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Research Article

### COMPARISON OF THE EFFECT OF BROCCOLI AND TURMERIC ON THE PAIN OF JOINTS IN ELDERLY PATIENTS WITH KNEE OSTEOARTHRITIS

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**Introduction:** Osteoarthritis is one of the most important causes of disability among the elderly, which causes pain, decreases the quality of life, and increases the dependence. Herbal medicine, as one of the nursing interventions, eliminates the symptoms of pain and, as a result, improves health. Therefore, this study aimed to compare the effect of the use of broccoli and turmeric on reducing the pain of joints in the elderly with knee osteoarthritis.

**Method:** The randomized clinical trial was performed on 60 elderly patients with knee osteoarthritis. The participants were divided into three groups; 20 controls, 20 broccoli recipients and 20 turmeric recipients. In this study, broccoli as 10 gr powder, and turmeric as 180 mg gelatin capsule were provided to the elderly. They were examined for 4 weeks. Also, koos questionnaire was used to determine the pain.

**Findings:** Findings of the study showed that there was no significant difference in pain intensity in broccoli, turmeric and control groups before intervention ( $P\text{-value} > 0.05$ ). According to the paired t-test, the severity of pain in the three groups was statistically significant after the intervention ( $P\text{-value} < 0.05$ ). Also, the Bonferroni test showed a significant difference between the control and broccoli groups after intervention ( $P\text{-value} < 0.05$ ). However, there was no significant difference between pain severity in control and turmeric, turmeric and broccoli groups after intervention ( $P\text{-value} > 0.05$ ).

**Conclusion:** The results of this study indicate that any of the above interventions (Turmeric and Broccoli) can reduce the pain of knee joints in the elderly with osteoarthritis. Given that the effect of broccoli and turmeric was at the same level, and many elderly people cannot use turmeric, broccoli is suggested to be included in the elderly diet.

**Keywords:** Broccoli, Sulforaphane, Knee pain, Elderly, Osteoarthritis, Turmeric

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## INTRODUCTION:

Old age is a vital phenomenon that involves everyone and is in fact a natural course in which physiological and psychological changes occur in the body. (1) Today, significant advances in medical science, an increase in the level of community health, reducing mortality and increasing birth rates have increased the average life span of people. As the community is getting older, the risk of life with chronic diseases such as diabetes, cardiovascular problems, and osteoarthritis is increased. So, attention to their problems is required (2). Osteoarthritis is one of the most common chronic diseases among the elderly and women (4). It affects about 30-40% of 65-year-old people (6). Its prevalence is 73.6% in women (7). In America, osteoarthritis is the most common form of arthritis and the second leading cause of long-term inability among adults. It is estimated to affect about 43 million people in the country. (7) In a study conducted on 10,291 people in Tehran in 2008, the prevalence of knee osteoarthritis was reported to be 15.3% (9). Elderly patients with knee osteoarthritis suffer from pain, knee stiffness, and progressive disability while walking, and going up and down the stairs. This reduces the quality of life of the elderly and increases their dependence (11). Since pain is one of the factors that slows the walking speed of patients with knee osteoarthritis, the aim of treatment in osteoarthritis is to reduce pain, which can help to improve the movement of patients (12). Different pharmacological treatments (Acetaminophen and topical drugs) as well as non-pharmacological treatments (exercise, lifestyle modifications, thermo therapy, and herbal medicine) are used (13). Nonsteroidal anti-inflammatory analgesics increase the risk of gastrointestinal diseases such as nausea, vomiting, diarrhea and constipation. It also decreases the number of blood cells and causes side effects, such as confusion, depression and tinnitus. They, in turn, cause more severe problems, such as the fall in the elderly (14). In the recent decade, many studies have been conducted on non-pharmacological treatments for a patient with knee osteoarthritis. One of the non-pharmacological interventions is the use of herbal medicine.

