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**Chapter 4**

# Prevelence of depression in patients with osteoarthritis and its relationship with associated pain and physical disability – A Descriptive Cross-sectional Questionnaire Based Study

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## Abstract

**Aim and Objective:** This study was aimed at establishing a correlation between disease activity (Total WOMAC Score), pain (VAS-during interview, WOMAC Pain-while doing activities), stiffness (WOMAC Stiffness Score), disability (WOMAC Disability Score), duration of disease (caused due to osteoarthritis) to prevalence of comorbid depression (BDI).
**Methodology:** This is a descriptive cross-sectional questionnaire-based study on 151 participants with osteoarthritis. The study was conducted in the Government Wenlock Hospital, Mangalore, Karnataka, India from 17th May to 29th September 2018. The WOMAC (Western Ontario and Macmaster Universities Arthritis Index) was used to assess symptoms for the past 48 hrs and the VAS (Visual Analogue Scale) was used to measure pain intensity. Backs Depression Inventory ( B D I ) scale is used to measure depression.
**Results:** In this study it was found that depression was highly prevalent among osteoarthritis patients. 73.83% of participants were found to have moderate depression. Pain experienced during interview due to osteoarthritis (as measured by VAS) had very high statistical correlation with depression.
Pain experienced due to osteoarthritis while performing certain daily activities (as measured by pain section of WOMAC) had significant statistical correlation with depression (p=0.028).
**Conclusion:** The study concluded that pain caused due to osteoarthritis has significant correlation with comorbid depression. Duration of disease and duration of treatment though was not significantly correlated with depression [p(disease)=0.382 and p(treatment)=0.521]. Physical disability caused by osteoarthritis (as measured by disability portion of WOMAC) is not significantly correlated to depression (p=0.464, r=0.060).

**Keywords:** Depression, Osteoarthritis, WOMAC, VAS, BDI

## 1. Introduction

Osteoarthritis is a rheumatological disorder characterized by hyaline articular cartilage loss present in a focal and initially in a nonuniform manner. There is also thickening and sclerosis of the subchondral bony plate (due to outgrowth of osteophytes at the joint margin), stretching of the joint capsule and weakness of muscles responsible for joint movement. Osteoarthritis usually involves the weight bearing joints (knee, hip, back) and the interphalangeal joints but may affect other joints also. Pain is chronic relapsing type and is aggravated by joint use or after long period of inactivity. It is the most common type of arthritis globally and an important cause for disability among elderly. With modern trends of increased obesity and sedentary lifestyle it is on the rise [1].

With the advent of modern medicine, increase in food production and other scientific advances there has been a significant increase in the average life expectancy hence geriatric diseases has become more important [2]. Better management of diseases such as osteoarthritis will lead to increased productivity of individuals and help increase the quality of life of affected individuals.

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Depression in India is still a vastly underdiagnosed disorder and continues to be a major mental health problem. A cross sectional study in rural areas among elderly indicate that 42.7% were depressed and 6.8% had severe depression [3].

It is generally accepted that that depression is a significant clinical feature in rheumatoid arthritis associated with increasing physical deformity [4] there is no consensus about depression occurring due to osteoarthritis. Moreover, osteoarthritis affects the elderly who are at higher risk of depression and have less psychological adaptability [5].

It is widely accepted that complete reliance on the established signs and symptoms and the treatment outcome may be an inadequate indicator of the impact of the disease and its detrimental effects on society. Hence a more holistic approach to treatment might be required to be adopted if depression is really adding to the burden of the disease. This will in turn lead to better physical and emotional remedy [6]

### Objectives

This study is aimed at establishing a direct correlation between pain and disability in osteoarthritis and its emotional ramifications.

- Prevalence of depression in patients with osteoarthritis
- Correlation between pain and depression
- Correlation between duration of the disease, duration of treatment and depression
- Correlation between physical disability and depression

## 2. Methodology

The study was approved by the Institutional Human Ethics Committee of Kasturba Medical College Mangalore. A quantitative descriptive cross-sectional study of the clinical investigations' variety was conducted. The study was conducted in the Government Wenlock Hospital from $17^{th}$ May to $29^{th}$ September 2018.

### 2.1. Study Population

Consenting patients clinically diagnosed of osteoarthritis visiting outpatient departments of Orthopaedics, Medicine, Physiotherapy and patients admitted in Medicine, Surgery and Orthopaedics wards of Government Wenlock Hospital, Mangalore.

**Exclusion Criteria:** Non-consenting patients, patients with past or family history of psychiatric disorders, patients with physical disability (e.g.-post stroke paralysis) who could not move or actively use their limbs, patients in extreme pain, non-cooperative patients and patients unable to communicate verbally due to language barriers (tulu or konkanni speaking patients).

Verbal informed consent was taken before investigating patients and they were required to sign an informed consent form. If the patient was illiterate or physically unable to sign signature of bystander family member was taken. Nonprobability sampling was followed.

### 2.2. Sample size

Using $\frac{n=Z^2\times pq}{d^2}$ where n=desired sample size, Z=1.96 at 95% confidence level d=20% of p (80% power) With 95 % confidence level and 80% power with reference to p=40 [7]. The sample size comes to be 150.By adding 10% as nonresponse error, the final sample size comes to be 165.

Finally, 159 patients were interviewed after rejecting 6 cases because of ambiguous answers and unwillingness to complete the questionnaire data for 151 patients were collected and compiled.

