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EFFECTS OF GELATINE HYDROLYSATES IN THE PREVENTION OF ATHLETIC INJURIES

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SUMMARY

The present study shows the action of administering a nutritional supplement (ARTIVIT BIOSOL®) based on a Gelatine hydrolysate on the thickness of the articular cartilage, by ecographic method, in athletes. The administrations, spanning a six month period of a single daily dose of 10g of gelatine hydrolysate plus vitamin B and magnesium; significantly increases the thickness of the cartilage of the scapula-humeral-joint and the femora-tibial-joint (with an average increase of 14%, showing an increase of 5% in the intercondylar recess, 13% ($p < 0.05$) in the medial femora-condyle and 27% ($p < 0.05$) in the lateral femora-condyle, and 11%, 16% and 14% ($p < 0.05$) in the central, lateral and medial sides of the humeral cartilage, respectively). The control group, after the 6 months of the study, does not show an increase in the thickness of the cartilage, on the contrary, the lateral and medial scapula-humeral locations significantly decreases the biometric measurements of the cartilage, showing a decrease of 16% and 13% respectively ($p < 0.05$).

These results show that the long-term administration of a gelatine hydrolysate, plus vitamin B and magnesium; to athletes can be useful in aiding in the prevention of surcharge articular injuries.

Key words: Cartilage, Gelatine hydrolysates, Articular surcharge, Athletes, Ecographic methods.

INTRODUCTION

It is evident that injuries derived from sporting activities represent a health problem that is occasioned by important solicitations athletes submit upon their organism.

An important increase of sporting related injuries has derived over the past decade. The reasons are the increased number of people who practice sport, as well at competitive as recreational level, the increased number of hours that are dedicated to physical activity, and the improvement of diagnostic methods.

Reports show that between 30% and 50% of sporting related injuries are caused by overuse taken place when the demand of work exceeds the level of tolerance of the implied anatomical structure, due to the repetition of the lesion mechanism.

This sort of injury is more frequent when athletes do not follow a correct training program, vary their work routine, apply sudden changes in the intensity or do not take enough time to warm up and/or to rest. These circumstances easily occur at both the amateur and competitive levels.

The articular cartilage, histologically is formed by a cellular phase, the chondrocytes, and by an extracellular matrix[7]. The matrix of the articular cartilage is composed by circa 60% collagen fibers and 40% interfibrillar proteoglycans gel with a great affinity to water[6]. The collagen is the main component of the connective tissue and it is located in tissues like the skin, the tendons and the bones. The collagen, unlike other proteins of the organism is characterized by the high content of cyclical amino acid, proline and hidroxiproline, also containing an important amount of glicine and alanine.

The word *gelatine* derives from the Latin verb *gelare* that means *to freeze*, being well known since Ancient Egypt, and later from Plínio and Lucrecio during the Roman Empire. Shakespeare and Bacon also make frequent notices about gelatine in their works. Gelatine is obtained from the dissolution or the fractioning of the collagen fibers. The different types of gelatine are characterized by their origin: pig, bovine or fish, the fractioning degree the collagen is submitted to, as well as by the used method to fraction the collagen[3]. The present study considers the enzymatic hydrolysate of gelatine obtained from pigskin collagen and enriched with vitamins and magnesium, of easy assimilation by the organism.

This compound (ARTIVIT BIOSOL), due to its gelatine content, provides amino acids that play an important role in the collagen synthesis[1]. Adam Milan[1] has observed after oral administration of gelatine preparations an improvement of the symptomatology in 52 patients that were affected by degenerative processes of the hip and knee joints.

Trentham et al. (1993)[8] observe a reduction in the number of painful joints in 60 patients with severe rheumatoid arthritis after the nutritional supplement with collagen type II during three months. Arquer and Pujol (1996)[2] have observed in 20 patients whose activity was limited by pain at the movement, a progressive and statistically significant reduction of the number of patients with severe and moderate pain after the

dietetic supplementation with highly purified gelatine hydrolysates during 16 weeks and, at the same time, a reduction of the rigidity when initiating the movement.

The reliability[5] of the ecography as an evaluation method of integrity and thickness of the articular cartilage has been settled.

The aim of this study is to evaluate the effect of the supplement with gelatine hydrolysate (ARTIVIT BIOSOL) in a daily dose of one sachet dissolved in water (containing 10g of enzymatic hydrolysate of gelatine) on cartilage biometric parameters. A second purpose is to observe the influence of the supplementation on the anthropometric parameters, especially the body fat percentage.