According to statistics, about 25% of drugs prescribed by doctors in the United States contain at least one independent plant. The use of herbal medicines has increased in recent decades. One of the herbal medicines for pain relief of patients with osteoarthritis is turmeric (16).

Turmeric is from the ginger family, which has been used as food and medicine since ancient times in Asian countries. Curcumin is the effective ingredient of turmeric (19). In addition to curcumin, there are several chemical compositions such as volatile oil, zingiberin, alpha and beta turmerone, and other substances such as arabinose and glucose in the rhizome of the turmeric plant. Turmeric plant color is related to colored materials like Curcumin and desmethoxycurcumin (18). Inflammatory injuries are one of the causes of pain in the joints. Therefore, turmeric with antioxidant and anti-inflammatory effects can be effective in reducing joint pain (20).

Saterska performed two studies on the effect of using 1200 mg daily turmeric on Rheumatoid arthritis compared to the use of 30 mg of phenylbutazone. And they reported the recovery of joints fatigue in the morning, walking time, and decreased arthritis (21,22).

Gautam et al claimed that the positive effect of turmeric in diseases such as arthritis, allergies, asthma, atherosclerosis, Alzheimer's disease, high blood sugar and cancer is probably due to the effect of this substance on the immune system (23).

In spite of the anti-inflammatory properties of turmeric, the plant has side effects such as nausea, vomiting, abdominal pains, and even in more severe cases peptic ulcer, which has limited the use of this plant by some elderly patients (27). Due to the complications of turmeric, we look for a new alternative with less complication such as broccoli. Broccoli is a Latin word which means branch (28). Broccoli contains sulfur and can play anti-inflammatory role in the human body. (29). Broccoli has a substance called sulforaphane, which reduces the number, size, and proliferation of cancer cells. (30.)

Kojy et al. investigated the effect of intra-articular treatment of sulforaphane in patients with osteoarthritis. The results showed that broccoli recipients had less destructive effects in their extracted joint after the surgery. This indicates early effects of broccoli on the pain, which confirms Protein inhibition in the joint (31)

David Cian performed a study titled "Cabbage and its anti-inflammatory effects", which showed that at 8 weeks after the start of treatment, a significant decrease in joint inflammation was observed. The knee pain scores were significantly lower (20).

The studies of Azizi et al. and Dr. Mohajeri et al. show the anti-inflammatory effects of broccoli. (21,22).

Given the lack of proper effectiveness of the current medical treatment, the proportionality of complementary therapies to the nature of the patient, low cost and simple medical treatment, and the need to study the effectiveness of this treatment, especially in the elderly, this study aims to compare the anti-inflammatory effects of turmeric and broccoli on pain reduction in elderly patients with osteoarthritis.

#### **METHODS:**

The present study was a randomized clinical trial with the code of ethics (zbmu.lrec.1396.69). The population was all residents of Home for the Aged in Zabol city, who suffered from knee osteoarthritis in year 96. Considering the 95% confidence coefficient, 87% statistical power, and the minimum accuracy of two units of change in the mean pain intensity, the sample size was considered 20 patients for each group.

The sampling method was simple random sampling. The elderly people with knee osteoarthritis were randomly divided into three groups of control, broccoli recipients, and turmeric recipients.

The criteria for entering the study include ages 60 to 80 years, crepitus less than 30 minutes, presence of symptoms more than 3 months in the elderly, WOMAC score less than forty, having reading and writing skills, confirming osteoarthritis by orthopedic specialist.

Exit criteria include people under the age of 60 and people over 80, severe joint effusion, persons with history of trauma, injury or surgery, and lower part fractures, unwillingness to cooperate, having the history of joint problems such as gout and rheumatoid arthritis, injection of joint corticosteroids in the last two weeks (such as hyaluronic acid, and, more importantly, not having knee physiotherapy record during the past month).

