ASSOCIATION OF HYPERURICEMIA WITH BODY MASS INDEX IN PATIENTS WITH KNEE OSTEOARTHRITIS

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ABSTRACT

Background:- Osteoarthritis (OA) the most common form of arthritis worldwide may be a painful and debilitating condition, most commonly seen in female population. Purpose of the study was to find the association between hyperuricemia and BMI in knee osteoarthritis patients. **Methodology:** This observational cross sectional study was carried out on 375 diagnosed patients of knee osteoarthritis with age >40 years. Participants were selected by non-probability convenient sampling from the District Head Quarter (DHQ) hospital, Gujranwala and Aziz Bhatti Shaheed Teaching hospital, Gujrat during May to September 2022. Patients of knee surgery and rheumatoid arthritis were excluded from study. After taking written consent, data were collected. All data were entered and analyzed using SPSS software version 24. Chi Square test, independent t- test, ANOVA, Post Hoc test (Tukey's HSD Test) and Pearson's Correlation Co-efficient were applied for statistical significance at 95% confidence interval.

Results: Out of total 375 diagnosed knee osteoarthritis patients, females were observed 256 (68.3%) whereas males were 119(31.7%) and fourth part, 101(26.9%) of selected participants were of age 61-70 years. Relation between body mass index (Kg/m^2) and serum uric acid (mg/dl) was found strong positively (r=0.552) statistically significant with p-value <0.001 in patients with knee osteoarthritis.

Conclusions: Findings showed that the body mass index and serum uric acid are strong positively associated in patients with knee osteoarthritis. Females were observed more prone to knee osteoarthritis as compare to males.

***Keywords*:** Knee osteoarthritis, serum uric acid, Body mass index, hyperuricemia, association

INTRODUCTION

The most prevalent type of arthritis in the world, osteoarthritis (OA), is a painful and crippling condition for which there is currently no treatment, the prevalence of radiographic knee osteoarthritis (RKOA) and symptomatic radiographic knee osteoarthritis (sRKOA) in the USA was estimated to be 37.4% and 12.1%, respectively, in individuals over 60. Although OA was once thought to be a mechanical degenerative disease, it is now understood that inflammation is a key factor in its pathogenesis[1]. Knee osteoarthritis (OA) is a common progressive multifactorial joint disease and is characterized by chronic pain and functional disability. Knee OA accounts for almost four fifths of the burden of OA worldwide and increases with obesity and age[2]. Musculoskeletal diseases (MSDs) were the second-largest contributor to global disability according to the 2016 Global Burden of Disease (GBD) survey. Arthritis is one of the MSDs that greatly increases the burden of impairments worldwide. According to data analysis from the WHO's SAGE project, arthritis prevalence is higher in low- and middle-income environments. Other MSDs, including OA, were rated 10th and 11th, respectively, among the leading causes of years lived with disabilities (YLDs) in 2017. Globally, 8.34 million YLDs are directly attributed to knee OA. It accounts for 50% of all MSDs. globally, among people over 60 years old. OA symptoms are present in 9.6% of men and 18% of women, with the knee being the most often affected joint[3].

The requirement for the onset of gout, the most prevalent inflammatory arthritis, is hyperuricemia, a chronic metabolic disorder[4]. In the US, the prevalence of asymptomatic hyperuricemia (AH: hyperuricemia without gout) has been rising and is currently 17.6%, which is much greater than the occurrence of gout (3.9%). Numerous researchers have discovered possible biological connections between OA, gout, and urate· Elevated serum urate levels (SU) levels have been reported to facilitate low-level systemic inflammatory states, even in the absence of frank gout[5]. Urate can crystalize as monosodium urate (MSU), stimulating the NLRP3 inflammation and potentially promoting cytokines production and cartilage damage[6].

HUA (high uric acid) is potentially defined as uric acid levels greater than 6.8mg/d[7]. According to certain clinical trials, HUA is uric acid levels that are higher than 7mg/dl for men and 6mg/dl for women [8]. Alcohol consumption, a diet high in fructose, meat or shellfish, some drugs including diuretics, angiotensin converting enzyme, hypertension and obesity are all established

risk factors for high uric acid levels[9, 10]. The widespread presence of HUA within the united states of America accomplish 13% of the general population according to by a serum uric acid >7mg/dL in males and >5.7mg/dL in females[4].

According to the Framingham study, body mass index (BMI) is considerably higher in gout patients. 3,153 people were followed up with after two years. According to Ishizaka, a change in BMI causes a change in serum uric acid. BMI is a valid modifiable risk factor for hyperuricemia in United States, Japan, and other nations since the relationship between obesity and blood uric acid is well documented[11].

In Jiangsu province of China, they discovered a connection between BMI and serum urate levels in healthy people. In more recent investigations, obesity and blood uric acid levels were found to significantly positively correlate in the populations of China, Japan, India, Pakistan, Iraq, and the United States[12]. The study was conducted have reported that both obesity and OA are chronic disease. Globally, obesity is regarded as a main issue and its prevalence has been increasing at an alarming rate it is three to six times the body weight during a single stance. The knee joint experiences weight bearing. Therefore, an increased body could place more strain on several joints in obese people[13]. As far as it is concerned, limited literature was found related to this issue so, current study was conducted to find the association between hyperuricemia with BMI in patients with knee osteoarthritis.

METHODOLOGY

Design, study population, setting and duration of study

An analytical cross-sectional study was conducted on 375 diagnosed knee OA patients. All data were collected from District Head Quarter (DHQ) Gujranwala and Major Aziz Bhatti Shaheed teaching hospital Gujrat for May to September 2022.

