

Promotion of Extra Virgin Olive Oil as an ergogenic aid for athletes

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Summary

Extra virgin olive oil (EVOO) is one of the healthiest and most natural fats that we can provide to our body. EVOO is one of the main foods in the Mediterranean diet, and therefore, its consumption is scientifically recommended, since a multitude of benefits are attributed to it, such as; greater longevity, lower risk of cardiovascular disease, cancer and even cognitive decline. But in addition to these benefits, its direct relationship with sports performance is increasingly being demonstrated thanks to its components, monounsaturated and polyunsaturated fatty acids, and vitamins. The objective of this work is to promote EVOO in athletes as an ergogenic aid, to increase its consumption to be the main additive fat in the athlete's diet and observe the direct relationship with sports performance.

The method used is a bibliographic search to know the relationship and effects of EVOO on sports performance and to highlight its great anti-inflammatory and antioxidant capacity, together with an experimental study in runners.

In conclusion, the effects of consuming EVOO are considered an ergogenic aid in athletes, more specifically for runners, and its direct relationship with performance means that its consumption must be promoted so that everyone can benefit from the golden fat.

Key words:

Extra virgin olive oil.
Sports performance.
Ergogenic aid. Athletes.

Promoción del AOVE como ayuda ergogénica en el deportista

Resumen

El aceite de oliva virgen extra (AOVE) es una de las grasas más saludables y naturales que podemos aportar a nuestro organismo. El AOVE es uno de los principales alimentos de la dieta mediterránea, y por tanto, su consumo está recomendado científicamente, ya que, se le atribuyen multitud de beneficios, como por ejemplo; mayor longevidad, menor riesgo de sufrir enfermedades cardiovasculares, cáncer e incluso deterioro cognitivo. Pero además de estos beneficios, se está demostrando cada vez más su relación directa con el rendimiento deportivo gracias a sus componentes: ácidos grasos monoinsaturados, poliinsaturados, vitaminas. El objetivo de este trabajo es promocionar el AOVE en deportistas como una ayuda ergogénica, para aumentar su consumo para siendo la principal grasa de adicción en la dieta del deportista y observar la relación directa con el rendimiento deportivo.

El método utilizado es una búsqueda bibliográfica para conocer la relación y los efectos del AOVE en rendimiento deportivo y poder destacar su gran capacidad antiinflamatoria y antioxidante, junto con un estudio experimental en corredores.

En conclusión, los efectos del consumo de AOVE son considerados como una ayuda ergogénica en los deportistas, más concretamente para los corredores, y su relación directa con el rendimiento hace que se deba promover su consumo para que todos puedan beneficiarse de la grasa dorada.

Palabras clave:

Aceite de oliva virgen extra.
Rendimiento deportivo.
Ayuda ergogénica. Deportistas.

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Introduction

Our body needs nutrients to stay healthy. Each of these nutrients is obtained from different foods and each of them gives our body a function.

Extra virgin olive oil (EVOO), also known as “liquid gold”, is a healthy fat¹. It is obtained exclusively from olives, the fruit of the olive tree (*Olea europea*). According to the International Olive Council (IOC)², EVOO has a high percentage of oleic acid, vitamin E and phytosterols which is obtained through mechanical processes in the first cold pressing, meaning that the product does not lose any of its properties despite being a processed product. It also contains a high percentage of monounsaturated fatty acids, polyunsaturated fatty acids and phenolic compounds, whose antioxidant capacity is significant³.

We have to be aware these days of the importance of nutrition and have to consume natural foods to maintain a healthy, varied and balanced diet. According to De Pablo *et al.*⁴, olive oil is a product of great importance and enormous biological value which also has protective and immune properties when ingested regularly. We should promote the consumption of products that are beneficial for our development and EVOO is one.

