A STUDY ON THE INFLUENCE OF ENVIRONMENTAL FACTORS IN OSTEOARTHRITIS

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ABSTRACT

BACKGROUND

Osteoarthritis is a common rheumatological disorder of unknown cause. The development of rheumatological disorders like osteoarthritis depend on the interaction between genetic background and a number of environmental factors. Environmental factors implicated in the aetiology of rheumatic diseases include trauma, sunlight, cold climate, smoking, drugs and adjuvants, diet, exercise, occupation, radiation exposure, drinking water, psychological stress, air pollution, chemicals, drugs, socioeconomic status, geographic location, hot and cold climate, occupation and alcohol.

MATERIALS AND METHODS

This is a cross sectional observational study. The sample selected was of 174 patients with osteoarthritis fulfilling the ACR criteria. The tools used were clinical profile, ACR criteria for OA, serology, X-rays and acute phase reactants. The data was analyzed using SPSS software.

RESULTS

In the study, most of the osteoarthritis patients were females. In the study, majority of the patients with osteoarthritis resided in high ranges, were smokers and non-alcoholics. Osteoarthritis is common in patients taking non-vegetarian diet, manual labourers, those with low level of education and low socio-economic status. Most of the patients with OA had aggravation of symptoms following exposure to cold and stress. Patients who resided in high ranges, smokers, alcoholics, manual labourers, who had low level of education and belonged to low socio-economic class had frequent aggravation of symptoms.

CONCLUSION

In the study, most of the osteoarthritis patients were females. Environmental factors like smoking, alcoholism, diet, occupation, educational status, socioeconomic status, place of residence, climatic conditions and stress significantly influenced the occurrence and progression of symptoms in osteoarthritis patients.

KEYWORDS

Osteoarthritis, Environmental Factors.

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BACKGROUND

Osteoarthritis (OA) is a common degenerative joint disease. It is characterized by slow and progressive deterioration of articular cartilage, followed by new born formation. Distal and proximal interphalangeal joints of the hands, knees hips, lumbar and cervical spine are the joints commonly involved in OA[1]. Osteoarthritis is classified as idiopathic or primary osteoarthritis, secondary osteoarthritis, and erosive OA osteoarthritis.

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Epidemiology

Osteoarthritis is common in old age but can occur in any age, especially as a result of joint, chronic inflammatory arthritis or congenital malformation. As a result of spinal stenosis patients may present with aching or pain in the legs or buttocks on standing or walking. In some patients, weakness of upper and lower limbs can occur.

Pathology and Pathogenesis

In OA progressive destruction and loss of articular cartilage occurs. The exposed subchondral bone becomes sclerotic, with increased vascularity and cyst formation. Attempts at repair produce cartilaginous growths at the margins of the joint which later become calcified (osteophytes).

Mechanisms Involved in Pathogenesis

- Metalloproteinases, such as stromelolysin and collagenase, degrade the cartilage components collagen and proteoglycans.

- Environmental factors like food, life style, climatic conditions, occupation, socio economic status are involved in causation and progression of OA.
- Inflammatory mediators such as interleukin-1 and tumor necrosis factor-a stimulate metalloproteinase production and inhibit collagen production.
- Genetic susceptibility (35-65%) influence from multiple genes, currently unidentified, rather than a single gene defect.
- Deficiency of growth factors such as insulin-like growth factor and transforming growth factor impairs matrix repair.

Most OA is primary with no obvious predisposing factor. Secondary OA occurs in joints that have been damaged in some way (e.g. intra-articular fractures, avascular necrosis) or are congenitally abnormal (e.g. slipped femoral epiphysis).

Clinical Features

The most important symptom is pain in and around the joints which is localized, intermittent, deep aching and occurs in a symmetrical fashion. The pain is aggravated by joint use and rest relieves pain.[2] Bony swelling occur at the DIPJ (Heberden's Nodes) and PIPJ (Bouchard's nodes). In the knee, cartilage loss due to OA can result in deformity with varus ('bowleg') or valgus ('knock-knee') angulation. A fluctuant swelling along the posterior aspect of the knee, popliteal or Baker's cyst occurs in some patients with a knee effusion.

