEGMENT IN THE SUCCESS OF A TRIATHLON ATHLETE PARTICIPATING IN THE PROJECT: HUMANITY AS A FORGOTTEN OLYMPIC DISCIPLINE

[1]Faculty of Agriculture and Food Sciences, University of Sarajevo, BiH

Correspondence to
Irzada TALJIĆ,
Faculty of Agriculture and Food Sciences, University of Sarajevo, Bosnia and Herzegovina
i.taljic@ppf.unsa.ba

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ABSTRACT

This work is part of the project “Humanity as a Forgotten Olympic Discipline” which represents a humanitarian expedition where an athlete will be enduring 13 days of a triathlon starting at the Faculty of Agriculture and Food Sciences, University of Sarajevo, Bosnia and Herzegovina, and finishing at the top of the Olympus Mountain in Greece.

The primary goal of this project was to collect financial resources for the purpose of treating patients with cancer. Through his actions, the triathlon athlete faced extreme challenges which symbolically represent a battle full of ups and downs which these patients are fighting each day. A triathlon is a sport that requires skills, effort, endurance and motivation. It combines three sports disciplines: running, cycling, and swimming. The athlete was engaged in these disciplines during his venture to the Olympus Mountain. Most important aspect of this humanitarian expedition was the power of will. The will to succeed equals the will to get well. In these extreme circumstances, the athlete had support from his team: project coordinator, Doctor of Medicine, nutritionist, mountain climbing expert and photographer.

Due to daily exhausting physical activity, the role of nutritionist played a significant part in his endeavor. Hence, the dietary plan was adapted to the conditions of staying in camper vans and facing unexpected challenges.

Used methods were: Anthropometry (height, weight, BMI); instrument based on bioelectrical impedance method (BIA); software Program Prehrane 5.0; creating a dietary plan for 11 days including food preferences, energy needs and endurance parameters. Expected outcome refers to meeting the nutritional needs of the athlete with the aim of maintaining endurance and energy.

Keywords: humanity, triathlon, dietary plan, endurance, macronutrients

INTRODUCTION

According to data stated by the USA triathlon (USA triathlon, 2006), the first triathlon was held on Mission Bay in San Diego on September 25, 1974. and consisted of 6 miles of running, 5 miles of cycling, and 500 yards of swimming (Strock et al., 2006). Endurance sports are becoming increasingly popular and more people are running half marathons, marathons, ultramarathons, half Ironmen, and even Ironman competitions, lasting anywhere between 2 hours and 17 hours

(Saris et al., 2003). Preciously, triathlon is multidisciplined activity which comprises three sports of swimming, cycling and running (Burns et al., 2003) and competitions last between 1 hour 50 minutes (Olympic distances), and 14 hours (Ironman distances). Independent of the distance, dehydration and carbohydrate depletion (CHO) are the most likely causes of fatigue in triathlons, where gastrointestinal (GI) problems, hyperthermia and hyponatremia are potentially health threatening, especially in events of longer duration (Jeukendrup et al., 2005). Fatigue during prolonged exercise is often associated with glycogen depletion (Bergström et al., 1967; Hultman, 1967) and reduced blood glucose concentrations (Coyle et al., 1986) and, therefore, high pre- exercise muscle and liver glycogen concentrations are believed to be essential for optimal performance (Jeukendrup et al., 2005). In addition, Noakes (Noakes, 2000) suggested that it is unlikely that muscle glycogen depletion "alone" limits prolonged exercise performance. Using a stimulated Ironman triathlon model, Noakes predicted that after 4.5 hours of cycling at an estimated exercise intensity of 71% maximum oxygen consumption (VO2max), an elite male Ironman triathlete would have almost completely depleted his or CHO stores. Interestingly, after the completion of the 180 km cycle, elite triathletes are able to run at the speed of 16 km/h for another 160 minutes, which represents an exercise intensity of >66% VO2max (Jeukendrup et al., 2005). Considering the afore mentioned results, this review focuses on the athlete's dietary needs, while facing physically intense endurance in particular circumstances.

Understanding that the "endurance triathlon", or Ironman triathlon, is a 3-sport event consisting of a 3.8km swim and a 180 km cycle, followed by a 42.2 km marathon run with a duration longer than 4 hours, it can and be considered as "ultraendurance" (Kreider, 199; Hawley et al., 1995). Therefore, a more appropriate name for the race may be an "ultraendurance triathlon" (UET) (Laursen et al., 2001). Referring to that, the project "Humanity as a forgotten Olympic discipline" could be also considered as a "ultraendurance" triathlon in addition of 13- day long endeavor from Sarajevo (BA) to Olympus Mountain (GRE). Due to the mentioned expedition, the athlete's diet played role in fulfilling his energy needs to accomplish the project successfully.