### 2.3. Sample collection

Patients were investigated with the help of a pre-validated questionnaire. The questionnaire was translated to Kannada language. After signing the informed consent form the patient details in the proforma was filled by the investigator. The questionnaire was explained in detail. The rest of the questionnaire was either self-reported or the questions were asked and explained by the investigator and the responses were noted.

The questionnaire consisted of the following - Patient details, WOMAC (Western Ontario and Macmaster Universities Arthritis Index) scale to asses associated pain and disability clinically [8] and VAS (Visual Analogue Scale) to measure pain intensity [9] and the BDI-Becks Depression Inventory scale to measure chronic depression [10].

### 2.4. Statistical Analysis

Quantitative variables are described using means, standard deviation, medians and analyzed using Analysis of variance (ANOVA f) Test and Kruskal Wallis test. Qualitative variables are to be described using number proportion and percentage. They are analyzed by Chi square test. Pearson's correlation is used to find the strength of association between two continuous variables. The Statistical package for social sciences (SPSS 29) was used to analyze the data.

## 3. Results

A total of 151 patients with clinical diagnosis of osteoarthritis were interviewed. Here are the descriptive statistics as acquired from the questionnaires of 151 patients as reported by them.

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**A. Age- (in years)**

**Table 1:** Age

| Age (years) | Number of patients ( in percentage ) |
|---|---|
| 45 - 55 | 26 ( 17 % ) |
| 55 -65 | 41 ( 27 % ) |
| 65 - 75 | 60 ( 40 % ) |
| >=75 | 24 ( 16 % ) |

**Table 2:** Age

| Age of patient when interviewed (in years) | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| Age | 45 | 82 | 65.72 | 8.903 |

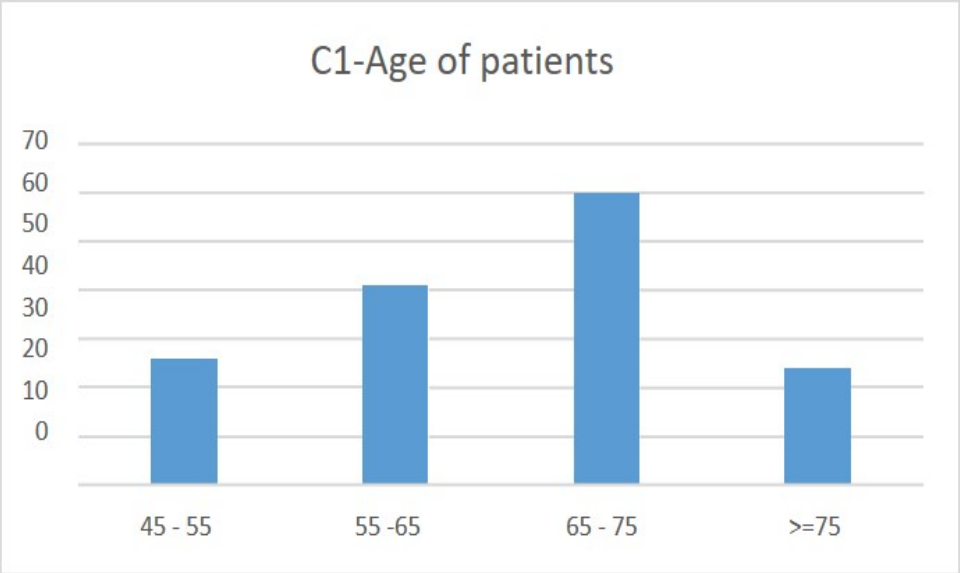


**Figure 1:** Age of patients

x axis –class intervals of age in years
y axis-number of patients

The range of age of patients lie between 45 and 82 years of age with a mean age of 65.7 years and SD of 8.903.60 patients were found between 65 and 75 years of age. It is inferred that osteoarthritis is a disease of old age.

**B. Gender of patient**

**Table 3:** Sex

| Sex | Frequency | Percent |
|---|---|---|
| Male | 84 | 55.6 |
| Female | 67 | 44.4 |
| Total | 151 | 100.0 |

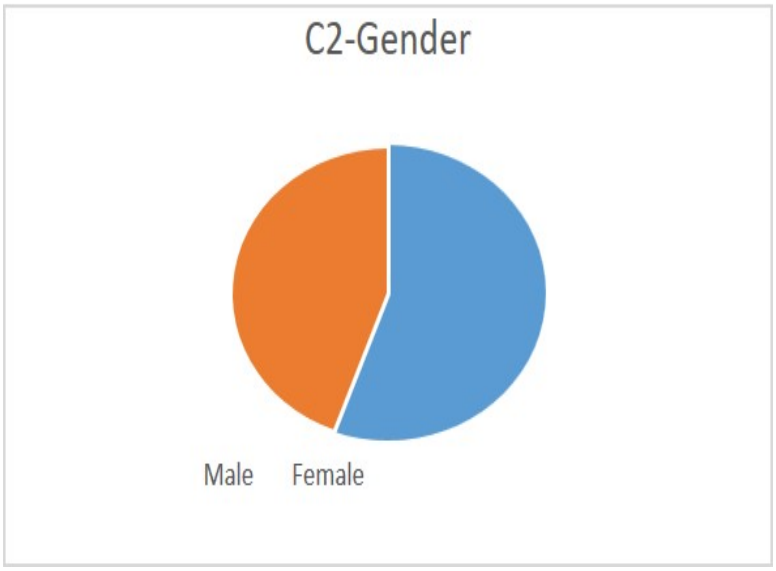


**Figure 2:** Gender

### C. Marital status

**Table 4:** Marital status

| | Frequency | Percent |
|---|---|---|
| Married | 115 | 76.2 |
| Widow/er | 34 | 22.5 |
| Unmarried | 2 | 1.3 |
| Total | 151 | 100.0 |