Diagnosis

Diagnosis of OA is clinical aided by a detailed history, investigations like X-ray, synovial fluid analysis and MRI of involved joints.

Investigations

- FBC and ESR are normal.
- X-rays shows narrowing of the joint space.
- MRI demonstrates early cartilage changes.
- Arthroscopy shows fissuring and surface erosion of the cartilage, but is unnecessary for diagnosis.

Management

Treatment should aim at symptom relief and prevention of disability. Obese patients should be encouraged to lose weight, particularly if weight-bearing joints are affected. Treatment measures includes patient education and non-pharmacological measures, drugs, and surgical measures. Local strengthening and aerobic exercises maintain muscle power and improve the mobility of weight-bearing joints. Excess exercise can cause progression of knee OA and hip OA. Application of local antiinflammatory ointments followed by application of heat can produced pain relief. Hydrotherapy may be helpful.

Drugs

Non-steroidal anti-inflammatory drugs (NSAIDs), e.g. ibuprofen, are indicated in patients who do not respond to simple analgesia and should ideally be used on an intermittent rather than a continuous basis. NSAIDs inhibit cyclo-oxygenase (COX, prostaglandin synthetase) with reduced production of prostaglandins, thromboxane and prostacyclin.

Diacerein IL-I inhibit metalloproteinases which is concerned with cartilage destruction. Tanezumab is a newer experimental drug for OA.

- Intra-articular steroids can be used for inflammatory exacerbations, but systemic corticosteroids are not used. For radicular symptoms epidural steroid injections can be given.
- Surgical strategies in osteoarthritis includes osteotomy, arthrodesis, synovectomy and removal of loose bodies from the joints. Other treatment strategies include transcutaneous electrical nerve stimulation, acupuncture, use of walking aids, knee braces, cervical collar, lumbar corset, use of local heat. Surgical intervention may include total hip and knee replacement.

Need and Significance of the Study

It is seen that rheumatological disorders are common in the general population and it's a common observation that aggravation of almost all rheumatological disorders occur during winter or during rainy season in Kerala and South India. Similar observations have been made in western countries.

Estimate of heritability suggest that genetic factors are responsible for at least 50% of the risk of developing RA. This means that gene-environment interactions and environmental factors could explain the rest. Evidence suggests that environmental factors important in RA may act years before clinical disease become apparent. Achilles tendinitis seen in long distance runners and prepatellar bursitis in housemaid's knee are other examples of occupation -related rheumatic disorders. Enthesopathies like lateral and medical epicondylitis of elbow (syn. Tennis elbow and golfer's elbow) are common in Indian household workers. It has been found that higher risk is present in long distance runners for developing hip and knee OA[3]. Osteoarthritis has been associated with occupations where exposure to vibrations, repetitive trauma, knee bending or lifting heavy weight are involved such as in farmers, truck drivers, quarry workers and manual labourers. Environmental factors lead to the progression and aggravation of signs and symptoms of rheumatological diseases. Although a number of studies have been done regarding the role of genetics but only a few studies have been done regarding the influence of environmental factors in OA.

Objectives of the Study

1. To study the influence of environmental factors among individuals with osteoarthritis based on-
   a. Gender
   b. Locale
   c. Smoking habits
   d. Alcoholism
   e. Diet

2. To compare the influence of external environmental factors among individuals with osteoarthritis disorders based on
   a. Occupational status
   b. Educational status
   c. Socio-economic status

3. To study the influence of a. cold climate b. stress based on aggravation of symptoms in osteoarthritis

Hypothesis

1. There will be no influence of environmental factors in osteoarthritis
2. There will be no difference in the prevalence of osteoarthritis between males and females.
3. There will be no difference in the prevalence of osteoarthritis based on occupation, education and socio-economic status.
4. Rheumatological disorders will be more common in older age group compared to younger patients.

MATERIALS AND METHODS

The study was Quasi experimental in nature and the study design was cross sectional observational. The population was patients with rheumatological disorders attending the rheumatology clinic the sample of present study consists 174 patients with osteoarthritis attending the rheumatological clinic at Medical College, Kottayam, Kerala from the district of Kottayam, Ernakulam, Idukki, Pathanamthitta and Alappuzha.