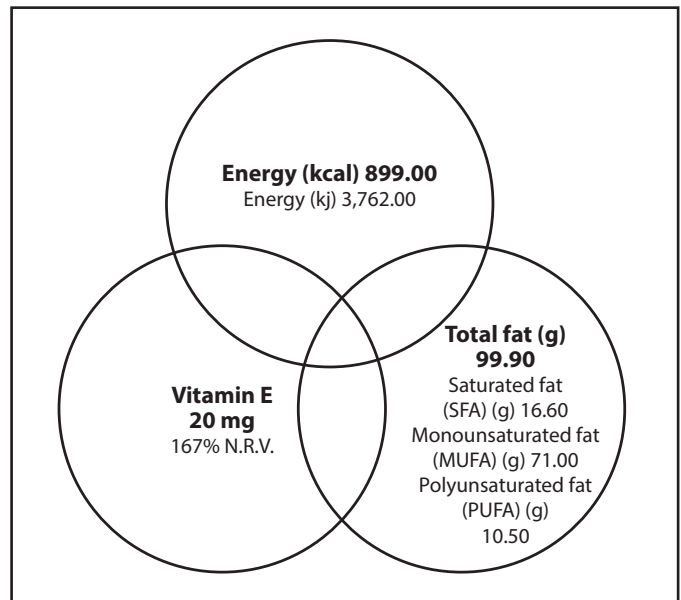
Numerous studies show how the intake of EVOO is beneficial in the prevention and/or reduction of certain health problems, such as: hypercholesterolaemia, atherosclerosis, hypertension, obesity, type 2 diabetes, oxidative stress, inflammatory conditions, cardiovascular diseases and cancer^{5,6}, and we should, therefore, bring it into our diet and/or increase its intake, thus avoiding the consumption of other more harmful and less nutritious fats.

The Mediterranean diet (MedDiet) is considered one of the diets with the most scientific evidence behind it⁷. The MedDiet is a healthy eating model which uses extra virgin olive oil as its main component⁸. In their study, Ros *et al.* indicate that the scientific community is increasingly interested in studying its preventive and anti-degenerative capacity to treat various pathologies associated with chronic inflammation, such as metabolic syndrome (MS), diabetes, cardiovascular disease (CVD), neurodegenerative diseases and cancer, among others⁹⁻¹¹.

In recent decades, the number of publications on the subject has grown exponentially, reaching nearly 500 articles in Pubmed in 2014.

Therefore, the Mediterranean diet based on the intake of EVOO¹², together with other healthy foods such as fruit and vegetables, is capable of improving health in the general population. Casas *et al.*, Capó *et al.* and Esquiú *et al.*, among others, study scientific evidence on the consumption of EVOO and performance in athlete¹³⁻¹⁵ although we already know some benefits, such as favouring weight control (it has a satiating effect), protecting our bones and joints, its anti-inflammatory effect and, above all, its vitamin E and polyphenol content with its antioxidant effect, a very important factor for runners. Its consumption could also be very beneficial for this type of athlete because, thanks to its multiple properties, it can help the runner over their sporting life.

Figure 1. Extra virgin olive oil composition.



According to FESNAD (Spanish Federation of Nutrition, Food and Dietetics Associations), the quality of dietary fat has a profound influence on health, and therefore, we should replace saturated fatty acids (SFA) with monounsaturated fatty acids (MFA). The composition of olive oil provides us with 98% monounsaturated fat, as well as vitamin A (carotenes), antioxidants (phenolics and chlorophylls), vitamin E (tocopherols) and sterols (intestinal absorption of cholesterol), among others. By ingesting olive oil, we consume a product with a high vitamin, essential fatty acid and natural antioxidant content which allows athletes to function correctly and energetically. The objective of this paper is: to promote the consumption of EVOO as an ergogenic aid for endurance athletes to improve their performance; more specifically, to identify the nutritional habits of a group of middle-distance runners in terms of EVOO consumption; to observe the performance of middle-distance runners with an EVOO-based diet; and to establish dietary guidelines with increased EVOO consumption to improve performance in a group of runners. Consequently, some of the questions we ask ourselves are:

- How can we use EVOO as a factor for an athlete’s performance?
- What benefits does its consumption bring to the athlete in terms of physical condition?
- What dose of EVOO is needed to improve performance and health in athletes?
- How can we promote its consumption in athletes?

It should be added that EVOO has been proven to have multiple benefits, not only as a nutritional supplement, but as a factor which can enhance an athlete’s performance. Therefore, this study wishes to promote its consumption as an ergogenic aid for middle-distance runners and demonstrate that it helps performance. EVOO is very healthy and

beneficial for endurance athletes and should, therefore, be an essential part of their diets.

Material and method

First, a bibliographic search was carried out using information from books, databases, websites and current papers which included data on olive oil consumption and its relationship with athlete performance.