### D. Occupation

**Table 5:** occupation

| Occupation | Frequency | Percent |
|---|---|---|
| Unemployed | 10 | 6.6 |
| Unskilled | 24 | 15.9 |
| Semiskilled | 23 | 15.2 |
| Skilled | 5 | 3.3 |
| Business | 4 | 2.6 |
| Clerk | 5 | 3.3 |
| Housewife | 36 | 23.8 |
| Professional | 2 | 1.3 |
| Retired | 42 | 27.8 |
| Total | 151 | 100.0 |

### E. Education

**Table 6:** Education

| Education | Frequency | Percent |
|---|---|---|
| Illiterate | 13 | 8.6 |
| Just literate | 55 | 36.4 |
| Primary | 32 | 21.2 |
| Middle school | 19 | 12.6 |
| High school | 10 | 6.6 |
| Pre-University | 12 | 7.9 |
| Graduation | 7 | 4.6 |
| Post-Graduation | 3 | 2.0 |
| Total | 151 | 100.0 |

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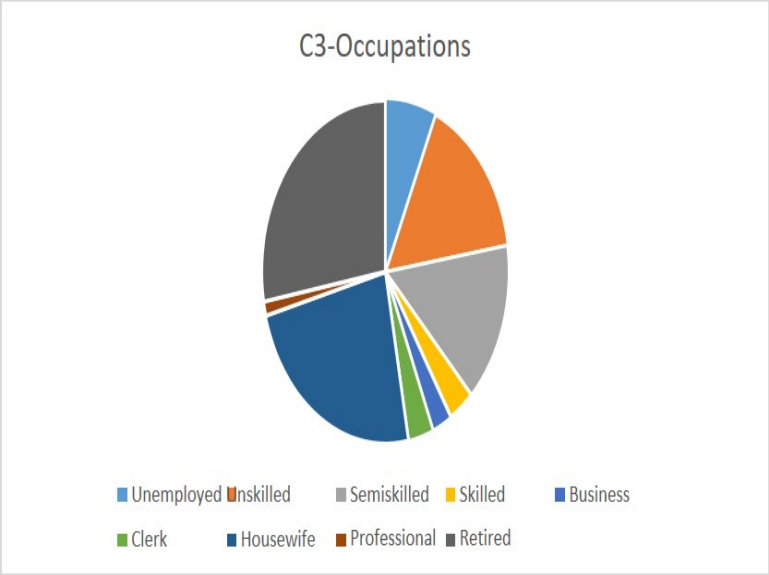


**Figure 3:** Occupations

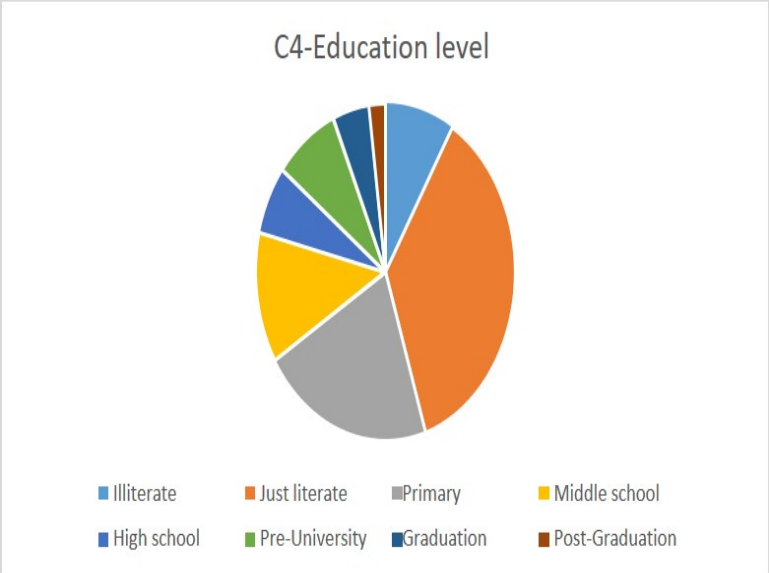


**Figure 4:** Education level

**F. Number of family members patients are residing with**

**Table 7:** Number of Family members, patient

| | Frequency | Percent |
|---|---|---|
| 1 | 8 | 5.3 |
| 2 | 15 | 9.9 |
| 3 | 25 | 16.6 |
| 4 | 46 | 30.5 |
| 5 | 28 | 18.5 |
| 6 | 16 | 10.6 |
| 7 | 10 | 6.6 |
| 8 | 3 | 2.0 |
| Total | 151 | 100.0 |

**G. Socioeconomic status-calculated as per Modified BG Prasad Scale (updated on 2016) [11].**

**Table 8:** A. Socioeconomic status

| Income | Monthly per capita |
|---|---|
| Upper Class | $\geq$ Rs. 6346 |
| Middle class | Rs. 3173 -6345 |
| Middle class | 1904-3172 |
| Lower middle class | 952-1903 |
| Lower class | Rs. $\leq$ 951 |

**Table 9:** B. Socioeconomic status

| | Frequency | Percent |
|---|---|---|
| Lower class | 20 | 13.2 |
| Lower middle | 88 | 58.3 |
| Middle class | 40 | 26.5 |
| Upper middle | 3 | 2.0 |
| Total | 151 | 100 |

