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Effect of hydrolyzed collagen intake on pain relief and mobility in patients with osteoarthrosis

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Abstract

Background and objective: Osteoarthritis is a disease in which the joints are damaged and the patients experience pain and reduced mobility. However, supplementation with hydrolyzed collagen may be effective in reducing the symptoms. Therefore, we studied the impact of hydrolyzed collagen consumption on pain and mobility in patients with osteoarthritis attended the Military Hospital of Paraguay in 2018. In addition, nutritional status of the patients was evaluated for better comparison.

Materials and methods: Intragroup clinical trial was done in 40 patients with osteoarthritis. Nutritional status (by BMI), pain (by the Visual Analogue Scale), and mobility (by the Tinetti Scale) were evaluated in the patients before and after 90-days supplementation (400 mg hydrolyzed collagen by intake of three capsules per day). Physical function was also evaluated by the WOMAC scale. All the patients filled the consent form and the bioethical principles of the Declaration of Helsinki were taken into account. Chi-square and student's tests were used for data analysis at $p \leq 0.05$.

Results and conclusion: Average age of the population was 63 ±1.6 years and 67% of the patients were female. Nutritional status was included to 55% overweight, 17.5% obesity I, and 7.5% obesity II. With regard to pain intensity, 95% of the patients had slight pain and the remained 5% had moderate pain after intervention, so that significant difference was observed before and after supplementation ($p<0.016$). Moreover, a significant improvement was observed in functional capacity ($p<0.001$) and risk of fall decreased after intervention ($p<0.001$). We conclude that hydrolyzed collagen supplementation is a beneficial adjunct treatment in pain relief and mobility improvement in patients with osteoarthritis.

Keywords: Hydrolyzed collagen, mobility, osteoarthritis, pain

1. Introduction

Osteoarthritis (OA) is a complex disease in which different environmental factors interact with multiple genetic factors. It is a degenerative pathology of the articular cartilage, with subsequent deterioration of the other synovial-articular structures, which affects approximately 9.6% of men and 18% of women over 60 years of age. The etiology is not clearly known. Therefore, the risk factors associated with its development are divi-

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ded to being modifiable and non-modifiable [1]. Obesity is of influential modifiable factors. Excessive weight increases joint loading, resulting in deleterious effects on weight-bearing joints. Overweight can stress articular cartilage beyond its biological capabilities and causes degenerative outcomes [2]. Up to 0.5 kg weight loss entails a reduced load across the knee joint 2-4 times [3,4]. Body fat mass is also a risk factor for cartilage defects. For example, 1-kg increase in total body fat accelerates the cartilage defects, as a hallmark of early knee osteoarthritis [5]. Metabolic and brachial factors may explain the higher incidence of OA in non-weight-bearing joints (e.g. hands) in people with high body mass index (BMI) and body fat [6].

Destruction of cartilage is usually occurred in joints of knees, hips, lower back, neck, and small joints of fingers [7]; however, knee joint is the most affected in approximately 83% of OA patients [8]. The main clinical manifestations of OA are joint pain, stiffness after inactivity, limited mobility, crepitus, varying degrees of local inflammation, and occasionally stroke [9].

Treatment of arthritic pathology is difficult, considering that there is no consensus on reference treatment. Currently, pharmacological and non-pharmacological modalities are taken into account. Importantly, a basic therapeutic core should be implemented for all locations. For example, increasing people awareness and education, self-care, reduction of overweight, and exercise are strongly recommended; although patients' adherence to specific treatment is also essential [10].

Salazar-Guzman and Garfias-Rosas showed that use of collagen in OA reduces joint stiffness, followed by improving the quality of life in treated patients [11]. Another study revealed that continuous intake of hydrolyzed collagen (HC) helps in joint pain reduction, slows down loss of bone mass, and attenuates signs of dermal aging. These features along with its safety and tolerance, make HC an appropriate supplement for long-term use in prevention and treatment of chronic degenerative diseases (OA and osteoporosis), as well as to prevent and attenuate dermal aging [12].

In medium- and long-term treatments, cease of progressive deterioration of articular cartilage and subchondral bone by disease Modifying Osteo Arthritis Drugs (DMOAD) is of concern. Nonetheless, no effective DMOAD drug has been introduced. Interestingly, HC is a highly absorbable protein that stimulates the regeneration of articular cartilage and is considered as a useful therapeutic agent for prevention and/or treatment of osteoarthrosis [13].

The current work tried to examine the efficacy of HC supplementation in treatment of OA. For this, assessment of nutritional status, pain intensity, physical function, and risk of fall were monitored in adult patients with OA before and after HC supplementation. The main objective was development of a safe route in favor of reduced consumption of anti-inflammatories and analgesics in the patients.

2. Materials and methods

2.1. Study design

The current work was experimental intragroup study in which the dependent variables were measured before and after intervention in the OA patients. The investigation was carried out in 2018 in the Central Military Hospital, located at 745 Don Bosco Street in the city of Asuncion (Paraguay). The research was conducted according to the ethical principles of the Declaration of Helsinki [14] and approved by the Hospital Ethics Committee.

