Vitamin C Intake and Risk Factors for Knee Osteoarthritis

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Abstract

Background: Knee osteoarthritis (OA) is a degenerative disease of the knee joints characterized by progressive softening and disintegration of articular cartilage. In OA, which is influenced by several risk factors, free radicals are increased by local ischemia in the cartilage. As an exogenous antioxidant, vitamin C also plays an important role in collagen and glycosaminoglycan synthesis. This study was carried out to identify vitamin C intake as well as risk factors in knee OA.

Methods: The study population was determined by non-probability sampling with convenient approach to knee OA patients at the Rheumatology Outpatient Clinic of Dr. Hasan Sadikin General Hospital in October–November 2013. Data were obtained through questionnaire interview about risk factors, severity index of OA and vitamin C intake profile. Data presentation was conducted by descriptive method.

Results: There were 47 patients diagnosed with knee OA in the Rheumatology Outpatient Clinic. The result showed that 7 patients (14.9%) had low vitamin C intake for the last 3 months. There were 30 patients with family history of OA (63.8%). Thirty two patients (68.1%) were passive smokers, 44 patients (93.6%) had history of repeated use of knee joints and majority of respondents had obesity.

Conclusions: Most of the subjects have sufficient vitamin C intake and more than half have risk factors that may contribute to the incidence of knee OA.

Keywords: Knee osteoarthritis, risk factors, vitamin C intake

Introduction

The disease pattern of the developing world has shifted from infectious and acute diseases to chronic and degenerative diseases.[1] Osteoarthritis (OA) is a degenerative joint disease associated with damage to the joint cartilage and one of the 10 most common disabilities in the developing country. The OA most frequently attacks the spine, hip, knee and ankle. The prevalence of OA is about 50–60% from 23.6–31.3% of the total patients with joint disease in Indonesia.[2] Prevalence of knee OA is quite high at 14.9% in women and 8.7% in men.[3]

In OA, free radicals level elevated in cartilages by local ischemia degrade its components, triggering synovial and immune responses that promotes further cartilage damage.[4] To protect the cells and organ systems, humans have evolved a highly sophisticated antioxidant protection system, which can be either naturally produced in situ (endogenous) or externally supplied through foods and supplements (exogenous).

As one of the exogenous antioxidants, vitamin C is critical to bone health, acting as sulfate carrier in glycosaminoglycan synthesis which may be relevant to OA etiology because depletion of sulfated proteoglycans from the articular cartilage extracellular matrix is one of the earliest expressions of OA, which eventually leads to degeneration of the cartilage.[5] Concentration of vitamin C in the body is mostly determined by its dietary intake. Adequacy of vitamin C in the body may help to slow down the progression of OA.

The objectives of this study was to identify the dietary intake of vitamin C and risk factors for knee osteoarthritis

Methods

This study was conducted in the Rheumatology Outpatient Clinic of Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia

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from October to November 2013. This study was approved by the Health Research Ethics Commitee of the Faculty of Medicine, Universitas Padjadjaran. The sampling method used was non-probability sampling (convenience sampling) and the minimal sample needed for this study was determined through the categorical descriptive formula. Data was taken from 46 patients who were diagnosed as having knee osteoarthritis (OA) by doctors of the Rheumatology Outpatient Clinic of Dr. Hasan Sadikin General Hospital Bandung, and was validated by the consultant of rheumatology. The subjects were patients who fulfilled the inclusion and exclusion criteria. The inclusion criteria were patients aged 40–70 years as well as willing to answer the questions in the questionnaire. The exclusion criteria were patients with dementia, patients who had knee traumatic history and had undergone menisectomy (knee joint surgery). Furthermore, respondents were asked to sign the inform consent form, and then interviewed using a questionnaire for identification of risk factors related to osteoarthritis. The Western Ontario and McMaster Universities Arthritis Index (WOMAC) form was used to classify respondents OA severity and the Food Frequency Questionnaire (FFQ) form to find out about the respondents dietary vitamin C intake for the last 3 months which were obtained through frequency and amount of fruit and vegetables that respondents ate every day or week or month.

Respondents were asked to indicate risk factors such as lifestyle information about smoking routine as well as history of smoking and passive smokers history at home, metabolic information about body weight history and body height, biomechanical factor information about occupational history and history of daily activities that included repeated use of knee joints, and genetic information about family history of knee OA.