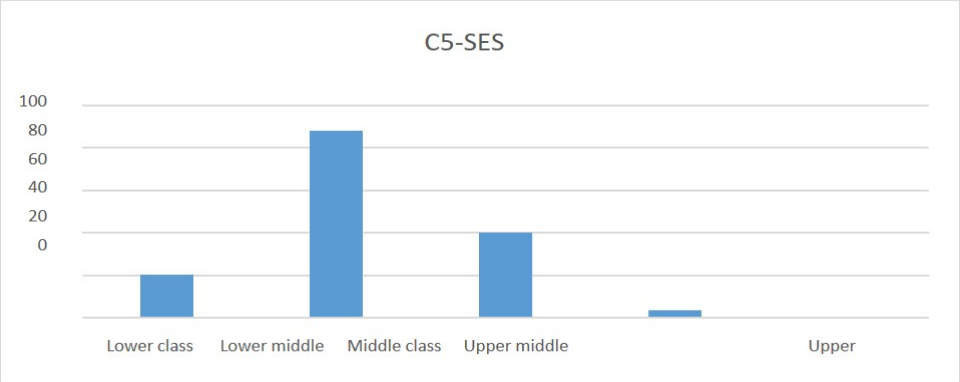


**Figure 5:** Socioeconomic status

Most of the study population belonged to the lower middle- and middle-class SES.

**H. History of other medical disorders or comorbid conditions**

**Table 10:** History of other medical disorders or comorbid conditions

| Comorbid conditions | Frequency | Percentage (%) |
|---|---|---|
| No other comorbidities reported | 45 | 29.801 |
| Diabetes mellitus | 46 | 30.463 |
| Hypertension | 57 | 37.748 |
| Chronic kidney disease | 16 | 10.596 |
| COPD/asthma/RTI | 7 | 4.636 |
| Alcoholic liver disease or cirrhosis of liver | 2 | 1.325 |
| Ischemic heart disease | 12 | 7.947 |
| Other disorders | 22 | 14.570 |

I. No patients had either past or family history of psychological disorders as per exclusion criteria.

**J. Duration of disease and duration of treatment.**

**Table 11:** Duration of disease and duration of treatment

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Duration of disease | 151 | 2 | 20 | 8.01 | 3.328 |
| Duration of treatment | 151 | 1 | 15 | 7.26 | 3.052 |

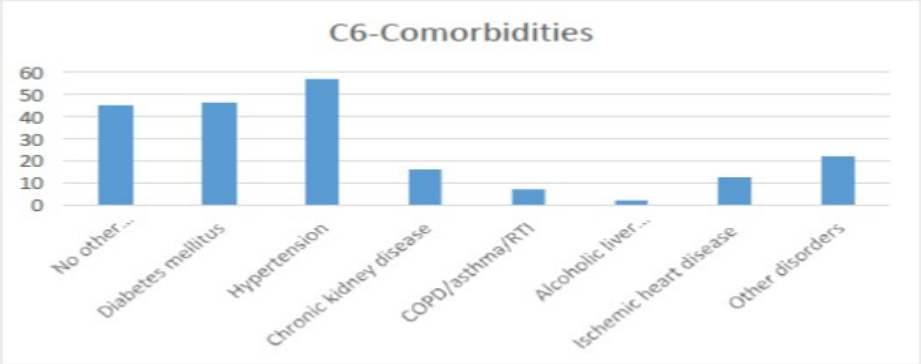


**Figure 6:** Comorbidities

### K. Treatment compliance

**Table 12:** Level of treatment compliance

| | Frequency | Percent |
|---|---|---|
| Poor | 35 | 23.2 |
| Average | 74 | 49.0 |
| Good | 42 | 27.8 |
| Total | 151 | 100.0 |

### L. WOMAC, VAS and BDI

**Table 13:** WOMAC VAS and BDI

| Score | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| WOMAC | 151 | 46 | 82 | 65.02 | 9.290 |
| VAS | 151 | 4 | 10 | 7.69 | 1.103 |
| BDI | 151 | 10 | 37 | 25.44 | 4.570 |

The mean WOMAC score came to be 65.02 (SD of 9.29). Mean VAS Score of 7.69 (SD 1.103) was reported. The mean BDI score was 25.44 (SD 4.57) which indicated moderate depression.

**Table 14:** Descriptive Statistics of depression in study population

| Level of depression | Number of participants |
|---|---|
| Normal | 1 |
| Mild Mood Disturbance | 3 |
| Borderline clinical | 14 |
| Moderate depression | 113 |
| Severe depression | 20 |
| Extreme depression | 0 |

**Table 15:** Pain, stiffness and disability (WOMAC) descriptive statistics

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Pain | 151 | 8 | 17 | 11.59 | 2.395 |
| Stiffness | 151 | 1 | 7 | 3.96 | 1.437 |
| Disability | 151 | 34 | 65 | 49.34 | 7.329 |
| Valid N (listwise) | 151 | | | | |

As per table 15-
a. Patients complained of Pain with a mean score of 11.59 (SD 2.395).
b. Mean Stiffness score experienced due to osteoarthritis is 3.96 (SD=1.437)
c. Mean Disability score is 49.34 (SD=7.33).