Independent variable was environmental factors and the Extraneous variables are age, sex, birth, weight, educational status and place of residence.

The tools like Baseline proforma, Observational check list along with standardized instruments like weighing machine and measuring tape were used for collecting the anthropometric measurements of the patients Feedback schedule was also administered among patients under gone treatment. The data were analysed using simple percentage analysis

Study Design

Cross sectional observation study.

Inclusion Criteria

- All patients diagnosed with osteoarthritis according to ACR radiologic and clinical criteria for OA.
- Patients with no previous history of long-term treatment for other chronic illness.
- Patients with more than 10 years period of residence in particular geographic area.
- Patients had smoking habit more than 10 years.
- Patients had duration of consumption of alcohol was taken as more than 10 years with more than 3 drinks weekly.

Exclusion Criteria

- Patients with other co-morbid medical illness.
- Patients undergoing treatment for other co-morbid medical problems.

Analysis and Interpretation of Data-

I. Prevalence of Osteoarthritis in The Study

a. Prevalence of Osteoarthritis Patients Based on Gender

The number and percentage of patients with osteoarthritis were calculated and tabulated as shown below.

Gender	Osteoarthritis	
	Number	Percentage
Male	76	43.67
Female	98	56.32
Total	174	100

Table 1. Number and Percentage of Patients with OA Based on Gender

Out of 174 patients with osteoarthritis 76 patients (43.67) were male patients whereas 98(56.32) patients were female patients.

b. Distribution of Osteoarthritis Patients Based on The Geographic Area/Locale of Residence

The total of OA patients from geographic area/locale of residence were subjected to percentage analysis based on gender and tabulated as shown below.

Place of Residence	Number of Patients	Percentage
High Ranges	97	55.74%
Plains	45	25.86%
Coastal Area	32	18.39%

Table 2. Number and Percentage of OA Patients Based on The Geographic Area of Residence

Out of the 174 patients with osteoarthritis 97 patients (55.74%) resided in the high ranges and hilly areas whereas 45 patients (25.86%) resided in the plains and lowlands. 32 patients (18.39%) came from the coastal area. Of the 97 patients who resided in high ranges and hilly areas 88 patients (90.72%) had frequent aggravation of symptoms.

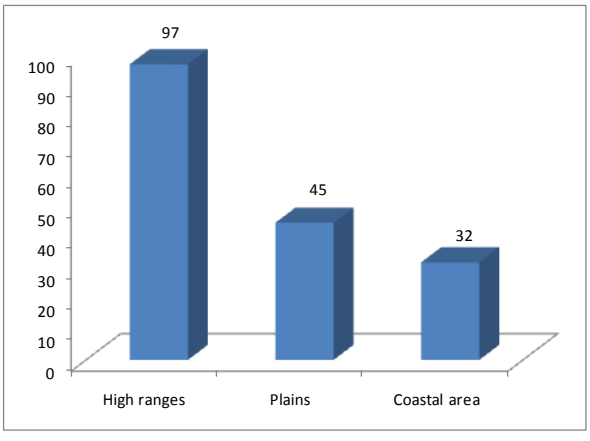

Figure 1. Number of OA Patients Based On Geographical Area of Residence

c. Distribution of Osteoarthritis Patients With/Without Smoking Habits Based on Gender

The total of OA patients with/without smoking were subjected to percentage analysis based on gender and tabulated as shown below.

Gender	Smoker		Non-Smoker	
	Number	Percentage	Number	Percentage
Male	56	73.68	20	26.31
Female	10	10.20	88	89.79

Table 3. Number and Percentage of OA Patients With/Without Smoking Habit

Out of the 56 male patients 56 patients were smokers whereas 20 patients were non-smoker. Among the female participants of the study 10 patients were smoker whereas only 88 patients were nonsmokers. Of the 66 smoker OA patients 60 patients (90.90%) had frequent aggravation of symptoms.