The WOMAC form consists of 24 questions divided into 3 parts. Part 1 is about the pain that the patient feels for the last 48 hours when doing 5 activities, for example: walking on a flat surface, going up and down stairs, disturbing pain at night while sleeping, sitting or lying and standing upright. Part 2 is about stiffness or a sensation of decreased ease in moving joint that the patient has in their knee during the last 48 hours while doing these 2 activities: after awakening in the morning and after sitting, lying, or resting in the day. Part 3 consists of 17 questions about difficulties the patient has experienced in doing daily physical activities due to the patient's hip/knee during the last 48 hours, this mean the ability to move around and look after oneself. Each of the questions is scaled from 0–10 by visual analog scale. Afterwards, each of the respondents' severity indices are calculated and classified into 3 classes of OA severity from mild, moderate to severe.

The FFQ is a tool used to assess individual dietary intake history using a list of foods on which respondents report their usual consumption frequency over a given period. The quantitative food frequency used in this study included more precise food portion size estimates in household measures. The FFQ used in this study consisted of a list of fruit and vegetable containing vitamin C, their frequency every day, week and month as well as each portion size. Seasonal fruit and vegetable were excluded in this questionnaire to minimize bias.

The statistical analysis was calculated by used of Microsoft Office Excel. The presentation of data was performed by used of the descriptive method through frequency distribution tables about dietary intake of vitamin C, risk factors of knee OA and WOMAC severity index of OA.

Results

This study discovered that most of the patients were middle-aged females. Most of the respondents completed the senior high school (38.3%). Based on the respondent's occupation, 46.8% were government employer (Table 1).

Dietary intake of vitamin C was assessed using the Food Frequency Questionnaire. This questionnaire assessed the daily fruit and vegetable containing vitamin C intake of respondents for the last 3 months. Only 7 patients (14.9%) had low daily dietary intake of vitamin C (Table 2).

Furthermore, risk factors for knee OA were determined by what was presented, mostly the respondents were passive smokers in their home (68.1%) and 53.2% of the respondents had body mass index (BMI) more than normal which was divided into 2 categories, overweight and obese. More than a half of knee OA patients showed history of repeated use of knee joints in three categories, stood for 2 hours or more (59.6%), walked for 2 hours or more (57.4%) and went up and down stairs for more than 2 times (51.1%). Family history was present in 25 patients (53.2%) (Table 3).

Knee OA severity of each patient was

Table 1 Characteristic of Respondents

Characteristic	Frequency	%
Sex		
Female	42	89.4
Male	5	10.6
Age (years old)		
< 50	7	14.9
50–60	26	55.3
> 60	14	29.8
Education level		
Did not graduate elementary school	1	2.1
Graduated elementary school	6	12.8
Graduated junior high school	2	4.3
Did not graduate senior high school	1	2.1
Graduated senior high school	18	38.3
Graduated academy	10	21.3
Graduated scholar	8	17
Graduated magister	1	2.1
Occupation		
Government employer	22	46.8
Entrepreneur	2	4.3
Retired	10	21.3
Housewife	12	25.5
Never worked	1	2.1

assessed using the WOMAC form. There were 41 patients (87.2%) with mild osteoarthritis and 6 patients (12.8%) with moderate osteoarthritis. There was no patient with severe osteoarthritis (Table 4).

Discussion

This study discovered that several risk factors contributed to the incidence of knee osteoarthritis. The percentage of people with knee OA aged less than 50 years was lower than those aged older than 50 years. This findings was similar to a study conducted by Patil et al.[6] The proportion of women with disorders was higher compared to men. A study carried out by Patil et al.[6] also observed that OA is higher in women (65.7%) than men (34.3%). Patients, who graduated from academy and above, show lower incidence of

Table 2 Dietary Intake of Vitamin C Classification

RDA Classification	Frequency	%
Low (<75 mg)	7	14.9
Normal (75–1000 mg)	40	85.1
Excess (>1000 mg)	0	0
Total	47	100

Note : RDA = Recommended Dietary Allowance

Table 3 Risk Factors for Knee Osteoarthritis

Risk Factors	Frequency	%
Active smoker		
Yes	4	8.5
Used to	6	12.8
No	37	78.7
Passive smoker		
Yes	32	68.1
No	15	31.9
Body mass index		
Normal	22	46.8
Overweight	9	19.2
Obese	16	34
History of repeated use of knee joints		
Lifting/pushing heavy objects	20	42.6
Stands for 2 hours/more	28	59.6
Walks for 2 hours /more	27	57.4
Up and down stairs more than 2 times	24	51.1
Squat for more than 2 hours/repeatedly	15	31.9
Family history of knee osteoarthritis		
Yes	25	53.2
No	21	44.7
Unknown	1	2.1

knee osteoarthritis compared to the patients with lower educational level. It was suspected that the higher the level of education, the higher the level of knowledge and awareness of health was.