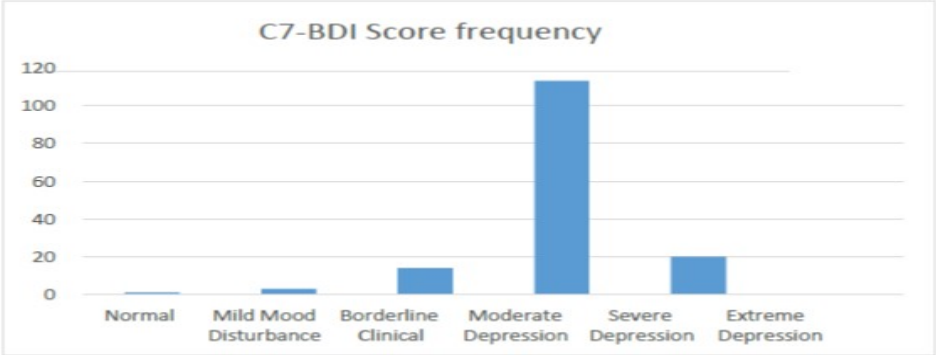


**Figure 7:** BDI Score frequency

Most of the study population suffered from moderate depression.

**Correlations-**

An r value (Pearson coefficient) of more than 0.5 and p value (probability factor) of less than 0.05 has been considered significant. n stands for sample size (N=151).

**Table 16:** Correlations b/w WOMAC, VAS AND BDI

| | | VAS | BDI |
|---|---|---|---|
| WOMAC | r | .543 | .112 |
| | p | .000 | .172 |
| | N | 151 | 151 |
| VAS | r | | .303 |
| | p | | .000 |
| | N | | 151 |

As per table 16

a. The correlation between disease activity (as measured by the WOMAC scale) and depression (as measured by the BDI scale) is not significant as r value (Pearson coefficient) =0.112 is less than 0.5 and the p value(probability) =0.112 which is more than 0.05.

b. Amount of pain patient was in during the interview was measured using VAS scale. There seems to be significant correlation between pain (VAS) and depression (BDI) as p value=0.000(<.05).

**Table 17:** Correlation between duration of disease and treatment with depression

| | | Duration of | Duration of |
|---|---|---|---|
| BDI | r | .053 | .072 |
| | p | .521 | .382 |
| | N | 151 | 151 |

**Table 18:** Caption

As per table 17

Duration of disease and duration of treatment does not have significant correlation with depression as r disease=.072 and treatment=.053 (r<0.5) and p values are more than 0.05.

**Table 19:** Correlation between pain, stiffness, disability and BDI

| | | Pain | Stiffness | disability |
|---|---|---|---|---|
| BDI | r | .179 | .096 | .060 |
| | p | .028 | .239 | .464 |
| | N | 151 | 151 | 151 |

As per table 19-pain, stiffness and disability are a direct consequence of osteoarthritis and comprises the WOMAC Scale which signifies disease activity.

a. Pain and BDI correlation-Pain while doing various activities as recorded from pain section of WOMAC scale seems to have significant correlation with depression (BDI) as p(pain)=.028($p < .05$). Hence pain caused due to osteoarthritis has significant correlation with depression.

b. Stiffness and BDI correlation-r(stiffness)=.096(< .5 and p(stiffness)=.239(> .05) hence there is no correlation.

c. Disability and BDI correlation-r(disability)=.060(¡.5) and p(disability)=.464(> .05)hence there is no correlation.

**Table 22:** ANOVA for BDI vs Age

| | F | P |
|---|---|---|
| Between Groups | .335 | .800 |

**Table 24:** ANOVA for BDI vs SES

| BDI | F | P |
|---|---|---|
| Between Groups | 1.390 | .248 |

**Table 20:** Correlation between gender and depression

| | Sex | N | Mean | Std. Deviation | t |
|---|---|---|---|---|---|
| BDI | Male | 84 | 25.18 | 5.260 | .797 |
| | Female | 67 | 25.78 | 3.533 | p=0.427 (ns) |

As per table 20 p(gender)=0.427$(> .05)$ so no significant correlation between gender and depression exists.

**Table 21:** BDI vs Age group

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| 45 - 55 | 26 | 25.23 | 4.043 | 13 | 32 |
| 55 -65 | 41 | 25.00 | 3.801 | 15 | 35 |
| 65 - 75 | 60 | 25.57 | 4.893 | 10 | 37 |
| >=75 | 24 | 26.13 | 5.566 | 18 | 37 |

As per table 20 and 21 P(age)=0.8$(> .05)$ after doing Fischer test. So, there is no significant correlation between different age groups and depression.

**Figure 8**

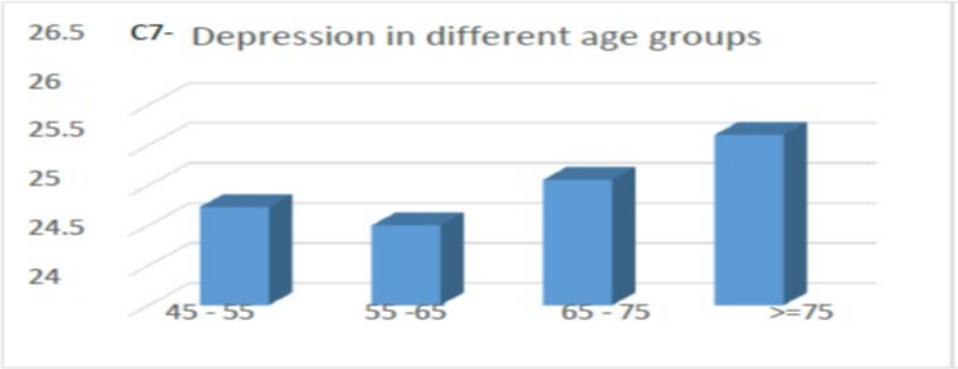


**Figure 9:** Depression in different age groups

**Table 23:** BDI vs Socioeconomic status

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Lower class | 20 | 25.05 | 5.176 | 15 | 37 |
| Lower middle | 88 | 25.44 | 4.441 | 13 | 35 |
| Middle | 40 | 25.25 | 4.562 | 10 | 37 |
| Upper Middle | 3 | 30.67 | 2.309 | 28 | 32 |

As per table 25 and 26- p(SES)=.248$(> .05)$ So no significant correlation between socioeconomic status and depression.