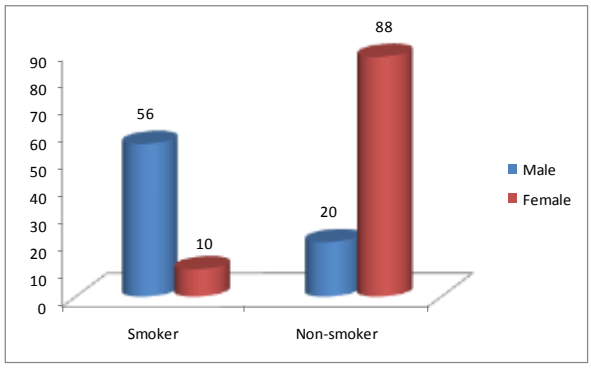

Figure 2. Number of OA Patients With/Without Smoking Habit Based on Gender

d. Distribution of Osteoarthritis Patients With/Without Alcohol Consumption Based on Gender

The total of OA patients with/without alcohol consumption were subjected to percentage analysis based on gender and tabulated as shown below.

Gender	Alcoholic		Non-Alcoholic	
	Number	Percentage	Number	Percentage
Male	25	32.89	51	67.10
Female	12	12.24	86	87.75

Table 4. Number and Percentage of OA Patients With/Without Alcoholic Consumption

In the study 174 patients with osteoarthritis of the 76 male patients 25 were alcoholic whereas 51 were nonalcoholic. Of the 37 alcoholic OA patients 30 patients (81.08) had frequent aggravation of symptoms.

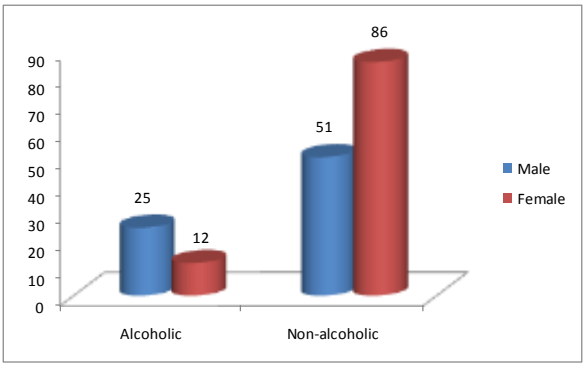

Figure 3. Number of OA Patients With/Without Alcohol Consumption Based on Gender

e. Distribution of Osteoarthritis Patients in The Study Based on Dietary Habits

No. of Patients	Vegetarian	Non-Vegetarian	Mixed Diet
174	23(13.21%)	115(66.05%)	36(20.68%)

Table 5

Of the 174 osteoarthritis patients 23 patients were vegetarians, 150 patients were non-vegetarian and of the rest 36 patients consumed mixed diet. Of the 115 patients consuming mixed diet 96 patients (83.47%) had frequent aggravation of symptoms.

II. Prevalence of Osteoarthritis Patients Based on External Environmental Factors

a. Distribution of Osteoarthritis Patients Based on Occupation Status

The total of OA patients based on occupational status were subjected to percentage analysis based on gender and tabulated as shown below.

Occupation	Number	Percentage
Manual Labourers and Technicians	100	57.47
Office Workers	35	20.11
High Officials	39	22.41

Table 6. Number and Percentage of RA Patients Based on Occupation Status

Out of the 174 patients with osteoarthritis, 100 (57.47%) were manual labourers and technicians, 35(20.11%) were office workers, and the rest 39 (22.41%) were high officials. Of the 100 OA patients who were manual labourers 85 (85%) patients had frequent aggravation of symptoms.

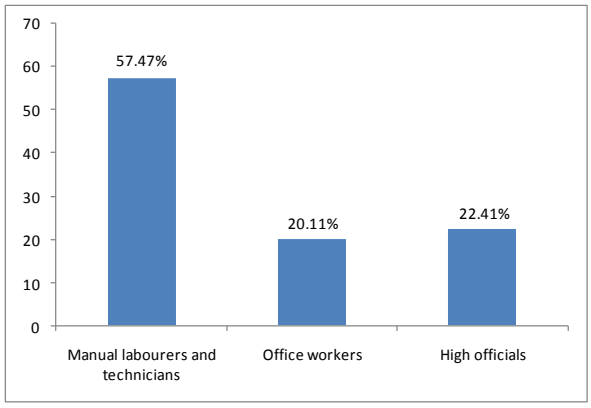

Figure 4. Occupation Status of OA Patients (Percentage)

b. Distribution of Osteoarthritis Patients Based on Educational Status

The total of OA patients based on educational status were subjected to percentage analysis and tabulated as shown below.