Based on the respondents' characteristics, the public servants occupation showed a higher level of osteoarthritis (46.8%) than other occupations. This difference might be due to the lack of physical activity, mobility, social issues as well as work that put extra load on the knee joints (e.g. lifting patients and pushing beds for nurse as public servants).[7]

Dietary intake of vitamin C assessed by the Food Frequency Questionnaire showed 85.1% of patients had normal vitamin C intake based on *Angka Kecukupan Gizi Indonesia* (AKG), 2004, while the rest of 14.9% patients had low level of vitamin C intake. This result roughly correlated with the literature which stated that higher plasma vitamin C is found in patients with lower grade of OA, and in this study 41 patients (87.2%) had mild OA severity index.[8]

Other risk factors was smoking. This study

Table 4 Knee Osteoarthritis Severity

WOMAC Classification	Frequency	%
Mild (<=80)	41	87.2
Moderate (81–160)	6	12.8
Severe (>160)	0	0
Total	47	100

Note: WOMAC = The Western Ontario and McMaster Universities Arthritis Index

revealed that most of the patients were passive smokers which proved the free radical theory of OA was caused by many factors such as smoking, both active and passive, pollutants, and free radicals produced by environment around the patients.[9]

More than half of the patients had body mass index higher than normal (53.2%), this is in agreement with the risk factors of OA found in the study conducted by Patil et al.[6]

Moreover, the history of repeated use of the knee was observed as 42.6% for lifting or pushing heavy objects, 59.6% for standing for 2 hours or more, 57.4% for walking for 2 hours or more, 51.1% for climbing up and down stairs for more than 2 times and 31.9% for squatting for more than 2 hours or repeatedly. These results agreed with the theory of repetitive use of knee joints as risk factors for developing knee OA. It was stated that workers performing repetitive tasks as part of their occupations for many years are at high risk of developing OA in the joints they use repeatedly for example, workers whose jobs require regular knee bending or lifting or carrying heavy loads have a high rate of knee OA.[10]

Additionally, osteoarthritis is also influenced by genetic factors such as familial history, it corresponded with the results of our study which showed more than a half of the patients (53.2%) had family history of knee osteoarthritis from their mother, father, or other siblings.[10]

This study had limitations. The use of food frequency questionnaire that rely on the patient's memory may cause a recall bias. Moreover, to understand what the researcher asked and the patient's cooperation may lead to bias.

In conclusion, most of the respondents have sufficient profile of vitamin C intake. More than a half of the respondents have significant risk factors which may contribute to the incidence of knee osteoarthritis. These risk factors can be prevented with a healthy lifestyle as well as awareness of factors that may induce osteoarthritis in the later life.

References

1. WHO. Global health and aging. National Institute on Aging, National Institute of Health, U.S. Department of Health and Human Services; 2011.p.9–11.
2. Nainggolan O. Prevalensi dan determinan penyakit rematik di Indonesia. Maj Kedokt Indon. 2009;59(12):588–94.
3. Quintana JM, Arostegui I, Escobar A, Azkarate J, Goenaga Jl, Lafuente I. Prevalence of knee and hip osteoarthritis and the appropriateness of joint replacement in an older population. Arch Intern Med. 2008;168(14):1576–84
4. Ziskoven C, Jager M, Zilkens C, Bloch W, Brixius K, Krauspe R. Oxidative Stress in secondary osteoarthritis: from cartilage destruction to clinical presentation? Orthop Rev (Pavia). 2010;2(2):e23.
5. Peregoy J, Wilder FV. The effects of vitamin C supplementation on incident and progressive knee osteoarthritis: a longitudinal study. Public Health Nutr. 2011;14(4):709–15.
6. Patil PS, Dixit UR, Shettar CM. Risk factors of osteoarthritis knee – a cross-sectional study. IOSR JDMS. 2012;2(5):8–10.
7. Palmer KT. Occupational activities and osteoarthritis of the knee. Br Med Bull. 2012;102:147–70.
8. Naskar DS, Dawn DI, Sarkar DS, De DC, Biswas DG. A comparative study between plasma vitamin c level and severity of knee osteoarthritis. IOSR-JDMS. 2013;4(1):10–4.
9. Loeser RF. Molecular mechanisms of cartilage destruction in osteoarthritis. J Musculoskelet Neuronal Interact 2008;8(4):303–6.
10. Felson DT. Osteoarthritis. In: Anthony S, Fauci M, editor. Harrison's rheumatology. 2nd ed. New York: The McGraw-Hill Companies, Inc.; 2010. p. 223–34.