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# The association of milk consumption with the occurrence of symptomatic knee osteoarthritis

C. Kaçar, E. Gilgil, T. Tuncer, B. Bütün, S. Urhan, G. Sünbüloglu, Ç. Yildirim, V. Arikan, Ü. Dündar, M.C. Öksüz, I. Tekeoglu

*Department of Physical Medicine and Rehabilitation and Rheumatology, Akdeniz University Faculty of Medicine, Antalya, Turkey.*

*Cahit Kaçar, MD; Erdal Gilgil, MD; Tiraje Tuncer, MD; Bülent Bütün, MD; Sevgi Urhan, MD; Günsel Sünbüloglu, MD; Çinar Yildirim, MD;Volkan Arikan, MD; Ümit Dündar, MD; Mehmet C. Öksüz, MD; Ibrahim Tekeoglu, MD.*

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*Please address correspondence to: Dr. Cahit Kaçar, Akdeniz University Faculty of Medicine, Department of Physical Medicine & Rehabilitation and Rheumatology, 07058, Antalya, Turkey. E-mail : ckacar@akdeniz.edu.tr*

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**Key words:** Osteoarthritis, diet.

**ABSTRACT**

**Objective.** *To evaluate the association of nutritional factors with symptomatic knee OA.*

**Methods.** *This cross-sectional study was performed face-to-face using a structured interview. Individuals who had a diagnosis of symptomatic knee OA and were aged 50 years or over were included in this study. The frequency of consumption of dairy products, meat/poultry, fish, cereals, vegetables, tea and coffee were also determined. The diagnosis of knee OA was made clinically or clinically and radiologically according to the ACR criteria for knee OA.*

**Results.** *A total of 655 subjects was interviewed. The frequency of symptomatic knee OA was significantly lower in daily milk consumers ($p < 0.05$). Tea consumption was also inversely associated with symptomatic knee OA ($p < 0.05$), although other nutritional elements showed no significant relationship with OA.*

**Conclusion.** *Milk consumption may have beneficial effects on symptomatic knee OA.*

## Introduction

It has occasionally been debated whether nutrition has a role in the management of rheumatic diseases (1-4).It is known that osteoarthritis (OA) is associated with obesity (5-7). It was reported that low vitamin D intake and low serum vitamin D levels might increase the risk for progression of knee OA (8). On the other hand, it was suggested that a vitamin and selenium supplemented diet might have a protective role against mechanically induced OA (9). McAlindon *et al*. reported in a community-based study that a higher consumption of anti-oxidant micronutrients, especially vitamin C, might decrease cartilage loss and OA progression (10). If the protective and anti-progressive role of nutrients can be established, they might be used in the primary or secondary prophylaxis of OA and progress in the management of OA could be achieved. This community-based study was carried out to investigate the association of OA with diet.

## Materials and methods

This cross-sectional study was performed as part of an epidemiological survey on rheumatic diseases in the urban population of Antalya, a city located in the south of Turkey. In the 1997 national census Antalya's population was 508,840 inhabitants. A sample size of 3,012 was determined to enable a prevalence of 2% for rheumatoid arthritis (95% CI: 1.5–2.5) (11). Based on the records of the local offices of the Ministry of Health, a total of 100 sites – each comprising several neighbouring households and at least 30 individuals aged 16 or over – were randomly selected for systematic sampling. Subjects aged 50 or over were included in this study.

A structured interview was performed face to face. The study team consisted of 10 specialists and residents and 20 medical students, all of whom were appropriately trained. One of the three rheumatologists attended successively all the interviews for supervision. The interview included the following questions:

1. Have you ever had knee pain without swelling or warmth of the knee joint?

If the subject responded 'yes', the following questions were asked:

2. Is the pain aggravated with motion and does it subside with rest?
3. During initial movement after rest, do you experience stiffness at the knee joint lasting less than 15 minutes?

The subjects who answered "yes" both to the first question and to at least one of the two following questions were suspected of having knee OAand were invited to the hospital for a thorough physical examination and/or an X-ray of the knee joint (anteroposterior and lateral), if required. Radiographs were evaluated by 2 rheumatologists who were unaware of the clinical diagnosis. For the 'clinical'or 'clinical and radiological'diagnosis of knee OA, the ACR criteria were used (12). Radiological assessment was made on the basis of a Kellgren-Lawrence score ≥2 (13). Subjects with symptomatic knee OA were enrolled as patients and subjects aged 50 years or over without symptomatic knee OAserved as controls.