MATERIAL AND METHODS

Study group

The study group was chosen on a voluntary basis and previously informed about the project through an informed consent form. The study group consisted of a 16 member masculine team of Mountain Bike competitors (BTT) (age 24.19 ± 5.23) and a feminine basketball team of the first division of the Spanish league formed by 10 individuals (age 20.30 ± 3.40).

Methodology

A complete anamnesis of all project participants was conducted before beginning the study, concerning the antecedents related to locomotive system pathologies. This was in turn followed up by an extensive physical basic exploration took place evaluating the condition of the joints and the degree of articular mobility using goniometry. An anthropometric study for the determination of the corporal composition based on the division in four components[4] and one ergospirometric evaluation to determine the degree of physical preparation also took place.

FIGURE 1

FIGURE 2

We made one first muscle-skeletal ecography of the scapula-humeral-joints and femora-tibial-joint using an echograph (Concept/MC Ultrasound Scanner) equipped with a 7,5 Mhz transducer. The analysis of the shoulder was made in internal rotation and hyperextension with the patient in sitting position[7]. Measurements were done in the following zones: lateral (HL), medial (HM) and central (HC) of the humeral head cartilage (ecography Figure 1). The measurement of the femora-condyle cartilage and the intercondylar recess were carried out with the knee in 70° of flexion (ecography Figure 2), taking measurements in the intercondylar recess (FC) and in the medial (FCM) and lateral condyles (FCL). All measurements were made in the right joints using the electrical calibrator of the echograph. The cartilage thickness value was defined by the average results obtained by two observers for each location.

The athletes continued their habitual training program in their respective sports and had a free diet basis during the period of study.

The study participants have received a patient diary with the purpose of controlling all situations that could influence or alter the fulfillment of the dosage and/or the study results like: appearance of aches; cold, catarrhal, gastroenteric and/or allergic processes and medication intake. The nutritional supplement consisted of ingestion of a 10g dose of gelatine hydrolysate (ARTIVIT BIOSOL) enriched with magnesium (160 mg/dose) and vitamins B1 (1,4 mg/dose), B2 (1,6 mg/dose), B5 (6,00 mg/dose) and B6 (2,00 mg/dose) during a period of 6 months.

A second evaluation was made after six months of treatment. The incidences dairy, in this evaluation, was analyzed taking into account the fulfillment of the treatment dosage, and an anthropometric analysis. It was then possible to rate changes in the corporal composition parameters and to carry out a second ecography measuring the biometric parameters of the cartilage.

A statistical treatment of the obtained results, at the end of the study, was realized in order to evaluate the differences in each one of the project goals, between the beginning and the end of the nutritional supplement. The statistical function of Student's t Test was applied in all cases (according to the SPSS - Statistical Package for the Social Sciences).

Results

Although a slight increase in the fat and bony percentage and a slight reduction in the muscular percentage (Table 5) have been observed, significant changes in the corporal composition parameters could not be observed. None of these changes shows statistical differences between groups.

	FIRST MEASUREMENT	SECOND MEASUREMENT
Fat percentage	10.6875 ± 1.114	11.0125 ± 1.201
Muscle percentage	47.4625 ± 1.989	46.9500 ± 1.621
Bone percentage	17.7750 ± 1.323	17.9875 ± 1.312

Table 5 - corporal composition values (first and second measurement)

PARTICIPANT	HUMERAL			FEMORAL		
	HL	HC	HM	FCL	FC	FCM
1	3,9	2,7	3,7	2,8	4,4	2,8
2	1,6	1,3	1,5	2,9	4,2	2,9
3*	1,3	2,3	1,7	2,3	3,5	2,0
4	2,5	2,5	2,7	3,1	6,0	2,2
5	1,8	1,9	1,6	3,4	5,9	1,7
6*	1,5	1,2	1,7	2,2	4,3	2,6
7*	2,0	1,9	2,3	3,2	4,8	2,5
8*	2,0	1,6	1,3	2,1	3,6	2,1
9*	1,7	1,6	1,9	2,7	4,0	1,6
10*	2,3	1,6	2,8	3,0	3,7	2,5
11*	2,2	1,7	1,8	3,1	4,9	2,4
12	2,3	1,9	2,7	2,2	5,8	2,0
13	1,6	1,3	2,3	2,4	3,2	3,0
14	1,4	1,9	1,4	2,5	4,6	1,9
15	1,8	1,6	2,2	3,0	4,6	2,9
16	1,7	1,7	1,9	2,6	3,2	2,4

*Supplemented participants
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 1 – initial measurement of the articular cartilage, group formed by the masculine Mountain Bike (BTT) team.

