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Effects of 50 Days Eggshell Membrane Ovomet® Supplementation on Biomechanics Parameters and Subjective Pain Perception Among Crossfit Athletes. A Preliminary Study

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Abstract

The eggshell membrane has shown a positive effect on joint pain relief. In this study, several tests have been performed to measure the effect of Ovomet® supplementation on subjective perception and biomechanical variables to crossfiters before and after 50 days of administration.

Pain perception questionnaires were performed in order to assess and demonstrate the protective or potentiating of Ovomet® effect on athletes' joints. In addition, we measured biomechanical variables such as muscle strength and power in knee extension, linear stiffness of the Achilles tendon (AT) by ultrasound, muscle stiffness through sensor in two different manoeuvers.

Of all the biomechanical variables, the measurement of tendon stiffness by ultrasound, proves to be a useful tool to study the factors that can affect the joints, like our object of study, the effect of joint supplementation on athletes.

Keywords: Eggshell membrane; Crossfiters; Linear stiffness; WOMAC; Biomechanics; Collagen

Introduction

When practicing sports, injuries are very frequent, some occur accidentally and others due to bad training practice or incorrect use of some sports equipment. Somebody could suffer from injuries due to lack of training or is not in a good physical condition or a diet cannot supply the nutritional needs of the body in correspondence with the type of training the individual is carrying out [1-3].

To avoid or treat injuries or diseases related to the joints, there are different treatments that can alleviate these problems, some are non-pharmacological such as weight loss or rehabilitation, others are nutraceutical therapies, such as the ingestion of collagen, glucosamine, chondroitin Sulfate, etc. The intra-articular viscosupplementation therapy is used in more advanced cases [4].

The tendon is composed of type I collagen that in combination with the glycoproteins and proteoglycans form a perfect matrix for the correct functioning of the joints [5]. The tendon itself is responsible for transmitting the contractile forces to generate movement and give stability to the joint, for these, the tendon must be strong and with a linear stiffness that allows it to support high tensions [6-8].

The use of nutritional supplements oriented to joints problems has received much attention in recent years as preventive or treatment therapy of joints diseases and its injuries.

The eggshell membrane is one of the supplements that has been showing good results in joints disease and is composed largely of collagen, mostly type I, among other metabolites that have shown an action on joint problems such as Glycosaminoglycans and proteins responsible for the mineralization of eggshell, as well as others that play a very important role in microbial resistance [1,2,9,10].

It is known that the need for supplements containing sulfur compounds for recovery after intensive exercises, that is why the use of compounds such as MSM in formulations has aroused great interest [11,12].

The eggshell membrane is very rich in sulfur amino acids (SAA) and may be an alternative supplementation for athletes [13].

To evaluate the response to treatment, the WOMAC and EVA questionnaires were applied pre and post intervention.

Kinematic parameters are often used to objectively assess the functionalities of joints in athletes, these variables could provide useful information on the biomechanics of the joints and study the causes of injuries and how to prevent them as well as improvement of the athlete's own capacities with training.

For the study of supplementation oriented to joints problems, the ultrasound measurement of stiffness of AT could be an objective biomechanical measure that can be used, since it depends on two fundamental factors, the quality of collagen (in which an effective supplementation could influence) and the tendon cross section itself (which can be influenced by training) [14,15].

Common tendon problems include acute lacerations, spontaneous ruptures, excess strain of joints, etc., which are often associated with significant pain and joint mobility problems. These lesions usually take a long time to heal due to poor irrigation and the slow process of cellular replacement in the joint tissues. If this is accompanied by problems in nutritional quality, the healing process can take even longer [16].

In recent years, ultrasonic techniques have been developed with the potential to measure in real time what happens in the tests of movement that conventionally had been used to study the biomechanical functioning of the body and further to achieve a more accurate understanding of these parameters.

This study evaluates different biomechanical parameters to verify if the supplementation of eggshell membrane which could exert positive and improved effects on the functionalities and capacities of crossfiters as well as a possible protective effect on joints.

Materials and Methods

Approval ethic committee

The study was approved by the ethical committee of animal experimentation and biosafety of the Public University of Navarra with code PI-019/15 of July 30, 2015.

Informed consent

The study participants were provided with a consent model with all relevant information about the study, as well as making clear the fundamental rights of the people who access the study.