The research units filled and signed the informed consent form before participating in the research. The data collection tools were the demographic characteristics questionnaire and KOOS questionnaire. Demographic characteristics questionnaire included age, sex, marital status, employment status, number of family members, educational level, history of disease in relatives, duration of illness, other diseases, type of drug, care providers at home, and satisfaction with the treatment. In order to measure the validity of this questionnaire, we asked the opinion of 10 faculty members of the Faculty of

Nursing and Midwifery. The KOOS questionnaire is a standardized questionnaire for assessing the outcome of the treatment of patients with knee osteoarthritis. The questionnaire information is designed to measure the severity of osteoarthritis and knee pain, symptoms, motor activity in daily activities, sports and recreation, and quality of life in the knee joint.

For each question, there are 5 options that will be scored from 0 to 4 points. In total, the score obtained in each subgroup will be calculated and the number 100 will be the absence of a problem. This questionnaire has been translated and indigenized in Iran. Its Persian version has been confirmed for repeatability in various studies (Saranipour and Salavati and Akbari).

To observe ethical issues, control the use of pain killers and unify the groups, the elderly who received the same pain killers were selected. Turmeric was provided to the elderly as a soft gelatin capsule containing 180 mg Nano Curcumin (Sina Curcumin Company). The elderly took it three times a day after each meal for 4 weeks. Broccoli was prepared as powder in 10g packages. The elderly took it during one of the meals (preferably at lunch) for 4 weeks. In the event of any complications or new symptoms, the patients were excluded from treatment. After the initial description of osteoarthritis disease and describing how to fill the questionnaire, and assuring the participants about the confidentiality of the responses, the questionnaires were filled out by the researcher in all 4 weeks. So, in the event of not observing the recommended regime or arising complications for each sample, the sample will be replaced with new one. At the end of the fourth week, the results and questionnaires were generally collected and evaluated.

The data were analyzed by Kruskal-Wallis test and Paired t-test in SPSS 18 software.

#### **FINDINGS:**

According to the results, men have the highest number (63.3%). The highest frequency was related to single people (60%). The highest frequency in the duration of the disease was observed in the category of 7 to 10 years with 40%. Illiterate class had the highest frequency (48.3%). The option "I am not satisfied with the pre-intervention treatment" had the most frequency in all three groups (broccoli, turmeric and control) with 59.3%.

Paired t-test was used to compare the severity of pain in different weeks. Each group was individually compared over the various weeks.

The results of paired t-test in the control group showed that the mean scores of pain in the first comparison, which was in the first week and second week of the intervention, were not statistically significant. It also showed that there was no significant difference in the second comparison

between the second and third weeks ( $P = 0.263$ ) ( $P = 0.30$ ).

However, there was a significant difference in the third comparison (between the third and fourth weeks after the beginning of the intervention) ( $P = 0.005$ ).

**Table 1: Comparison of knee joint pain severity in the first to fourth weeks of the control group**

Significance level	df	Degrees of freedom	Paired t-test				
			Confidence level 95%		Mean (Standard deviation)		
			upper bound	Lower bound			
0.263	19	-1.15	1.31	-4.53	40.98(8.73)	First week	First comparison
					42.58(7.93)	Second week	
0.30	19	-2.34	-0.30	-5.35	42.58(7.93)	Second week	Second comparison
					45.41(7.50)	Third week	
0.005	19	-3.16	-0.63	-3.09	45.41(7.50)	Third week	Third comparison
					47.27(7.29)	Fourth week	

The results of paired t-test of broccoli group indicate that the mean score of pain in the first, second and third comparisons was statistically significant ( $P = 0.000$ ), which indicates the positive effect of broccoli in reducing the pain of joints in elderly patients with knee osteoarthritis.