## 4. Discussion

This study was aimed at establishing a correlation between disease activity (Total WOMAC Score), pain (VAS-during interview, WOMAC Pain-while doing activities), stiffness (WOMAC Stiffness Score), Disability (WOMAC Disability Score), duration of disease (caused due to osteoarthritis) to comorbid depression (BDI).

### Descriptive statistics

a. Age - From Table 1 and Table 2 and Figure 1 we see that the youngest patient was 45 years old and oldest patient was 82 years old. The mean age 65.72 years and the highest number of patients (60) belonged to the age group of 65-75 years. So, we infer that osteoarthritis is a disease of the elderly. The Framingham Osteoarthritis Study [11] reported a mean age of 73 years and concluded that the prevalence of osteoarthritis increases with age after 65 years.

b. Sex - Table 3 and Figure 2 states that 55.6% of the patients interviewed were male. The Framingham Osteoarthritis Study [11] found a slight preponderance of females (females 34% vs males 31%) to have osteoarthritis.

c. Marital Status - Table 4 -76% of the patients interviewed were married most of the rest had lost their partners. This might affect the socioeconomic status for female patients, as often males in the breadwinners in this demographic region.

d. Occupation - Table 5, Figure 3-Highest proportion of patients were retired (27.8%) this might be due to their advanced age or for patients engaging in physical labour it may be a consequence of the debilitating effects of osteoarthritis. Majority of the female patients (23.8%) were housewives. Significant number of patients were semiskilled (15.2%) or unskilled (15.9%) workers.

e. Education Level - Table 6 Most of the patient were just literate (36.4%) or had received only primary schooling (21.2%). This might have been a reflection of their socioeconomic status. The Modified Kuppuswamy scale recognizes the value of education and how it reflects on the socioeconomic status of a person (education is a part of the scale) [12].

f. Number of family members residing with the patient (Table 7) - This influences the patient's socioeconomic status. Patients living with more family members might be less depressed. (loneliness is a question in the BDI scale).

g. Socioeconomic Status-Table 8 and Table 9, Figure 5- Shows that majority of the patients belonged to the lower middle class (58.3%). This is probably due to the study setting.

h. History of medical illnesses other than osteoarthritis- Table 10, Figure 6- Patients with moderate grades of osteoarthritis are not admitted to Government Wenlock Hospital, some patients do develop osteoarthritis post trauma but they already have significant disability and were hence excluded from the study. Most of the study population comes from a lower socioeconomic status and might have a background of poor health awareness hence diseases such as hypertension, diabetes that demonstrate the iceberg phenomenon [13]. Nüesch E et al. reported similar findings stating cardiovascular disorders (e.g.- hypertension), diabetes were the most common causes of morbidity and mortality in osteoarthritis patients. The study also named depression as one of the most important comorbidities [14].

i. Patients with previous psychiatric illness or family history thereof were excluded from the study.

j. Duration of disease (osteoarthritis) and Duration of treatment Table 11- For duration of disease participants of the study were asked to recall when they first experienced the symptoms of osteoarthritis, this is highly subjective and susceptible to recall bias.

k. Treatment Compliance Table 12

l. Pain, stiffness and disability Table 15 - Pain during activity due to osteoarthritis- The mean pain score reported was 11.59/20. No established classification of WOMAC score and its subparts describing grades of osteoarthritis was found after literature review.

**Stiffness -** Experienced first after waking up in the morning and later during the day (not during activity). Mean-3.96/8. In osteoarthritis the pain and stiffness usually increases after recurrent movement of affected joint so it is expected to increase later in the day.

**Disability -** Discomfort or difficulty experienced while doing an activity. Mean-49.34/68. As, this questionnaire was chiefly developed to be applied to a western population with relatively higher socioeconomic status some of the questions were slightly impertinent to the population in question. m. WOMAC (indicator of disease activity), VAS (indicator of amount of pain patient is in during interview due to osteoarthritis) and BDI (indicator of depression) scale - Table 13.

**WOMAC** - Mean 65.02/96. No available grades for classification of disease activity found on literature review. The degrees of difficulty experienced during a task is described as none, mild, moderate, severe and extreme these are subjective questions and the difficulty experienced and its classification as mild, moderate, severe may vary from person to person.

**VAS** - Mean - 7.69/10. As participants might have had different experience of worst pain in their life there might be variation in their interpretation of pain. People also perceive pain differently and have different pain threshold [15].

**BDI** - Table 14, Figure 7 – Mean - 25.44/63. 73.83% of the participants suffered from moderate depression according to the BDI scores. BDI scale is almost universally used to measure depression however some questions (especially the physical factors) used in the questionnaire are not very amenable to the elderly age group. Most of the population in question belong to the lower middle socioeconomic strata and hence might be more prone to depression. Holzer CE et al. found significant correlation between lower socioeconomic status and depression (among other psychiatric disorders) [16]. Also, with increased age people are more susceptible to depression [5].