Evaluation of Boston Marathon finishers, dating all way back to 1920s, the data showed that those with higher blood glucose levels postmarathon, from prerace glucose loading and race fueling, tended to perform far better at finish (Gordon et al., 1925). CHO was and still is the primary energy source for endurance athletes including triathletes because of its importance as a fuel for muscle and central nervous system (CNS) functioning during moderate- to high-intensity endurance exercises (Jeukendrup, 2013). The ergogenic effects of exogenous CHO consumption during exercises are related to the sparing of skeletal muscle glycogen, prevention of liver glycogen depletion and the subsequent onset of hypoglycemia and/or facilitating high rates of CHO oxidation to fuel moderate- to higher-intensity exercise (Cermak et al., 2013). Recommended CHO intake during endurance exercises is based on event duration (Getzin et al., 2017). For exercise lasting between 1 and 2.5 h, 30 to 60 g of CHO per hour has been found to provide adequate exogenous CHO to spare glycogen (Bartlett et al., 2015; Burke et al., 2013; Thomas et al., 2016). For longer duration exercise/competition (>2.5 to 3 h), consuming amounts of CHO up to about 90 g per hour has been associated with better race times (Pfeiffer et al., 2012).

Body composition analysis procedures that are carried out today using different methods, are based on a simple two- component (distinguish the proportion of fat and lean mass in the total body mass), three-component (distinguish the proportion of water, fat and lean mass) and four- component (distinguish the proportion of water, bone minerals, proteins and fat) model (Mišigoj- Duraković et al., 2014).

The human body generally consists of lean and fat mass. Lean mass is heterogeneous and extremely metabolically active considering that it includes muscle and bone mass, extracellular water, nervous tissue, various organs and all cells except adipocytes (Willet, 2013). Fat mass is metabolically inactive, however, it plays an important role in hormone metabolism and adiponectin levels. It is divided into essential or tissue and non- essential or storage fat. Essential fat is found in a cell's membranes and is mostly made up of phospholipids and cholesterol (Mandić, 2007).

The most popular and common methods for assessing body composition are those that are relatively inexpensive and provide relatively reliable results, based on a two- component model of body composition such as that obtained using bioelectrical impedance (BIA). Apart from the mentioned methods, there are other, more technologically advanced methods based on multi- component body composition models. Some of them are nuclear magnetic resonance, computed tomography, dual-energy X- ray absorptiometry (DEXA), ultrasound methods, etc. (Duren et al., 2008).

BIA, as already mentioned, is a popular method of body composition analysis. It is a reliable, non - invasive method that is widely available. It works on the principle of passing a weak electric current signal through the body, where the voltage drop between two electrodes is proportional to the volume of water in that area of the body. The resistances of different tissues are standardized from previous laboratory measurements where muscle tissue contains a large proportion of water and therefore serves as an electrical conductor, while fat tissue contains a small proportion of water and therefore acts as a resistor to the flow of electrical signals (Mišigoj- Duraković et al., 2014). BIA is a very suitable method for epidemiologic research because of its ease of use, low cost, and minimal effort from the subject (Lee et al., 2008).