Education Status	Number	Percentage
Secondary	64	36.78
Higher secondary	60	34.48
Graduation	32	18.39
Post-graduation & above	18	10.34

Table 7. Number and Percentage of OA Patients Based on Educational Status

Out of 174 patients with osteoarthritis 64 patients (36.78%) had studied up to 10th standard, 60 patients (34.48%) had studied at pre-degree, 32 patients (18.39%) up to degree, and the rest 18 patients (1034%) had post-graduation or higher qualification. Of the 64 patients having education up to sec level 50 patients (78.12%) had frequent exacerbation of symptoms.

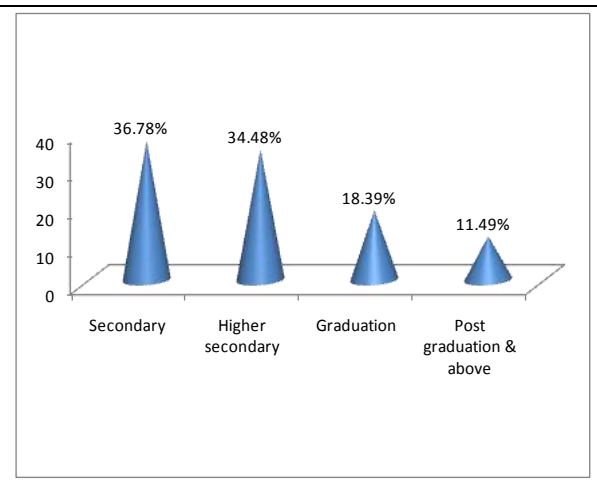

Figure 5. Education Status of OA Patients (Percentage)

c. Distribution of Osteoarthritis Patients Based on Socio-Economic Status

The total of OA patients based on socio economic status were subjected to percentage analysis and tabulated as shown below.

Socio Economic Status	Number	Percentage
High	38	21.83
Middle	41	23.56
Low	95	54.59

Table 8. Number and Percentage of OA Patients Based on Socio Economic Status

Out of the 174 patients with osteoarthritis, 38 (21.83%) belonged to high category, in middle socio-economic group 41 patients (23.56%), and the rest 95 (54.59%) belonged to low socio-economic status. Out 0f the 95 patients belonging to low socio-economic class 80 Patients (84.21%) had frequent aggravation of symptoms.

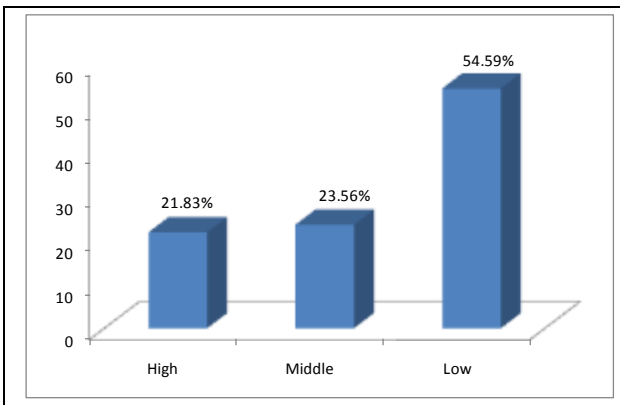

Figure 6. Socio Economic Status of OA Patients (Percentage)

III. Distribution of Osteoarthritis Patients Based on Aggravation of Symptoms Depending On A) Climatic Conditions, B) Stress

a. Distribution of Osteoarthritis Patients Based on Climate

The total of RA patients with/without exposure to cold were subjected to percentage analysis based on gender and tabulated as shown below.