The databases used were:

- Cuiden Plus. This is a bibliographic database with documents on health care of Ibero-American origin. Access is exclusive to subscribers.
- Pubmed. Database containing biomedical literature from Medline, scientific journals and online books.
- Researchgate. Online social network for users of any science discipline. It has a large database and offers a search function for papers from scientific journals, among other functions.
- MedlinePlus. Database produced by the United States National Library of Medicine. Its information comes from the National Institutes of Health, with journal citations and abstracts of biomedical literature from around the world.
- In addition to these databases, the Google Academic search engine was also used.

A search was carried out in Spanish and English using 3 key terms: *aceite de oliva virgen extra y rendimiento*/Extra virgin olive oil performance; *AOVE y beneficios*/EVOO and benefits; and *aceite de oliva ergogénica*/Olive Oil ergogenic. *AOVE*/EVOO was also combined with *Polifenoles* (polyphenols), *Oleocantal* (Oleocanthal), *Antioxidante* (Antioxidant), *Anti Inflamatorio* (anti-inflammatory), *Deporte y aceite de oliva* (Sport olive oil) and *efectos del aceite de oliva* (effect of olive oil). 135 papers were found. These were systematically reviewed to gather and condense scientific evidence on the consumption of EVOO and its relationship with performance, summarising and evaluating the studies available.

The papers were selected taking into account:

- Search criteria: Evidence on EVOO consumption and performance; Benefits of EVOO consumption in athletes.
- Papers sufficiently homogenous as to be able to perform a quantitative meta-analysis and see and interpret the results obtained in order to arrive at conclusions.
- The inclusion criteria used for the review:
 - Date: from 2015 to the present.
 - Papers which refer to the consumption of EVOO as an ergogenic aid.
 - An intervention group with EVOO and a control group.
 - The subjects should do sport on a regular basis.

The study variables aim to see if there is a relationship between EVOO and performance, and to consider its consumption as an ergogenic aid for athletes. Therefore, this work seeks to demonstrate the relationship between EVOO consumption and performance in order to define adequate consumption to serve as an ergogenic aid for athletes.

Programme or intervention design

This is a cross-sectional, quasi-experimental study. The variables to measure are:

- EVOO consumption.
- Sports performance.

Measuring tools

First, a nutritional survey was conducted on 30 amateur endurance athletes (women and men) of a medium-high level with a weekly diet of their own design to find out their eating habits and see how often they consume fats, olive oil or other types of oils.

When the surveys had been carried out and the information collected, the results were analysed and guidelines were set for the athletes surveyed to change their eating habits and eliminate all type of non-beneficial fats from their diets and change them for extra virgin olive oil as main beneficial, nutritious fat.

With this study, we will help to ensure that the overriding objective of the study can be achieved and that EVOO becomes a very important ergogenic aid to consider in athletes' diets.

Target population

The sample consists of 30 middle-distance runners and trail runners (10 - 21 km) (women and men) and a control group (30 runners).

Inclusion and exclusion criteria

- The inclusion criteria are:
 - Age between 25 and 45 years old.
 - Sports: middle-distance and trail running.
 - Training at least 3 to 4 days a week at advanced amateur level.
 - Having an injury or illness which may interfere with the results.
- The exclusion criteria are:
 - Not old enough.
 - Sport not running or trail running.
 - Not training at least three days a week.
 - Not wanting to participate in the study.
 - Having an injury or illness which may interfere with the results.

The recruitment protocol for the participants will be carried out through a pre-questionnaire where information will be collected on eating habits, training, intensity and EVOO consumption habits with informed consent regarding data protection and collection.

Activities to perform

- The intervention will take place during the month of January 2021.
- The following variables will be measured through the study's own online pre-post intervention questionnaire:
 - Sociodemographic data.
 - Eating habits.
 - Level of physical activity or sport.
- EVOO consumption habits.

- When the results are obtained, an infographic will be designed with information on the benefits of EVOO consumption which will then be given to the athletes in question so that they know about its benefits and how their performance could change if they increase their consumption.
- According to data from the Predimed study, about 40 ml of EVOO (about 37 grams) per day are sufficient in order to obtain benefits from it and balance the amount consumed with the Mediterranean diet. However, we will increase this consumption because this data is for the general population and the energy requirements of runners are higher and all their intake needs are higher in consonance.
- The recommended consumption to see a significant change is 40-50 ml of EVOO a day and they will be required to ingest this amount for 20 days to confirm the short-term effect and be able to observe that its consumption is beneficial and aids athletic performance. The study *Olive Oil Consumption and Cardiovascular Risk in U.S. Adults* by Dr Miguel Angel Martínez (Co-author of the Predimed study) published in the *Journal of the American College of Cardiology* confirms the amount of this product to consume and sets guidelines for its intake as a healthy main addictive fat.
- The EVOO-based diet set for the intervention group will consist of a weekly diet based on the consumption of EVOO as the only main fat.
- This diet will be adapted to the energy and nutritional needs of the runners and, therefore, will also be used as a source of energy. The control group will continue with their usual diet without adding

any food that they do not normally consume. Thanks to the dietary instructions, the consumption of EVOO will be increased and, consequently, it will become the main addictive fat and so the subjects' dietary habits will be modified in terms of fat consumption, with EVOO being the only fat they use.