**Table 2: Comparison of knee joint pain severity in the first to fourth weeks of broccoli group**

Significance level	df	Degrees of freedom	Paired t-test				
			Confidence level 95%		Mean (Standard deviation)		
			Upper bound	Lower bound			
0.000	19	-11.13	-13.08	-19.14	30.00(14.18)	First week	First comparison
					46.11(14.03)	Second week	
0.000	19	-6.12	-9.97	-20.31	46.11(14.03)	Second week	Second comparison
					61.25(15.98)	Third week	
0.000	19	-6.28	-7.47	-14.92	61.25(15.98)	Third week	Third comparison
					72.44(13.06)	Fourth week	

The results of paired T-test of turmeric group showed that the mean score of pain in the first and second comparisons was statistically significant ( $P = 0.000$ ). In the third comparison, there was no significant difference ( $P = 0.391$ ).

**Table 3: Comparison of knee pain severity score in the first to fourth weeks of turmeric group**

Significance level	df	Degrees of freedom	Paired t-test				
			Confidence level 95%		Mean (Standard deviation)		
			Upper bound	Lower bound			
0.000	19	-5.686	-4.65	-10.07	33.47(18.16)	First week	First comparison
					40.83(16.34)	Second week	
0.000	19	-1.292	4.74	-20.01	40.83(16.34)	Second week	Second comparison
					48.47(12.17)	Third week	
0.391	19	-3.335	-5.54	-23.91	48.47(12.17)	Third week	Third comparison
					63.19(13.11)	Fourth week	

In order to study the difference between the sub-categories of knee questionnaire of the two groups, the paired comparison test was used again.

**Table 4: Descriptive statistics of the paired comparison of subcategories of turmeric group and broccoli group**

Standard error	Standard deviation	Number	Mean	
7.1	31.1	19.0	293.8	Symptoms of broccoli group
8.0	35.0	19.0	273.5	Symptoms of turmeric group
5.2	22.8	19.0	120.1	Dryness of broccoli group
3.1	13.5	19.0	116.6	Dryness of broccoli group
37.7	164.5	19.0	482.3	Severity of pain in broccoli group
78.6	342.6	19.0	502.1	Severity of pain in turmeric group
56.1	244.6	19.0	1015.1	Performance of broccoli group
45.7	199.3	19.0	958.1	Performance of turmeric group
8.9	38.9	19.0	187.2	Sports-recreation of broccoli group
9.6	42.0	19.0	153.8	Sports-recreation of turmeric group
8.7	37.7	19.0	222.0	Quality of life in broccoli group
6.7	29.0	19.0	207.9	Quality of life in turmeric group

Comparison of the two groups based on the subcategories of the dryness, performance, sport and recreation, symptoms, and quality of life showed that the mean of 4 weeks in the treatment group of turmeric was higher in the subcategories of (pain intensity). However, it has a higher mean in other subcategories of broccoli group.

Table 5 shows the result of the paired comparison test for the hypothesis based on the difference in the effects of the subcategories of the two groups of turmeric and broccoli. Considering the significant level (P value) of more than 0.05, it can be said that the effects of subcategories, except in sports-recreation, on the pain severity of elderly patients with knee osteoarthritis is also different

**Table 5: The results of the paired comparison test between the subcategories of turmeric group and broccoli group**

Significance level	Degrees of freedom	T value						
			confidence 95% level		Standard error	Standard deviation	Mean	
			Upper bound	Lower bound				
.089	18	1.8	43.9	-3.4	11.3	49.1	20.3	Symptoms
.529	18	0.6	14.7	-7.8	5.4	23.4	3.4	Dryness
.832	18	-0.2	173.3	-212.8	91.9	400.5	-19.8	Pain intensity
.437	18	0.8	207.3	-93.4	71.6	312.0	56.9	Performance
.014	18	2.7	59.2	7.6	12.3	53.6	33.4	Sports-recreation
.223	18	1.3	37.4	-9.3	11.1	48.4	14.0	Quality of life

### DISCUSSION:

The aim of this study was to compare the effect of broccoli and turmeric on the pain severity of elderly patients with knee osteoarthritis (2017).