Total	Aggravation of symptoms on exposure to cold		No aggravation on exposure to cold	
	Number	percentage	Number	Percentage
174	148	85.05	26	14.94

Table 9. Distribution of Osteoarthritis Patients With/Without Exposure to Cold

Of the total 174 patients with osteoarthritis 148 (85.05) had aggravation of symptoms following exposure to cold whereas only 26 (14.94%) had no aggravation of symptoms following exposure to cold.

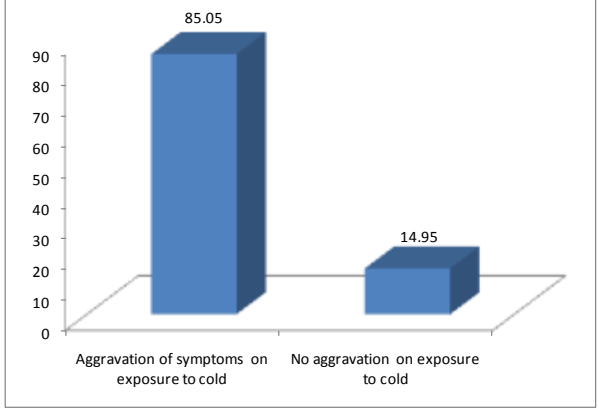

Figure 7. Number of OA Patients With/Without Aggravation of Symptoms Based on Exposure to Cold Percentage

b. Aggravation of Symptoms in Osteoarthritis Patients with Stressors

No. of Patients	Symptoms Aggravated		No Aggravation of Symptoms	
	No	%	No	%
174	146	83.90	28	16.09

Table 10

Of the 174 osteoarthritis patients who took part in the study 146 patients (83.90%) had aggravation of symptoms following stressors, and 28 patients (16.09%) reported no aggravation of rheumatological symptoms.

RESULTS

1. Out of 174 patients with osteoarthritis 76 patients (43.67%) were male patients whereas 98(56.32) patients were female patients.
2. Out of the 174 patients with osteoarthritis 97 patients (55.74%) resided in the high ranges and hilly ranges whereas 45 patients (25.86%) resided in the plains and lowlands. 32 patients (18.39%) came from the coastal area. Of the 97 patients who resided in high ranges and hilly areas 88 patients (90.72%) had frequent aggravation of symptoms
3. Out of the 76 male patients 56 patients were smoker whereas 20 patients were non-smokers. Among the female participants of the study 10 patients were smokers were as 88 patients were nonsmoker. Of the 66 smoker OA patients 60 patients (90.90%) had frequent aggravation of symptoms.
4. In the study 174 patients with osteoarthritis of the 76 male patients 25 were alcoholic whereas 51 were nonalcoholic of the 37 alcoholic OA patients 30 patients (81.08) had frequent aggravation of symptoms.
5. Of the 174 osteoarthritis patients 23 patients were vegetarians, 150 patients were non-vegetarians and of the rest 36 patients consumed mixed diet. Of the 115 patients consuming mixed diet 96 patients (83.47) had frequent aggravation of symptoms.
6. Out of the 174 patients with osteoarthritis, 100 (57.47%) were manual labourers and technicians, 35(20.11%) were office workers, and the rest 39 (22.41%) were high officials. Of the 100 OA patients who were manual labourers 85 (85%) patients had frequent aggravation of symptoms.
7. Out of 174 patients with osteoarthritis 64 patients (36.78%) had studied up to 10th standard, 60 patients (34.48%) had studied at pre-degree, 32 patients (18.39%) up to degree, and the rest 18 patients (11.49%) had post-graduation or higher qualification. Of the patients having education up to sec level 50 patients (78.12) had frequent exacerbation of symptoms.
8. Out of the 174 patients with osteoarthritis, 38(21.83%) belonged to high category, in middle socio-economic group 41 patients (23.56%), and the rest 95 (54.59%) belonged to low socio-economic status. Out of the 95 patients belonging to low socioeconomic class 80 Patients (84.21%) had frequent aggravation of symptoms.
9. Of the total 174 patients with osteoarthritis 148 (85.05) had aggravation of symptoms following exposure to cold whereas only 26 (14.95%) had no aggravation of symptoms following exposure to cold.
10. Of the 174 osteoarthritis patients who took part in the study 148 patients (85.05%) had aggravation of symptoms following stressors, and 26 patients (14.95%) reported no aggravation of rheumatological symptoms.