- Subsequently, a post-test of EVOO consumption with new items will be carried out to collect information again in order to analyse and assess the results of the period of recommendations and intake of EVOO as main fat.
- Finally, the runners' results in terms of perception of EVOO intake and its relationship with performance, measured through stress tests with the Cooper test and/or other tools we need to use to evaluate the impact of the intervention and EVOO intake on the athletes' performance, will be assessed.

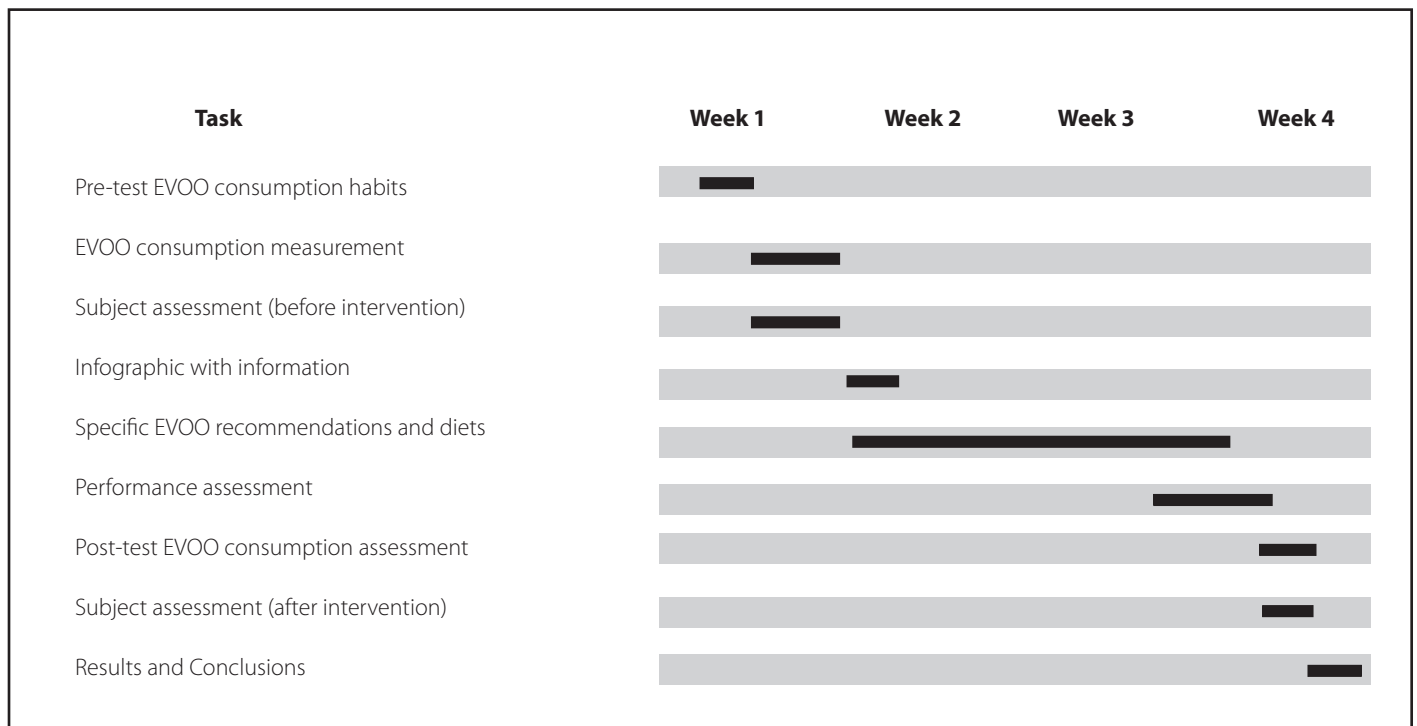
Required resources and budget

The resources necessary to carry out this intervention are:

- Human resources: The researcher/ student writing the dissertation and the sample group are from the Vega Baja region (Alicante) and mostly from C.A. Vega Fibra athletics club (Orihuela – Alicante).
- Material resources:
 - Consumables: pens, paper, pencils.
 - Non-expendables: computer, phone, tablet.
 - Other resources: literature review.