The study population was also questioned on the frequency of their consumption of certain food items grouped into five main categories as follows: dairy products (milk, cheese and yogurt), meat/poultry, fish, cereals, and vegetables. Those food items and their consumption frequencies were evaluated as follows: subjects were asked to state their average frequency of consumption of each item, graded as following: seldom (≤ 3 times a month), sometimes (1-5 times a week) and daily (≥ 6 times a week). The daily consumption of tea and coffee were also recorded as "yes" or "no".

**Table I.** Characteristics of the study subjects.

| | Non-OA (%) | OA (%) | p |
|---|---|---|---|
| Age (years) | | | |
| 50-59 | 339 (60.8) | 18 (18.6) | |
| 60-69 | 151 (27.1) | 47 (48.5) | 0.00 |
| 70-79 | 59 (10.6) | 25 (25.8) | |
| ≤ 80 | 9 (1.6) | 7 (7.2) | |
| Sex | | | |
| Male | 321 (57.5) | 28 (28.9) | 0.00 |
| Female | 237 (42.5) | 69 70.1) | |

**Table II.** Frequency of consumed dietary elements in symptomatic knee OA

| | Non-OA (%) | OA (%) | p |
|---|---|---|---|
| Milk | | | |
| Seldom | 102 (18.3) | 31 (32.3) | 0.00 |
| Sometimes | 269 (48.4) | 45 (46.9) | |
| Daily | 185 (33.3) | 20 (20.8) | |
| Yogurt | | | |
| Seldom | 11 (2.3) | 3 (3.5) | |
| Sometimes | 165 (35.2) | 29 (34.1) | 0.81 |
| Daily | 293 (62.5) | 53 (62.4) | |
| Cheese | | | |
| Seldom | 7 (1.5) | 1 (1.2) | |
| Sometimes | 103 (22) | 14 (16.5) | 0.49 |
| Daily | 359 (76.5) | 70 (82.4) | |
| Meat/poultry | | | |
| Seldom | 18 (3.2) | 2 (2.1) | |
| Sometimes | 404 (72.8) | 77 (81.1) | 0.23 |
| Daily | 133 (24) | 16 (16.8) | |
| Vegetables | | | |
| Seldom | 3 (0.5) | 1 (1) | |
| Sometimes | 61 (11) | 10 (10.3) | 0.83 |
| Daily | 493 (88.5) | 86 (88.7) | |
| Cereals | | | |
| Seldom | 20 (3.6) | 4 (4.1) | |
| Sometimes | 121 (21.8) | 25 (25.8) | 0.65 |
| Daily | 413 (74.5) | 68 (70.1) | |
| Fish | | | |
| Seldom | 524 (99.2) | 90 (96.8) | 0.07 |
| Sometimes | 4 (0.8) | 3 (3.2) | |
| Tea | | | |
| No | 43 (7.7) | 15 (15.5) | 0.02 |
| Yes | 512 (92.3) | 82 (84.5) | |
| Coffee | | | |
| No | 355 (66.1) | 66 (69.5) | 0.55 |
| Yes | 182 (33.9) | 29 (30.5) | |

*Statistical analysis*

Chi-square and logistic regression tests were used for the comparison of non-parametric data and to estimate the effect of nutritional factors, respectively. In univariate models corrected for age and sex and in the multivariate models, we used the lowest value for nutritional items (milk, yogurt, cheese, meat/poultry, vegetables, cereals, fish), age group 50-59 years, male sex, and no consumption of tea or coffee as the referent category. Odds ratios (OR) and corresponding 95% confidence intervals (CI) were calculated. A p value $< 0.05$ indicated a significant difference.

## Results

A total of 655 individuals (349 men, 306 women) aged 50 years or over were enrolled in the study. Their mean age was 59.7 ± 8.3 years (range 50-94 years). Knee OA was diagnosed in 97 (14.8%) individuals. Of these, 69 (71.1%) were women. The diagnosis of knee OA was made according to clinical and radiological findings in 70 patients, and clinical findings were sufficient for the diagnosis in 27 patients. Approximately half of the subjects with symptomatic knee OAwere in the age group 60-69 years (Table I).

The frequency of symptomatic knee OAwas significantly lower in the daily milk and tea consumers. Other nutritional elements were not found to be associated with symptomatic knee OA (Table I). There was no significant difference with regard to milk and tea consumption between the men and women as a whole. However, coffee consumption was significantly increased in men ($p = 0.008$). In the univariate model corrected for age and sex, decreased milk consumption was significantly associated with the occurrence of symptomatic knee OA($p = 0.002$). After performing multivariate logistic regression analysis, a decreased consumption of milk as well as advanced age and female sex remained as the only significant determinants for an increased risk of symptomatic knee OA(Table II).