The study was carried out for three months (August-October 2018) by investigators of Clinical Medical Department of the Hospital. Three timepoints were considered: baseline visit, follow-up visit, and final visit after three months of treatment. Prior to screening, the details, aim, methodology, and possible risks of the study were explained to the patients by the clinical investigators. The patients included in the study

underwent the usual assessments according to routine clinical practices so that their participation did not entail any additional risk.

2.2. Clinical endpoints

Two endpoints were included in the study. The primary endpoint was evaluation of HC efficacy in reduction of pain in the patients with OA. The secondary endpoints were 1) evaluation of nutritional status in the patients by using anthropometric indicators before and after supplementation, 2) evaluation of functional capacity in the patients by the WOMAC Index (Western Ontario and McMaster Universities Arthritis Index) before and after supplementation, and 3) assessment of risk of fall in the patients by using the Tinetti Scale before and after supplementation.

2.3. Participants

Inclusion criteria were 1) outpatient men and women over 40 years of age with diagnosis of OA who attended the hospital in the second half of 2018, and 2) willingness to participate in the study by signing the informed consent form.

Exclusion criteria were 1) pregnancy in women, 2) patients with physical or mental disabilities, 3) patients with kidney disorders and those with allergy to animal protein or any contraindication to receive collagen, 4) patients who consumed other supplements, 5) patients who underwent physiotherapy, 6) patients who performed physical activity, and 7) other conditions interfering in the study (e.g., comorbidities and polymediacation).

To eliminate the biases, each physician visited the first 10 consecutive patients who met all the inclusion criteria (and none of the exclusion criteria) during the recruitment period.

2.4. Treatment and patients' evaluation

HC capsules contained Hydrolyzed collagen (400 mg), Vitamin D (266 IU), Calcium (186.6 mg), Magnesium (16.6 mg), Zinc (2.5 mg), Manganese (0.6 mg), and Copper (0.33 mg). The participants were requested to consume three capsules daily for 90 days.

Nutritional status was studied by determination of BMI according to the parameters of the World Health Organization for adults [15]. Pain intensity was measured by using a visual analogue scale (VAS) of 0–100 mm (0 = no pain, 100 = as much pain as possible). It was measured from the left end of the scale to the point marked by the patient based on his/her perception of pain [16]. Functional capacity was studied according to the WOMAC Index (17 items). Degree of difficulty was defined as none, little, and a lot for the activities of going down and going up the stairs, getting up after sitting, standing, bending over to pick up something, walking through a field flat, getting in and out of a car, shopping, putting on socks, getting out of bed, taking off socks, lying in bed, getting in and out of the shower, sitting, sitting in and out of the toilet, doing housework heavy duty, and light housework. For each item, 0 was the best result and 4 was the worst possible result. The possible score range was 0-68 for physical function. This study evaluated the improvement of physical function in the patients at baseline and after three months of treatment by the WOMAC index scores [17]. Risk of fall was assessed by the Tinetti Scale. This scale was developed to assess mobility and balance in people and includes two dimensions of balance and gait. Maximum score for walking was 12, for balance was 16, and sum of the scales was 28. Scores less than 19 were considered as high risk of fall, scores 19-23 were related to moderate risk of fall, and scores 24-28 were associated with low or slight risk of fall [18].

2.5. Statistical analysis

All statistical analyses were performed with SPSS software version 21. Descriptive analysis of all the variables was done separately and data are presented as mean ±standard deviation. Chi square test was used for analysis of qualitative variables and student's t-test was used for analysis

of quantitative variables. Differences were significant at $p \leq 0.05$.

3. Results and discussion

Forty patients between 41-80 years of age (average age = 63 ±1.6 years) were included in the current study, of which 67% were female. Age distribution is presented in Table 1. It is similar to the study of Castano et al. in 2015. They studied clinical profile, involvement, and treatment of patients with OA in their knee, hip, and hands and found that most of the patients were female. Although, their patients were older than those participated in our study (average of 68 years) [19]. With respect to the location of pain, majority of patients (33%) felt pain in their knee (Table 2). It was in agreement with study of Negrin and Olavarria which reported knee OA as the most frequent and causative pain and disability in elderly [20].

Table 1- Demographic characteristics of the patients with osteoarthritis

Characteristic	n (%)
Gender	
Female	27 (67)
Male	13 (33)
Age (year)	
41-45	4 (10)
46-50	6 (15)
51-55	2 (5)
56-60	4 (10)
61-65	4 (10)
66-70	7 (17.5)
71-75	6 (15)
76-80	7 (17.5)

Table 2- Site of pain in the patients with osteoarthritis

Site	n (%)
Knee	16 (33)
Spine	10 (20)
Hips	8 (16)
Ankle	6 (12)
Shoulder	4 (8)
Elbow	1 (2)
Foot	2 (4)
Arms	1 (2)
Wrist	1 (3)

Regarding the nutritional status, it was observed that 55% of the patients were overweight and 25% of them were obese (Table 3). This observation differed from the results of Castano et al., in which 47.6% overweight or obese were reported [19].