Budget: the cost of resources is zero, everything is done online and at no cost. Digital resources are used for the promotion of EVOO. All the

Figure 2. Timeline. January, 2021.



information and feedback is collected and generated through digital applications and/or email. Therefore, this promotional campaign will not involve any expenses.

Ethical considerations

This study respects the freedom of participation and so it will be necessary for everybody to give their informed consent for the test and check the authorisation for their personal data to be processed for the purpose described.

"Data Protection Law. In accordance with the provisions of Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016, on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and with Organic Law 3/2018 of December 5 on the protection of personal data and guarantee of digital rights, we inform you that the data you provide in this form will be included in a computer file belonging to the researcher Laura Gil Caselles. The data will be processed for use in research work on EVOO and sports performance. The data will be kept for the time necessary to carry out the activity described and may only be transferred to third parties when so required in order to comply with legally established obligations. We inform you that at any time you may exercise your rights of access, rectification, erasure and objection, and the rights explained in the additional information. CHECK I expressly AUTHORISE Laura Gil Caselles, to process my personal data included in this questionnaire for the purpose described."

Also, the confidentiality of the participants' information and custody of the data collected in accordance with the provisions of: a. Organic Law 15/1999 of 13 December, regulating the automated processing of personal data. <http://www.boe.es/boe/dias/1999/12/14/pdfs/A43088-43099.pdf> b. Royal Decree 994/1999 of 11 June, passing the Regulations on security measures for computer files containing personal data.

Intervention evaluation plan

This project will be assessed by collecting information on extra virgin olive oil consumption from a group of amateur runners and trail runners.

First, an initial evaluation or pre-test will be carried out with 21 questions designed for this study based on the validated Predimed²⁸ questionnaire on consumption of and adherence to the Mediterranean diet, which will serve to find out the athletes' EVOO consumption and intake, and provide an initial basis on which to evaluate EVOO habits in the study group.

When the questionnaire has been completed and after verifying compliance with the inclusion criteria, the subject will be provided with information on the benefits of EVOO consumption for performance and the relationship between consumption and performance, and the research and promotion of EVOO as an ergogenic aid in sports performance will continue.

Subsequently, when the subjects' consumption habits are known, a promotion campaign will be designed with the material and information

needed to promote EVOO consumption and publicise its benefits as an ergogenic aid for sports performance.

The assessment will need to take into account certain variables which may arise and affect performance. Some of these factors are sleep, physical activity level, the consumption of toxic substances, environmental factors (air, wind, humidity, temperature, etc.), psychological factors and so on. Consequently, we must establish a recommendation protocol to apply during the EVOO intervention:

- Sleep 8-10 hours a day.
- Establish an appropriate physical activity level for the subject; train 3- 4 days a week at moderate intensity, not adding extra loads or increasing the average intensity during the study.
- Avoid the consumption of alcohol, tobacco and other elements harmful to the athletes which may minimise their performance and affect assessment.
- Monitor and know if any psychological factor may be limiting the athletes' performance and, consequently, the study.
- Assess environmental factors if they occur abruptly or the subjects are training in different conditions and environments.

A control group of study participants will be established to compare the two. Both groups (experimental group and control group) will be evaluated because it is necessary to compare the performance of the group that is consuming EVOO to increase their performance and another group (control group, which we will use for the purpose of comparison and which will perform the same activity but without the EVOO consumption). In this way, we can establish if there are significant considerations and changes thanks to EVOO consumption.

To measure sports performance, we will use a stress test, in this case the Cooper test¹⁰ to measure the athletes' VO_{2max} and see how much oxygen they consume and transport to their muscles.

The Cooper test involves running on flat ground for 12 minutes at maximum effort. The following equation is used to arrive at the results: VO_{2max} (ml/kg/min) = (22,351 x distance travelled (km)) – 11,288.

The beneficial effects of olive oil are observed at systemic level. Its benefits cannot be measured accurately with the maximum values and thresholds of physiological parameters.

Therefore, we can determine them through variables which indicate changes in the physiological system or monitor specific aerobic physiological markers such as maximum oxygen absorption (VO_{2max}) to obtain significant changes.