For the clinical trial, double-blind, placebo controlled, randomized balanced allocation was applied (ratio 1:1). The mean age, height, weight and body mass index of the 22 athletes was 37 ± 7 years, 1.75 m ± 0.09 m, 82.4 kg ± 17.3 kg and 26.8 kg/m^2 ± 3.7 kg/m^2. The crossfiters train an average of 4.5 ± 1.2 days per week with an average duration per session of 1.5 ± 0.6 hours, about 7.2 ± 3.8 hours of weekly crossfit. Some crossfiters had some chronic joint pain (>3 months) before voluntarily agreeing to participate in this project.

WOMAC and EVA questionnaires were applied before and after the intervention

Kinematic parameters like linear stiffness of the AT by ultrasound, muscle stiffness by means of sensor in two different manoeuvers, muscle strength and power in extension of knees were measured.

For the Explosive Force test-"Inertial Sensor" two types of jumps, Counter Movement Jump (CMJ) and Unilateral Drop Jump (UDJ) were performed, the time of flight was a variable of performance which was considered when comparing both types of test.

The ultrasound test was performed with a MyLabTMGamma ecograph, Esaote Biomédica Italia, placing a 7.5 MHz ultrasound probe on the Tendinous-Muscle-Junction (TMJ) of the soleus muscle and the AT of the dominant leg, in which a video is recorded to measure the displacement of the UMT for further analysis. The force, length and displacement of the AT is obtained in the ultrasound for the application of a linear regression and determine the slope, which is defined as stiffness (K=Ft/Lt).

Statistical analysis: Data were analyzed using SPSS 21.0 program

Statistical analysis was designed to evaluate the data of the subjective rating scale, MTJ displacement and TA strength would follow a normal distribution by Shapiro Wilks test (n<30). In the case of normal distribution, the statistical comparison was performed using the paired Student's T test to study the effects of supplementation. If some of the variables would not have a normal distribution, the Wilcoxon non-parametric statistical test is performed. If $p<0.05$, it is assumed to establish significant differences.

Results and Discussion

The Likert test showed improvement in both control and intervention groups, with no significant difference between placebo and intervention. WOMAC although not statistically different results, reveals that the treated group had an average improvement of 62.1% +/- 16.5% compared to average 33.1% +/- 16% of the control.

Strength and muscle power tests in extension of knee, in both supplemented and placebo groups did not show significant differences before and after the study period.

The explosive force-"Inertial Sensor" test was performed in two types of jumps, Counter Movement Jump (CMJ) and the Unilateral Drop Jump (UDJ), the time of flight is a performance variable which was considered when comparing both types of test. Although very similar results were obtained before and after the supplementation and compared to the placebo group, there was a little decrease in the peaks of vertical force maintaining the same time of flight and can be attributed to the training itself. However, it seems that this type of test does not provide information in which an effect of supplementation for crossfiters can be verified.

The AT stiffness result shows a maintenance of the value in the Ovomet® treated group (0.6 N/mm ± 0.3 to 0.6 N/mm ± 0.2) while in the placebo group, a decrease of 37.5% (0.8 N/mm ± 0.3 to 0.5 N/mm ± 0.1) was observed.

Results show that the measurement of stiffness of AT by ultrasound could be useful in assessing the effectiveness of supplementation for joints nutrition, finding coincidence with certain bibliographies, which consider that stiffness of the tendon is one of the most commonly used study of the joints in the aging processes, physical inactivity and training [17-19].

The preliminary experimental results were statistically not significant, although the CMJ test, points to a decrease in the parameters of vertical force peaks in the Ovomet® treated group with respect to the placebo group (42.27% and 18.57%, respectively), maintaining the same time of flight (average 0.404 s before and after in the supplemented group compared to 0.402 s and 0.401 s in the placebo group).

Conclusions

A double-blind placebo-controlled study on the perception of functional ailments and abilities of a group of crossfiters was carried out with the objective of evaluating the effect of Ovomet eggshell membrane supplementation on the performance, protection and improvement of the functional capabilities of the joint system using different biomechanical tests to study the influence that the eggshell membrane can exert as a supplement on the joints. Of all the biomechanical tests performed, linear stiffness shows that it can provide more information in studies where the influence of effective joint supplementation is intended to study.

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