Table 3- Nutritional status of the patients with osteoarthritis

Nutritional status	n (%)
Adequate	8 (20)
Overweight	22 (55)
Obesity I	7 (17.5)
Obesity II	3 (7.5)

OA is a major contributor to global disability and knee has been identified as one of the most affected joints. Several experiments showed that obesity and OA are closely related. Due to the mechanical effects of obesity on OA, risk of developing knee OA is increased in obese or overweight people. However, obesity is positively associated with radiographic and symptomatic OA in non-weight bearing joints such as hand. Weight loss in obese subjects with OA alleviates the symptoms of OA [21].

Regarding the pain intensity, 80% of the patients felt moderate pain before the intervention, while 95% felt slight pain and 5% felt moderate pain at the end of intervention ($p<0.016$) (Table 4). It was in agreement with study of Llopis et al., in which 108 subjects with knee OA were supplemented with HC for 90 days. Similarly, the authors reported an improvement in decreased pain and increased mobility. Although, Llopis et al. recruited patients who performed scheduled physical activity. The possible mechanism for reducing pain in OA after consumption of collagen might be its role as analgesic by protection of cartilage [22].

A significant improvement was observed in physical function after the intervention (Table 5). In this regard, a decrease of 4.2 ±9.7 was calculated in WOMAC score after three months ($p<0001$). Fortunately, quality of life of the patients was improved after supplementation and

our intervention affected positively and returned the functionality to the participants.

Table 4- Efficiency of hydrolyzed collagen treatment in reduction of pain intensity in the patients with osteoarthritis

	Pain intensity			
	Slight n (%)	**Moderate n (%)**	**Severe n (%)**	**Total n (%)**
Pre supplementation	0 (0)	32 (80)	8 (20)	40 (100)
Post supplementation	38 (95)	2 (5)	0	40 (100)

*p<0.016 (Chi Cuadrado)

Table 5- Efficiency of hydrolyzed collagen treatment in physical function and risk of fall in the patients with osteoarthritis

	Baseline	**Month 3**	**Changes (baseline vs. month 3)**	**p-value**
		WOMAC		
Physical function	29 ±13.24	24.8 ±11.33	4.2 ±9.7	<0.001
		Tinetti Scale		
High risk of fall	17.3 ±2.3	20.5 ±3.2	3.2 ±3.1	<0.001
Moderate of fall	21.7 ±4.1	24.8 ±4.3	3.1 ±2.2	<0.001
Slight risk of fall	26.7 ±3.5	27.6 ±5.5	0.9 ±1.3	0.062

*n=40; All values expressed as mean ±standard deviation; WOMAC = Western Ontario and McMaster Universities Arthritis Index.

In the study carried out by Bernard-Pineda et al., 1849 patients with OA of knee and/or hip with a minimum age of 50 years were evaluated. They used the 17-item WOMAC questionnaire to assess the patients' functional capacity, and recommended it in clinical trials for patients with OA of hip or knee. The authors concluded that the WOMAC questionnaire is one of the best tools for evaluation of functional capacity in patients with OA [23]. In accordance, Puigdellivol et al. found a decrease of approximately 10 points in subscale of the questionnaire after three months HC supplementation of patients with OA [24].

Significant reductions were observed in risks of fall assessed by the Tinetti Scale (3.2 ±3.1 score reduction for high risk of fall and 3.1 ±2.2 score reduction for moderate risk of fall; p<0001). These improvements were associated with the improvement in pain intensity and physical function. Importantly, our study was the first trial to find the effect of HC consumption on risks of fall by using the Tinetti scale that is a commonly used method for elderly. Therefore, it is also recommended for patients with OA.

The study has some limitations. Firstly, it was not placebo controlled. Secondly, despite the sufficient subjects undertaken for the study and finding the beneficial effects of HC on OA-derived pain, three months interval is not enough for monitoring the patients affected by OA. Therefore, further long-term studies with a large sample size may be needed to better clarify the effect of HC supplementation on locomotor functions. Thirdly, we did not monitor the patients' daily diet, which might affect knee-joint functions. Finally, the capsules contained additional ingredients other than HC. Thus, further studies are needed to clarify contribution of each ingredient in the results.

No adverse effect was experienced by the patients during the intervention. It suggests that HC is a safe dietary supplement for human daily use.

4. Conclusion

HC supplementation is safe for elderly and patients with OA. It also is effective in reduction of articular pain and improving locomotor functions and quality of life in individuals with OA. Administration of HC together with other therapies help mitigation of OA symptoms in the patients. Importantly, majority of the patients studied in our trial suffered from overweight, obesity I, and obesity II. They should be undertaken by nutritionists to lose weight and improve their nutritional status to avoid aggravation of OA symptoms.

5. Conflict of interest

The authors declare that they have no conflict of interest.

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