METHODS

Participants and procedure

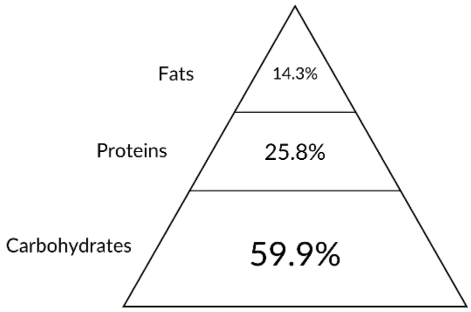
With the aim of establishing an optimal CHO fuel along with other macronutrients, the main focus of the athlete's dietary plan was to provide a suitable amount of it in order to fulfill energy needs for daily physical activity. Although we succeed to meet these requirements, we had to take into consideration the most convenient time interval for nutrient consumption and energy loading. Practical considerations unique to triathlon competition include the lack of opportunity for fueling during swimming. The cycling portion of the triathlon is the most conducive time for CHO ingestion and provides an opportunity for CHO and fluid intake in preparation for the running part (Getzin et al., 2017). The concept of the dietary plan was conducted into 3 main meals and 1 side dish. Hence, the breakfast was separated into 2 meals for the purpose of meeting adequate nutritional requirements. As a result of this dietary plan, the athlete had an early morning meal which was 2 hours before the 20 km of running, followed by prerace CHO ingestion 60 min or 30 min before the mentioned physical activity. Furthermore, the second meal intended to fulfill breakfast requirements, was in the time interval between the running and cycling distances. Moreover, the other meals were consumed after the physical activities for each day have been finished, along with the main focus on the athlete's recovery by an imminent nutrient intake. Nonetheless, the athlete had the opportunity to ingest additional calories from CHO fueling such as sports drinks, protein gels or protein bars during the running, cycling and swimming parts.
Prior to preparing the athlete for the enormous intensity of physical activities which he was supposed to face during this 13-days long expedition, we conducted several methods. Firstly, we measured the athlete's weight and height, which amounts to 100 kg of weight and 206 cm of height. After that, other anthropometric parameters were taken referring to the calculation of his body mass index (BMI) which resulted 23.6 kg2. Observing established range of BMI values according to the WHO for adults, where a threshold value of 25.0 kg/m2 indicates increased body mass, and a value of 30.0 kg/m2 obesity (WHO, 2000), we concluded that the athlete has a normal ratio of weight and height. Subsequently, we approached to athlete with bioelectrical impedance analysis (BIA) in order to determine the athlete's body composition by using small electrodes.
Except BIA, we used a questionnaire as a method for getting reliable data in order to question athlete's usual dietary habits and to evaluate his mental health status. Considering the inevitable difficulties during pro-longed period of this endeavor, possible complications such as dehydration and CHO depletion, we questioned the athlete's previous food preferences in order to get comprehensive picture of his nutritional status for the purpose of making the most eligible dietary plan adapted to staying in camper vans and facing unexpected challenges. Although last minute project-plan changes meant that instead of sleeping in camper vans, the team would sleep in the apartments, the pace and everyday changing locations mean that the dietary plan was still applicable.
Furthermore, the dietary plan was conceived through the software Program Prehrane 5.0. Additionally, the main focus was creating a dietary plan for 11 days including food preferences, energy needs and endurance parameters which will contribute to the successful accomplishment of the project. Considering that the athlete has spent last two days of this expedition in the mountain, those were determined as a dietary choice. Moreover, we wanted to obtain a balanced intake of nutrients despite the possible complications such as the impossibility to provide necessary nutrients in particular circumstances.

RESULTS and DISSCUSSION

In summary, this review highlights the importance of nutrition in every segment of a physically active cycle. This implies on the different stages of the training process such as pre-competition, race day and post-competition energy requirements. Precisely, it is important to ingest a proper amount of nutrients in the recovery phase. In order to provide sufficient nutrients to the body with the aim of establishing optimal glycogen reserves, we conducted a dietary plan where we wanted to accomplish adequate CHO fueling due to the resting phase. Based on the mentioned, the athlete's 2nd meal which refers to the lunch meal was consider to be the most meaningful.
The dietary plan was adapted for 11 days of regular meals including 3 main meals and 1 side dish as mentioned previously, where the tremendous effort was put into the accomplishment of the macronutrient balance, along with the main focus of CHO intake in order to provide maximum energy capacity for the endurance distances. After the 11th day of dietary plan, remaining 2 days of the project, were adapted to the climbing of Mount Olympus and staying in tents.

Regarding to the athlete's body composition and energy requirements, we created the dietary plan which contained approximately 4000-4500 kcal per day. As we considered breakfast to be the most important for providing energy, the athlete needed to ingest approximately 1700 kcal, which we divided it into two meals: pre running and post running meal. As mentioned before, we put the focus on CHO ingestion in order to provide sufficient energy from whole grain groceries with the aim of keeping blood sugar in balance.

Figure 1. Breakfast consumption

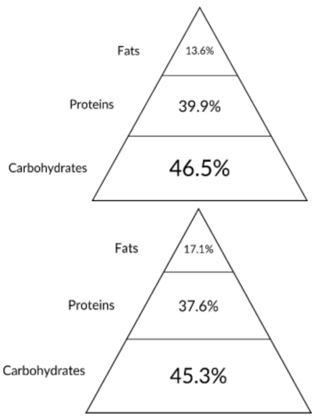


Additionally, the meal after the cycling phase was intended to be a way to obtain energy and provide proper recovery. We hypothesized the athlete's requirements for fast energy during cycling parts. Based on that, he consumed natural sugary components of fruits such as glucose and fructose, and the second alternative was fast energy-releasing sport drinks, protein gels or protein bars.