In the present study, both of the above interventions had an effect on knee pain reduction in elderly patients with knee osteoarthritis. The three groups did not differ in pain intensity before intervention. The comparison after the intervention shows a significant difference in the mean of pain intensity in all three groups. These results are consistent with other scientific findings such as Henrotin<sup>Lev.</sup>, Belcaro, yanclarc (45,46,47,48).

Given the findings of the research and the hypothesis tests based on the paired t-test, the results showed that there is a significant difference between pre and posttest of knee pain, motor activity intensity, and sports-recreation. (P-value> 0.05 pretest (P -value <0.05 posttest). These results are consistent with other findings (45,46,47,48)

Given the duration of the illness, 40% of the elderly suffered from knee osteoarthritis over 7 years, which suggests chronic osteoarthritis of the knee. In terms

of educational level, they were studied as five illiterate, under the diploma, and diploma classes. The highest frequency was related to the illiterate class with 29 people (48.3). Due to lack of awareness, we saw acute osteoarthritis. The option "I am not satisfied" had the highest frequency with 35 people (59.3). Others were satisfied (40.7%).

Based on the mentioned radiological criteria, all elderly patients are with moderate to severe osteoarthritis. It was probably due to the referral of patients in the terminal and severe stages of the disease and lack of awareness.

In recent decades, laboratory evidence has shown the effectiveness of curcumin in many ways, such as anti-inflammatory, anti-oxidant, and anti-cancer.

The mechanism of anti-inflammatory effect of curcumin is based on inhibiting substances such as phospholipase, collagenase, elastase, hyaluronidase, which play an important role in inflammation and pain.



Henrotin et al. found that curcumin preventsepcytosis of condorocytes by inhibiting TL-1B (47).

Lev reported that curcumin, with cox2, can inhibit E2 prostaglandins (45).

However, studies on the effect of curcumin in patients with knee osteoarthritis are rare.

Clinical studies have been conducted on the effectiveness of curcumin. Belcaro examined the effects of curcumin with other non-steroid anti-inflammatory drugs on 100 patients with mild knee osteoarthritis for 8 months. They found that womac scores and pain were improved in the intervention group. However, comparing their study with ours, we find out that their study was with lower dose of curcumin, for longer time, and in younger patients with mild knee pain. The results could be due to the combination of anti-inflammatory drugs.

Jan Clarke, a professor of musculoskeletal biology at Uea University and lead researcher, said in An American magazine that sulfurophan reduces the production of enzymes that damage human cartilage. It was also effective in protecting the damaged tissue of cow cartilage in the laboratory. Mice that had a diet rich of sulfuraphan had less symptoms of arthritis in their cartilages (48).

In another study on patients with knee osteoarthritis, researchers found that eating broccoli soup would have a positive effect (34).

The main results of this study showed that the effects of turmeric and broccoli on the severity of pain in elderly patients with knee osteoarthritis were different. The pain intensity after intervention in both treatment groups of turmeric and broccoli was significantly decreased. In the turmeric group, the pain reduction process was significant from the first week to the third week, but it increased again in the fourth week. The results were consistent with the study of Niempovg (41). It is probably due to the temporary protective role of turmeric against oxidation and protein degradation by reducing of the compensation of the activity of the antioxidant defensive system and eliminating free radicals (18).

In a study in India, the efficacy of drug compounds such as frankincense, ginger and turmeric was compared with that in the control group in 2012, which showed a reduction in the pain score and score of womac compared to the placebo group [3].

In line with these researches, Rpinsornsak performed a randomized comparative study on the effect of

diclofenac (75 mg per day) and turmeric (100 mg per day) on 81 patients with knee osteoarthritis for 3 months in 2012. Results did not show significant differences between the consumption of turmeric and diclofenac (14).