Significant differences related to the cartilage thickness were not observed in any of the groups evaluated at the beginning of the study.

The results obtained through the measurements of the thickness of the cartilage in the different locations at the beginning of the study and during the sixth month are presented in Tables 1 to 4.

PARTICIPANT	HUMERAL			FEMORAL		
	HL	HC	HM	FCL	FC	FCM
1	1,8	1,9	2,1	3,0	2,7	2,4
2	1,7	1,7	1,5	2,8	3,7	2,6
3*	1,6	1,5	2,1	2,0	3,8	2,7
4	1,8	2,4	2,0	2,6	3,9	3,5
5	1,2	1,1	1,9	2,8	3,9	2,6
6*	1,5	1,3	1,8	2,8	2,8	2,1
7*	1,6	2,1	1,9	3,0	5,0	2,8
8*	2,2	2,4	2,6	2,3	3,4	3,0
9*	1,8	1,9	2,3	2,7	4,1	2,3
10*	1,9	2,2	3,3	2,8	5,3	2,8
11*	1,5	1,5	2,0	2,7	3,1	2,0
12	1,3	1,9	1,5	3,6	3,7	2,7
13	1,9	1,5	2,3	2,7	4,0	3,1
14	1,5	2,1	1,3	2,1	2,6	1,8
15	1,9	1,5	2,0	3,0	4,2	2,9
16	1,5	1,3	1,9	2,6	3,3	2,4

*Supplemented participants
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 2 – second measurement of the articular cartilage, group formed by the masculine Mountain Bike (BTT) team.

PARTICIPANT	HUMERAL			FEMORAL		
	HL	HC	HM	FCL	FC	FCM
1*	1,8	1,7	3,4	3,4	4,3	3,6
2*	1,5	2,2	2,8	2,9	3,2	2,8
3	1,7	2,0	2,1	2,5	2,8	2,3
4*	1,5	1,8	2,0	2,9	2,8	2,7
5*	1,6	2,4	2,7	2,3	4,4	3,0
6	1,6	2,1	2,5	3,2	3,2	2,6
7	2,1	2,0	2,8	2,1	3,1	2,8
8*	1,3	1,9	2,5	3,1	4,9	3,1
9	1,6	1,5	2,1	1,6	3,4	1,7
10	2,3	1,9	2,3	2,0	3,8	2,8

*Supplemented participants
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 3 – initial measurement of the articular cartilage, group formed by the feminine basketball team.

The biometric parameters of the cartilage showed a significant increase in all measurements made in the supplemented individuals, with an increase of 13% and 27% in the medial and lateral femora-condyle, and of 14% in the medial zone of the humeral cartilage (with $p < 0,05$). A slight but statistically insignificant increase in the locations of the femoral recess (increase of 5%) and in the central (increase of 11%) and lateral (increase of 16%) scapula-humeral zones (Table 6) was observed.

PARTICIPANT	HUMERAL			FEMORAL		
	HL	HC	HM	FCL	FC	FCM
1*	2,8	2,1	3,2	3,2	5,2	3,6
2*	2,6	2,3	2,3	2,9	4,9	3,8
3	1,9	2,2	2,5	3,7	3,4	3,0
4*	2,0	2,0	2,3	3,9	4,9	2,8
5*	1,8	2,6	2,6	2,3	4,5	3,6
6	1,5	1,7	2,6	2,8	3,3	2,6
7	1,6	2,3	2,5	2,8	4,3	2,8
8*	2,0	2,3	2,7	3,3	4,9	4,0
9	1,9	1,6	2,0	1,8	3,4	1,7
10	1,3	1,7	2,0	3,0	5,4	3,0

*Supplemented participants
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 4 – second measurement of the articular cartilage, group formed by the feminine basketball team.

	FIRST MEASUREMENT	SECOND MEASUREMENT
FC	4.0333 ± 0.685	4.2333 ± 0.855
FCL	2.7667 ± 0.438	3.5250 ± 1.020*
FCM	2.5750 ± 0.533	2.9083 ± 0.633*
HC	1.8250 ± 0.341	2.0250 ± 0.403
HL	1.7250 ± 0.336	1.9917 ± 0.408
HM	2.2417 ± 0.610	2.5583 ± 0.545*

* = $p < 0,05$
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 6 – Group with supplementation

In the control group, after the six months of duration of the study, an increase in the thickness of the cartilage could not be observed. Just the opposite, the lateral and medial scapula-humeral locations showed a significant reduction of the biometric measures of the cartilage, losing 16% and 13% respectively (with $p < 0,05$) (Table 7).