To evaluate our intervention and see if there are significant changes, we need to set up a control group. We will also use tools to measure performance (Cooper test) in which we will monitor heart rate (HR) and maximum heart rate (MHR) to find out the intensity and effort of the athletes. We need to be aware that the parameters of improvement with EVOO consumption will be obtained through the athletes' physiological variables. EVOO will be introduced into the diet as a supplement that helps the athletes due to its antioxidant effect, which aids in the oxidation of the free radicals produced by exercise, and minimises muscle

damage through its anti-inflammatory effect, and this will be reflected in the athletes' performance.

Another evaluable point of the intervention design will consist of making a series of recommendations to the athletes in which a personalised diet model based on EVOO consumption will be established and will be assessed in the post-intervention because it will serve to improve their habits and effectively and efficiently increase their performance by demonstrating the ergogenic aid that is EVOO for sports activity. And lastly, there will be a final evaluation to analyse the results. Through a questionnaire (post-test), we will discover the perception of the respondents regarding EVOO consumption, but this evaluation is much more complex because we need to analyse all the information collected throughout the pre-post intervention process, produce parametric statistics comparing both groups (consumption group and control group) and also arrive at the relevant conclusions and/or benefits, including possible alternatives and future lines of research.

Applicability of the intervention

Although the multiple benefits of EVOO for the health of the general population, such as prevention of cardiovascular diseases, improvements delaying diseases, prevention of diabetes and some types of cancer, reduction of bad cholesterol and so on, are already known, this project aims to publicise the benefits of EVOO consumption in athletes. Therefore, given its beneficial effects in general, we have investigated how its consumption can also be beneficial in athletes and how it can be considered an ergogenic aid.

Ergogenic aids are defined as any strategy or method (nutritional, physical, psychological, etc.) given and/or applied to athletes with the aim of improving sports performance. In our case, we intend to highlight the benefits of EVOO consumption because it provides sufficient benefits to enhance athletes' performance and their performance will be affected differently as a result of its consumption because it has been observed that there is an improvement particularly as an ergogenic aid.

On the other hand, EVOO consumption is not a direct indicator of lowering running time, but it will because it helps at a physiological level and, therefore, we can see how its effect on the body benefits the athlete when he/she performs physical activity in his/her VO₂. We will therefore see how it improves the athletes' times thanks to its anti-inflammatory effect, which repairs muscle damage, and helps reduce the free radicals caused by exercise that limit performance. Consuming EVOO contributes and fights this thanks to its antioxidant effect, which, in general, will protect and look after the lives of athletes both when doing sports and in normal life.

The proposed future actions are as follows:

- To increase the promotion of EVOO consumption as addictive fat for endurance athletes.
- To demonstrate clinically and scientifically how its consumption directly affects performance through the physiological processes that occur when doing physical activity.

- To provide EVOO as a dietary supplement and/or ergogenic aid.
- To prescribe the recommended doses for different sports which may require more or less fat intake.
- Also, to use EVOO as an energy source, especially in food strategies such as hypoglycaemia dieting and fasted training.

Conclusiones

EVOO is a very important part of our diet. It is a very healthy vegetable fat with a multitude of health benefits: It supplies 822 kcal (per 100 ml), providing lots of energy, especially for athletes. If we combine EVOO with sport, we can see that its intake is beneficial for athletes for the following reasons:

- Oleic acid helps lower blood cholesterol levels.
- Its antioxidant effect helps athletes fight the free radicals produced by exercise and increases the creation of mitochondria, thereby augmenting their energy. It also reduces and prevents a multitude of diseases thanks to this component.
- Vitamin E decreases muscle damage from exercise and protects muscles. It is an indirect sports performance factor. A lack of this vitamin can limit performance, generating muscular dystrophy, anaemia, etc.
- Omega 3. Its Omega 3 content helps in muscle gain.
- Phenolic compounds: such as oleocanthal, a natural non-steroidal anti-inflammatory which is highly beneficial for athletes. 40 ml of EVOO is equivalent to 250 mg of Ibuprofen. As a consequence, the athlete will experience reduced muscle pain after exercise and enjoy a greater and faster recovery.

For all these reasons, EVOO is seen as an essential part of athletes' diets and, thanks to its benefits, it is considered an ergogenic aid because by consuming it, athletes are able to increase their performance and help their metabolism at a physiological level.

Conflict of interest

The authors declare that they are not subject to any type of conflict of interest.

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