1) Correlation of age with Depression (BDI) score - table 20 and table 22, Figure 8

There is no statistically significant correlation between age and depression in this study. Blazer D et al. found old age to be a risk factor for depression but could not establish a linear correlation thereof [17]. In this study patients more than 75 years of age (oldest age group) showed highest values of BDI score mean and hence displayed highest amount of depression. This might be due to the increased duration of disease (osteoarthritis). With advanced age people are prone to more diseases and decline of general health.

2) Correlation between gender of the patient and depression (BDI) is not statistically significant - Table 20.
Cole MG et al. found female gender to be at a higher risk for depression among healthy elderly subjects [18]. The presence of osteoarthritis and other comorbid factor might have influenced this result. Moreover, as more male patients were found despite osteoarthritis having higher prevalence in females it might be possible that associated comorbidities are more common in men (might influence depression) or men exhibit better health seeking behavior.

3) No statistically significant correlation between Socioeconomic status and depression (BDI) was found-Table 23, table 24. Participants belonging to the upper middle class of Modified BG Prasad Scale exhibited the highest mean BDI score (30.67) however there were only 3 such participants hence a conclusion cannot be inferred with confidence. 4) Correlation between duration of disease (osteoarthritis), duration of treatment and depression (BDI) is not statistically significant. Table 17 - Hence, the null hypothesis was accepted and reject the hypothesis that duration of disease and treatment is related to increased depression. Moussavi S et al. found that depression increases with duration of disease in chronic diseases like arthritis [19], also the Framingham Osteoarthritis Study revealed increase in prevalence of osteoarthritis with age [11].

5) Correlation between pain (during activity as measured by pain segment of WOMAC scale) caused by osteoarthritis and depression (BDI). Table 19 - There is statistically significant correlation between pain in osteoarthritis and depression hence we reject the null hypothesis and accept the alternate hypothesis that pain is associated with depression. Study conducted Rosemann T et al. showed that perceived pain due to osteoarthritis was the strongest predictor of depression. Framingham Osteoarthritis Study found such similar correlations. [11, 20–22]and several other studies have described statistically significant correlation between chronic pain and depression, depression can also increase perception of pain.

6) No statistically significant correlation was found between stiffness caused due to osteoarthritis and depression - Table 19. Stiffness in osteoarthritis may not be constant and there can be great deal of variability before and after joint use (early morning and later in the day) and between different days. Mean stiffness table 15 was 3.96/8 with SD 1.44. So, most of the participants reported only moderate stiffness.

7) No statistically significant correlation was found between disability caused due to osteoarthritis (WOMAC disability score) and depression (BDI Score) Table 19. Study by Rosemann T et al. concurred that physical limitation of lower body and the upper body respectively were the 2nd and 3rd most important predictors of depression in osteoarthritis patients [23]. Many other studies done by [24, 25] enumerate statistically significant correlation between physical disability and depression.

8) Correlation between disease activity (Total WOMAC Score) and depression is not statistically significant Table 16 so the null hypothesis was accepted and disease activity in osteoarthritis is not related to depression. The total WOMAC score is the sum of pain (out of 20), stiffness (out of 8) and disability (out of 68) hence disability has the greatest weightage. As explained above the correlation between disability and depression (not statistically significant) as found in this study is incongruent with results of other studies so disease activity (total WOMAC) has been found to also not be significant.
9) Correlation between pain (experienced during interview due to disease activity as measured by VAS) and depression is highly statistically significant [20–22] and several other studies have described statistically significant correlation between pain and depression, depression can also increase perception of pain.

Most of the participants had other important comorbidities (only 29.801% did not report any other comorbidity). Most patients belonged to lower middle socioeconomic status (according to Modified BG Prasad Scale) and were just literate or had only attended primary schooling. BDI scale used seemed to give slightly inflated values for the elderly age group. All these factors might have increased the depression index. Additionally, BDI is supposed to be a self-reported questionnaire but interviews had to be conducted to record responses, inadequate setting for psychiatric evaluation, presence of family members (patient party) or others nearby these might have led to inaccurate representation of depression.

WOMAC scale (especially disability) was not very amenable to the population in question. VAS scale scores are subjective and depend on patients previous most painful experience. Duration of disease as reported by patients is open to recall bias and may be differently described by different patients.

All these factors might have been some of the possible causes for the failure to prove all the required hypotheses.

## 5. Conclusion and implications-

This study was aimed at establishing a direct correlation between pain and disability in osteoarthritis and its emotional ramifications. Even though this study failed to establish a direct correlation between disability and depression several other studies [23–25], it proves a definite link between disability and depression. Modern advancements in science has proved that the best approach of treatment is the holistic approach that aims at improving both the physical and mental health [26]. Moreover depression can alter the perception of pain and adversely affect the quality of life of patients [27]. Depressed patients may also be much less compliant to prescribed treatment. The age of onset of osteoarthritis is also a factor to be considered. The elderly are often an emotionally vulnerable group and their mental health is often

ignored as they may suffer from social maladjustment [28]. In such a scenario a more aggressive approach should be undertaken to diagnose depression in patients with osteoarthritis and measures should be undertaken to improve their quality of life. Future research work are encouraged in this arena to establish link between pain disability and depression.