	FIRST MEASUREMENT	SECOND MEASUREMENT
FC	4.1571 ± 1.109	3.7000 ± 0.701
FCL	2.5929 ± 0.509	2.8071 ± 0.492
FCM	2.4286 ± 0.465	2.6429 ± 0.454
HC	1.8786 ± 0.398	1.7786 ± 0.379
HL	1.9929 ± 0.639	1.6786 ± 0.236*
HM	2.2714 ± 0.604	1.9729 ± 0.365*

* = $p < 0,05$
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 7 – Control group

Finally, when comparing the second measurement of the control group and the supplemented group, significant differences in the thickness variation of the cartilage in three of the locations were statistically observed: in the intercondylar recess of the femora-tibial-cartilage and in the lateral and medial zones of the cartilage of the humeral head.

	Supplemented Group	Control Group
FC	4.2333 ± 0.855	3.7000 ± 0.701*
FCL	3.5250 ± 1.020	2.8071 ± 0.492
FCM	2.9083 ± 0.633	2.6429 ± 0.454
HC	2.0250 ± 0.403	1.7786 ± 0.379
HL	1.9917 ± 0.408	1.6786 ± 0.236*
HM	2.5583 ± 0.545	1.9729 ± 0.365*

* = $p < 0,05$
Humeral head cartilage: lateral (HL), medial (HM) and central (HC) zones. Femora-tibial-cartilage: intercondylar recess (FC), medial condyle (FCM) and lateral condyle (FCL).

Table 8 – Comparative between the supplemented group and the control group in the second measurement

A basketball player presented the only case of intolerance to the nutritional supplementation during the study period with the appearance of nauseas and vomits. However she was diagnosed as having Hepatitis A and the mentioned symptoms were attributed to this pathology.

CONCLUSIONS

Overload injuries are acquiring an increasing importance in sport medicine. It does exist many factors that can be the potentially causes of these injuries: we can find intrinsic factors, like bad alienations and no balance; and extrinsic factors, mainly training errors.

There are some important conditions that can produce overload and stress in the articular cartilage. Most of them are related to problems on the joint that create then an abnormally small area of contact. An increase in the frequency and magnitude of the charges would explain how certain sport activities would experience a high incidence of cartilaginous degeneration. Thus processes of flexo-extension of the knee by cycling or anteversion/retroversion of the arm in basketball could produce articular stress. Cartilage alterations can also be derived from a molecular abuse over the collagen and proteoglycans matrix as in the rheumatoid arthritis or intra-articular hemorrhages. As a result of all this, the nutritional supplement with gelatine hydrolysate would greatly contribute in the treatment and prevention of cartilaginous injuries, once it increases the cartilaginous mass that is reduced in certain locations in individuals that practice sport on a regular basis.

The present work demonstrates for the first time that nutritional supplement of a single daily dose of 10g of gelatine hydrolysate enriched with vitamins and magnesium (ARTIVIT BIOSOL) significantly increases the articular cartilage mass. That is useful

in the prevention of cartilaginous injuries associated to an increasing frequency and magnitude of the charge that is produced in certain sport activities.

BIBLIOGRAPHY

1 ADAM, M.: „Welche Wirkung haben Gelatinepräparate?". Theraphiewoche, 41: 2456-2461. 1991.

2 ARQUER, A., PUJOL, P.: „Ejercicio físico en la tercera edad". Selección, 5 (3): 121-128. 1996.

3 British food Manufacturing Industry Research Association. Sourrey, UK, 1970.

4 DE ROSE, E.H., GUIMARAES, A.C.: „A model for optimization of somatotype in young athletes". In: Ostyn, M., Buenen, G., Simons, J.: Kinanthropometry Il, Baltimore University Park Press. 1980.

5 DONDELINGER, R.F., MARCELIS, S., DAENEN, B., FERRARA, M.A.: „Peripheral musculoskeletal ultrasound atlas". Thierne Medical Publishers, 1996.

6 FRANKEL, V.H., NORDIN, M.: „Basic Biomechanics of the Skeletal System". Philadelphia. Lea & Febiger. 1980.

7 MIRALLES, R.C., PUIG, M., SERVER, F.: „Biomecánica del cartílago y la cápsula articular". Revista de Ortopedia y Traumatología. 41: 182-190. 1997.

8 TRETHAM, D.E., DYNESIUS-TRENTHAM, RA., ORAV, E.J., COMBITCHI, D., LORENZO, C., SEWELL, K.L., HAFLER, D.A., WEINER, H.L.: „Effects of oral administration of Type II collagen on Rheumatoid Arthritis". Science 261: 1727-1729. 1983.