## Discussion

The influence of diet on rheumatic diseases has drawn increasing attention in

**Table III.** Associations between risk factors and symptomatic knee OA.

| | OR (95% CI) | p |
|---|---|---|
| Age (years) | | |
| 50-59 | 1.00 | |
| 60-69 | 6.24 (3.05-12.57) | 0.00 |
| 70-79 | 9.99 (4.39-22.73) | 0.00 |
| 80≤ | 20.26 (3.98-103.06) | 0.00 |
| Sex | | |
| Male | 1.00 | |
| Female | 3.77 (2.08-6.84) | 0.00 |
| Milk | | |
| Seldom | 1.00 | |
| Sometimes | 0.43 (0.22-0.84) | 0.01 |
| Daily | 0.29 (0.13-0.65) | 0.00 |

recent years. It has been suggested that vitamin and micronutrient supplements to the diet might be efficacious in the management of rheumatic diseases, although the efficacy was not the same in different rheumatic diseases (2-4, 9, 10). Nutrients may have effects on the prevention of excessive oxidative damage, modulation of the inflammmatory response, cellular differentiation and collagen synthesis (1). Kurz *et al.* reported that a selenium and vitamin supplemented diet decreased the development of experimental OAin mice (9).

The beneficial effects of milk on human health are well known. Colker *et al.* suggested that milk-based, bioactive micronutrient-containing drinks decreased the symptoms of OA and ameliorated the activities of daily living (14). We found in our study that the frequency of symptomatic knee OA was lower in daily milk consumers. However, this association may not imply a causal relationship between milk consumption and the occurrence of symptomatic knee OA. As an example, lactase deficiency, which may lead to the decreased consumption of milk, may be more prominent after infancy (15). Lactase deficiency is as high as 85% in Turkey (16). Although it might be suggested that older patients may exhibit more prominent lactase deficiency, it is unlikely that our patients had such a significantly low lactase activity compared to controls, as most of the decrease in lactase levels occurs up to the age of 5 years and then slows down. On the other hand, gender has no influence on the level of lactase activity. This suggests that, although our patients were older and mostly women, lactase deficiency should not have been significantly different between them and the healthy controls aged 50 years or more. However, confirmation of this suggestion warrants further investigation to determine the extent of lactase deficiency in patients with OA.

On the other hand, the peptides contained in milk may have anti-inflammatory, immunomodulatory, and opioid agonistic and antagonistic effects (14,17,18). There is evidence that the pathogenesis of OA includes mechanisms related to skeletal calcification (1). Hence, the likely protective role of milk on the microarchitecture of bone may have dilatory effects for the development of OA. It can be supposed that a change of diet after diagnosis might be possible.

Although we do not know the relationship between vitamin D levels and the occurrence of knee OA, it has been reported that low vitamin D intake is associated with the progression of knee OA (8). In spite of the high sun exposure in Turkey, veiled women in comparison with unveiled women did not show vitamin D insufficiency, suggesting diet as the major source of vitamin D in Turkish subjects (19). Thus, it can be deemed that the low milk consumption in our patients with symptomatic knee OA corresponds to low vitamin D levels.

As yet there are no data regarding the preventive effect of milk on OA. We suggest that longitudinal studies are required to confirm the results of our cross-sectional study and evaluate the relationship between the symptoms of OA and the quantity of milk consumed in the daily diet.

To our knowledge, there is no data in the literature concerning the association between tea consumption and human OA. It was reported that the catechins found in green tea might have anti-inflammatory effects by inhibiting tumor necrosis factor-α, and chondroprotective effects by inhibiting the breakdown of proteoglycans and type II collagen (20-22). Black tea also contains catechins relatively in lower quantities than green tea (22,23). While we did not inquire about type of tea consumed (it is known that the consumption of black tea is very high in Turkey), the rate of OA was significantly lower in tea consumers. We do not know whether tea consumers have a lower body weight, analogous to cigarette smokers. The beneficial effect of lower body weight on OA is obvious; however, in our study we did not measure the body mass index in the enrolled individuals. We found no association between coffee consumption and symptomatic knee OA; this may be linked to the uncommon consumption of coffee in Turkey.

It was reported that fish oil had beneficial effects on inflammatory rheumatic diseases. Those effects were suggested to be due to the omega 3 polyunsaturated fatty acids and eicosapentoenoic acid found in fish oil, especially that of cold water fish (3). Our study revealed no association between symptomatic knee OAand the frequency of fish consumption, although it should be emphsized that fish consumption is very low in Turkey. On the other hand, a previous study reported that fish oil was ineffective in the management of OA(3).

In conclusion, decreased milk consumption is associated with the occurrence of symptomatic knee OA. However, prospective studies are needed to determine whether there is a causal relationship between milk consumption and the occurrence of knee OA.

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