## References


[1] Fauci Longo, Kasper Hauser, et al. Harrisons principles of internal medicine. In *Medical, print year, pg-2829-2834*. McGraw Hill, 18th edition, 2012.

[2] C. E. Finch. Evolution of the human lifespan and diseases of aging: roles of infection, inflammation, and nutrition. *Proceedings of the National Academy of Sciences*, 107(suppl 1):1718–24, January 2010.

[3] S. P. Sinha, S. R. Shrivastava, and J. Ramasamy. Depression in an older adult rural population in india. *MEDICC review*, 15(4):41–4, December 2013.

[4] Y. Zyrianova, B. D. Kelly, J. Sheehan, C. McCarthy, and T. G. Dinan. The psychological impact of arthritis: the effects of illness perception and coping. *Irish journal of medical science*, 180(1):203–10, March 2011.

[5] M. G. Cole and N. Dendukuri. Risk factors for depression among elderly community subjects: a systematic review and meta-analysis. *American Journal of Psychiatry*, 160(6):1147–56, June 2003.

[6] J. G. Beales, P. J. Holt, J. H. Keen, and V. P. Mellor. Children with juvenile chronic arthritis: their beliefs about their illness and therapy. *Annals of the rheumatic diseases*, 42(5):481, October 1983.

[7] A. R. El-Najjar, M. G. Negm, and W. M. El-Sayed. The relationship between depression, disease activity and physical function in juvenile idiopathic arthritis patients in zagazig university hospitals–egypt. *The Egyptian Rheumatologist*, 36(3):145–50, July 2014.

[8] Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)Ackerman. Ilana. *Journal of Physiotherapy*, 55(3):213.

[9] J. Scott and E. C. Huskisson. Graphic representation of pain. *Pain*, 2(2):175–84, June 1976.

[10] A. T. Beck, R. A. Steer, and G. K. Brown. Beck depression inventory-ii. *San Antonio*, 78(2):490–8, 1996.

[11] D. T. Felson, A. Naimark, J. Anderson, L. Kazis, W. Castelli, and R. F. Meenan. The prevalence of knee osteoarthritis in the elderly. the framingham osteoarthritis study. *Arthritis Rheumatism: Official Journal of the American College of Rheumatology*, 30(8):914–8, August 1987.

[12] B. Kuppuswamy. *Manual of socio-economic status scale*. Manasayan Publication, Delhi, 1962.

[13] J. M. Last. The iceberg:'completing the clinical picture'in general practice. *International journal of epidemiology*, 42(6):1608–13, December 2013.

[14] E. Nüesch, P. Dieppe, S. Reichenbach, S. Williams, S. Iff, and P. Jüni. All cause and disease specific mortality in patients with knee or hip osteoarthritis: population-based cohort study. *Bmj*, 342:d1165, March 2011.

[15] D. Sheffield, P. L. Biles, H. Orom, W. Maixner, and D. S. Sheps. Race and sex differences in cutaneous pain perception. *Psychosomatic medicine*, 62(4):517–23, July 2000.

[16] C. E. Holzer, B. M. Shea, J. W. Swanson, and P. J. Leaf. The increased risk for specific psychiatric disorders among persons of low socioeconomic status. *American Journal of Social Psychiatry*, 1986.

[17] D. Blazer, B. Burchett, C. Service, and L. K. George. The association of age and depression among the elderly: an epidemiologic exploration. *Journal of gerontology*, 46(6):M210–5, November 1991.

[18] M. G. Cole and N. Dendukuri. Risk factors for depression among elderly community subjects: a systematic review and meta-analysis. *American Journal of Psychiatry*, 160(6):1147–56, June 2003.

[19] S. Moussavi, S. Chatterji, E. Verdes, A. Tandon, V. Patel, and B. Ustun. Depression, chronic diseases, and decrements in health: results from the world health surveys. *The Lancet*, 370(9590):851–8, September 2007.

[20] A. Surah, G. Baranidharan, and S. Morley. Chronic pain and depression. *Continuing Education in Anaesthesia Critical Care Pain*, 14 (2):85–9, April 2014.

[21] D. A. Fishbain, R. Cutler, H. L. Rosomoff, and R. S. Rosomoff. Chronic pain-associated depression: antecedent or consequence of chronic pain? a review. *The Clinical journal of pain*, 13(2):116–37, June 1997.

[22] J. M. Romano and J. A. Turner. Chronic pain and depression: does the evidence support a relationship. *Psychological bulletin*, 97(1): 18, January 1985.

[23] T. Rosemann, M. Backenstrass, K. Joest, A. Rosemann, J. Szecsenyi, and G. Laux. *Predictors of depression in a sample of 1,021 primary care patients with osteoarthritis*. Arthritis Care Resear.

[24] R. J. Turner and S. Noh. Physical disability and depression: A longitudinal analysis. *Journal of health and social behaviour*, pages 23–37, March 1988.

[25] M. Von Korff, J. Ormel, W. Katon, and E. H. Lin. Disability and depression among high utilizers of health care: a longitudinal analysis. *Archives of general psychiatry*, 49(2):91–100, February 1992.

[26] K. Park. Parks textbook of preventive and social medicine 23rd edition. *Bhanot publishers, pg*, 14, .

[27] M. J. Bair, R. L. Robinson, W. Katon, and K. Kroenke. Depression and pain comorbidity: a literature review. *Archives of internal medicine*, 163(20):2433–45, November 2003.

[28] K. Park. Parks textbook of preventive and social medicine23rd edition. *Bhanot publishers*, pg-5, .