There are three studies regarding the positive effects of curcumin on the severity of pain in patients with knee osteoarthritis and other rheumatic diseases. One is a pilot study and two others compare curcumin with diclofenac. They show the pain relief arising from curcumin alone or in comparison with other anti-inflammatory drugs (42 to 44).

Saquill et al (2009) conducted a study titled "The effect of turmeric on reducing the pain of knee osteoarthritis in comparison with Brouffen. They concluded that knee pain in the 52 members of the group of turmeric consumers in the weeks of 0, 2, 4, and 6 had a significant reduction compared to that of turmeric consumption group. Also, turmeric digestive problems were less than that of broffen. The results of this study are also consistent with the results of the current study (34). It is probably due to the fact that curcumin decreases the secretion of IL.12 (76) and increases the secretion of IL10 resulting in inhibition of TH1 cytokine secretion and the improvement of osteoarthritis symptoms.

However, in the broccoli group, knee pain decreases until the end of the fourth week. The results of this study are consistent with Azizi's study in 2011. In the aforementioned study, knee joint pain decreased in the elderly population due to eating cooked buds of broccoli (33).

Dr. Kan conducted a study in 2007 titled "Comparison of Tomato and Broccoli's Anti-Tumor Properties in Patients with Tumor". The results suggest the combined effect of tomato and cabbage in reducing tumor size (35).

Dr. AbuIn et al conducted a study in 2014 titled Research on Medicinal Herbs in Egypt, which was on the antioxidant and anti-carcinogenic activity of broccoli. It showed the anti-inflammatory effects of this plant (38).

Dr. Zigrid et al conducted a research in 2005 titled enrichment of selenium with broccoli. The study was conducted on people who consumed 200 grams of broccoli per day. They found that the level of antioxidants in the digestive system and respiratory system of those people was three times higher. In this study, researchers tracked people who consumed 340 grams or 50 grams of broccoli each week, and found that cancer-resistant genes were higher in these individuals (39).

All of these results are consistent with the aforementioned findings. The above results are probably due to the presence of sulfuraphan and anti-degradative enzyme properties, which causes inflammation and pain in the elderly.

The results of this study were consistent with the findings of the study by Koji et al. (2013), which investigated the effect of intra-articular treatment of sulfuraphan in patients with osteoarthritis. This is due to the fact that broccoli and turmeric powder had antioxidant and analgesic effect (22). It should be noted that in this experimental study, patients were divided into two groups of broccoli group and control group. The broccoli group received 150 mg of broccoli a week before the operation. The results indicated that the broccoli group had less destructive effects on the knee joint after the surgery. This suggests early relief of broccoli, which, in turn, suggests protein inhibition arising from the erosion of the joint (35). This is consistent with the result of this study.

The sum of the turmeric group scores in the four-week in the subcategories of motor performance, sports-recreation has increased. The quality of life, dryness, and symptom rates have had the slightest change.

The total score of the broccoli group was increasing in all subcategories such as symptoms, quality of life, dryness, pain, performance and quality of life in 4 weeks. It indicates that broccoli has been effective and sustained in reducing pain and increasing the quality of life of the elderly.

Inflammatory injuries are one of the causes of joint pain in osteoarthritis. So, it is possible that turmeric and broccoli, with their antioxidant and anti-inflammatory effects, can be effective in reducing joint pain.

The results of this study seem to be important because it talks about diets in reducing pain of osteoarthritis. So, doctors and nurses can recommend the results of this study, along with other drugs that protect the joints, for patients' health.

### CONCLUSION:

The results of this study indicate that any of the above interventions, such as turmeric and broccoli consumption can reduce the pain of joints in patients with immune and autoimmune diseases. However, broccoli is more effective and more stable due to its sulfuraphan and antioxidant properties. Turmeric was also useful in the short term due to its curcumin properties. Therefore, curcumin and Sulfuraphan should be used to reduce the pain as

well as the dependence on non-steroidal anti-inflammatory drugs in people unable to use drugs due to gastrointestinal complications.

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