The athlete consumed various types of grains such as rice, sweet potatoes, potatoes, whole grains pasta, etc., in a combination with protein, which was equally presented from animal and plant sources. Lunch meal was recommended to be consumed after the accomplishment of daily physical activities.

Nonetheless the recovery phase, we continued with CHO fueling in the dinner meal in order to meet athlete's requirements for additional energy

Figure 2 and 3. Lunch and dinner consumption

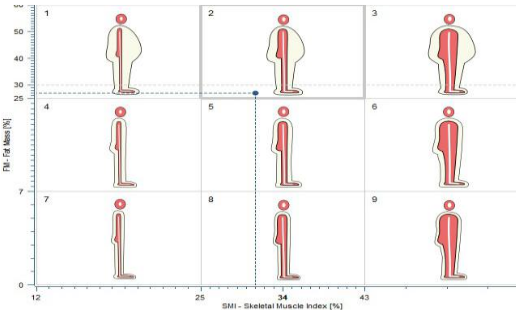


It is acknowledged that as reduced blood glucose concentrations (Hultman, 1967) and glycogen depletion (Coyle et al., 1986) during endurance exercises have been associated with fatigue, it is important for a triathlete to start such an event with high muscle and liver glycogen reserves (Robins, 2007). Glycogen reserves can be partially depleted following an overnight fast, making it important for the triathlete to replenish these reserves prior to a race. Some athletes do not tolerate CHO and fluid consumption during races, so the prerace meal may be the last opportunity to consume CHO without concern over ill effects during the race, such as gastrointestinal distress. During an Ironman triathlon, endogenous fuel reserves were estimated to supply over half of the energy expended (Kimber et al., 2002), providing further support for CHO-loading to maximize endogenous fuel reserves (Robins, 2007). CHO intake will increase blood glucose concentrations and augment CHO oxidation during endurance exercise (Coyle et al., 1986). Kimber et al., 2002 found that the average CHO intake (94% total energy intake) during an Ironman distance triathlon was 1.0 g/kg BW/h in females and 1.1 g/kg BW/h in males, which was sufficient to support the previously proposed maximum rate of CHO utilization of 1.0 g × kg-1 × h-1 (Hawley et al., 1992). Kimber et al., 2002 found that this level of CHO consumption (1–1.1 g/kg BW/h) was achieved by consuming large amounts (∼1.5 g/kg BW/h) during the cycling phase of the race, approximately three times as high as that consumed during the marathon run. Considering the above mentioned, the athlete had energy requirements for CHO fueling during the running phase instead of usual cycling phase requirements. Additionally, his lower extremities were trembling after the 10 km running distance since he felt fatigue and needed to ingest fast energy releasing source of food.

As a result of our specific dietary plan, we can agree with Thomas et al., 2016 who stated that nutrition plans need to be personalized to the individual athlete to take into account the specificity and uniqueness of the event, performance goals, practical challenges, food preferences, and responses to various strategies. Some nutrients (eg, energy, CHO, and protein) should be expressed using guidelines per kg of body mass to allow recommendations to be scaled to the large range in the body sizes of athletes. Sports nutrition guidelines should also consider the importance of the timing of nutrient intake and nutritional support over the day and in relation to sport rather than general daily targets.

The data implicated that the athlete has normal body composition parameters related to total body water (TBW= 52%), extracellular water (ECW=39%), intracellular water (ICW= 61%), along with body metabolic rate (BMR) which resulted 1943 (kcal/day). Based on the BIA, the athlete has 27% of fat mass and 31% of skeletal muscle, which can be seen in the attached figure of fat mass analysis. According to presented results of BIA, the ideal body weight for the athlete is 91.1 kg (min 88.8 kg, max 93.4 kg), which indicates that he is overweight.

Figure 4. Skeletal Muscle Index- Fat Mass Analysis



CONCLUSION

Overall, we considered the athlete's previous food preferences and usual training cycle in order to adapt for an enormous intensity along with the purpose of maintaining an energy balance after the peak performance due to the 13 days of continuous physical activity. Moreover, we have used the guidelines per kg body mass for CHO and protein, although as mentioned, the athlete had opportunity to ingest additional calories considering the uniqueness of this event. In conclusion, the dietary plan was successfully developed for this challenge, in order to provide sufficient nutrients and to be adaptable considering the circumstances of this project. Finally, the dietary plan was successfully conducted throughout the marathon, enabling the athlete to use the most out of his physical potential.

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Conflict of Interest

The authors do not have any conflicts of interest to disclose. All co-authors have reviewed and concurred with the manuscript's content, and no financial interests need to be reported.