DISCUSSION

In the study conducted out of the 174 osteoarthritis patients 76 were males whereas the rest 98 were females. This was similar to the study done by Zhang Y et.al. where the majority of patients were females.[4] In our study out of the 174 patients with osteoarthritis 97 patients (55.74%) resided in the high ranges and hilly areas whereas 45 patients (25.86%) resided in the plains and lowlands. 32 patients (18.39%) came from the coastal area and the results were similar to the study of Haq SA at al where the prevalence of osteoarthritis was higher in the rural population.[5] In our study out of the total 40 male patients 32(80%) patients were smokers whereas 8 patients were nonsmokers and similar findings were got in the NHS study were a linear relationship between smoking and risk of osteoarthritis whereby increasing doses of cigarettes (pack –years of smoking) was associated with an increased risk of OA.[6] In the study out of 40 male patients with osteoarthritis 32 (94%) were alcoholic whereas 8 patients (20%) were nonalcoholic and similar findings were observed in the HenrikKällberg, et al study were alcohol consuming people had statistically significant risk of osteoarthritis.[7] Of the 152 osteoarthritis patients 22 patients were vegetarians, 78 patients were non vegetarian and in the rest 52 patients consumed mixed diet and similar observations where increased red meat and protein intake was associated with an increased risk of inflammatory arthropathy.[8] Out of the

152 patients with osteoarthritis, 90 (59.21%) were manual labourers and technicians, 42 (27.63%) were office workers, and the rest 20 (13.15%) were high officials and similar observations where got in studies which showed patients whose occupation required manual labour the risk of osteoarthritis was high. In the study 64 patients (36.78%) had studied up to sec level, 60 patients (34.48%) up to higher secondary level, 32 patients (18.39%) up degree and the rest 18 patients (11, 49%) had post-graduation or higher qualification and these results are similar population based case control study in Callahan LF, et al. in which the risk of OA in patients without university degrees was 40% higher compared with those with university degrees.[9] In the study of 152 patients with osteoarthritis, 20 (13.15%) belonged to high category, 50 (32.89%) belonged to middle category and the rest 82 (53.94%) belonged to low socio economic status and similar findings where got in the study conducted by Cleveland RJ, Schwartz TA, Prizer LP, et al where higher incidence of osteoarthritis was found in patients with low socio economic status.[10]

Of the total 174 patients with osteoarthritis 148 (85.05%) had aggravation of symptoms following exposure to cold were as only 26 (14.95%) had no aggravation of symptoms following exposure to cold and similar results have been obtained in studies conducted by Aikman.H et al.[11]

Of the 174 with osteoarthritis patients who took part in the study 146 patients (83.90%) had aggravation of symptoms, following stressors, and 28 patients (16.09%) reported no aggravation of rheumatological symptoms and similar results have been observed in osteoarthritis where stress exacerbates rheumatological diseases.[12]

CONCLUSION

The cause of development and progression of osteoarthritis are multi factorial of which environmental factors are very important. In several studies the association of osteoarthritis and environmental factors have been under-estimated and more importance given to genetic aetiology. In our study, environmental factors like smoking, alcoholism, diet, occupation, educational status, socio-economic status, place of residence, climatic conditions and stress significantly influenced the occurrence and progression of osteoarthritis. Genetically susceptible patients after exposure to a particular environmental factor can develop osteoarthritis as the environmental factors may be the cause for that particular rheumatological disorder. More knowledge about the environmental factors help in broadening our knowledge of how and what extent these environmental factors are involved in the causation of osteoarthritis and how alteration or manipulation of the environmental factors can help in preventing the causation and progression of osteoarthritis. It will also help in gaining more knowledge about gene environmental interaction in cases of rheumatological disorders. Along with life style modification, modification of the other environmental factors, judicious use of drugs can go a long way in the better management of osteoarthritis and preventing the exacerbation of symptoms.

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