Sampling technique and sample size calculation

Non-probability, covenant sampling technique was applied for the selection of participants.
Sample size calculation was done using below maintained formula.

$$n = (Z_{1-\alpha/2})^2(P)(1-P)/(d)^2$$

In formula, $Z_{1-\alpha/2} = 1.96$, It was standard normal variate at 5% significance level, p = 0.58, which was expected proportion based on previous study, d = absolute error or precision or marginal error is 5%

$$n = (1.96)^2(0.58)\ (0.42) / (0.05)^2$$

$$n = 375$$

At least 375 participants were required within 5% precision. After taking written consent from 375

Participants

Diagnosed knee OA patients of age ≥ 40 years who were visited OPD with their serum uric acid report were included as a sample. Osteochondrmoa, bone tumors, knee surgery, patellofemoral pain syndrome (PFPS), rheumatoid arthritis and pregnancy women were exclusion from the study.

Consent and ethical approval

Oral and written informed consent was taken from all the participants. The subjects were informed that there was no disadvantages or risk on the procedure of the study. All information of participants was kept confidential. Participants were remained anonymous throughout the study.

Data collection procedure:

Participants were selected who were fulfilled inclusion and exclusion criteria. In this study, 375 knee OA patients were included who came in OPD with their serum uric acid reports. Their height (m^2) and weight (kg) were measured with measuring tape and weight machine respectively. Weight (kg) was divided by height (m^2) for the calculation of BMI (kg/m^2) of each selected participant.

Statistical Analysis:

Data were used to enter and analyzed through Statistical Package for Social Sciences (SPSS), version 24, IBM Corp., IBM Corp., released in 2016. For descriptive analysis, frequency and percentages was used for qualitative variables and mean and standard deviation for quantitative variables. Chi Square test was applied to find the association whereas independent t-test and

ANOVA was used for comparison and Post Hoc test (Tukey's HSD Test) was applied for multiple comparison. Strength of association between 0t n BMI (kg/m^2) and Serum uric acid (mg/dl) was calculated by Pearson's Correlation Co-efficient. P-value ≤ 0.05 was considered as a significant value, and all results were calculated at 95% confidence interval.

RESULTS

A sample of 375 knee OA patients were included who came in OPD with their serum uric acid reports. Data were collected by a questionnaire and entered in SPSS. Mean±S.D were calculated for quantitative variable data and Pearson correlation coefficient (r) was applied for association between BMI (Kg/m^2) and serum uric acid (mg/dl)

Table 1. Descriptive analysis of participants

Variables	Mean±S.D
Age (Years)	62.02±13.21
Weight (Kg)	72.87±13.93
Height (m^2)	2.66±0.491
BMI ($Kg/m^{2)}$	27.98±6.02
Serum uric acid (mg/dl)	5.47±1.82

In Table 1. average age 62.02±13.21 years, BMI (kg/m^2) 27.98±6.02, and serum uric acid **(mg/dl)** 5.47±1.82 was observed of the participants. More than 3 out of 4 , 256(68.30%) were female and had age 40-70 years. Participants with normal and over weigh were 116(30.90%) and 130(34.70%) respectively and 64(17.10%) were diagnosed with hyperuricemia that is shown in table 2.

Average BMI (Kg/m^2) and serum uric acid (mg/dl) was compared in male and female that was shown statistical significant difference with p-value=0.005 and <0.001 respectively shown in Table 3. To test the overall significance, ANOVA was applied to compare the serum uric acid among different health status (underweight, normal, overweight, obese class I and Obese class II that was found statistically significant difference with p-value <0.001.

Table 2. Descriptive analysis in responses

Variables	Response	n	%
Gender of participant	Female	256	68.3
	Male	119	31.7
Age Group(years)	40-50	89	23.7
	51-60	90	24
	61-70	101	26.9
	71 80	59	15.7
	80-90	36	9.6
BMI (kg/m^2)	<18.5 (Underweight)	10	2.7
	18.5 to 24.9 (Normal weight)	116	30.9
	25 to 29.9 (overweight)	130	34.7
	30 to 39.9 (Obese class1)	104	27.7
	>39.9 (obese class2)	15	4
Serum uric Acid (mg/dl)	Positive	64	17.1
	Negative	311	82.9
Total		**375**	**100**

Table 3. Comparison between male and female participants

Variables	Mean±S.D		T-Score	P-value	95%Confidence interval	
	Female	Male			Lower	Upper
Body mass index (Kg/m^2)	28.57±6.03	26.71±5.85	2.845	0.005*	0.57	3.15

Serum Uric Acid (mg/dl)	5.16±1.86	6.18±1.55	-5.57	<0.001 *	-1.38	-0.66

" * " indicates the statistical significant difference

Table 4. Between group comparison in health status through (BMI kg/m^2)

Variation	Sum of Squares	df	Mean Square	F	p-value+
Between Groups	354.091	4	88.523	36.57	<0.001*
Within Groups	895.635	370	2.421		
Total	1249.726	374			

"+" p-value was calculated by ANOVA test

As a Post Hoc test, Tukey's HSD test was applied to specify the statistical significance difference was observed in underweight with obese I and II,like that normal weight with obese I and II that is indicated in **Table 4 and 5.**

Table 5. Multiple comparison among health status through Post Hoc test (Tukey Test)

Body mass index (Kg/m^2) Level		Mean Difference	P-value	95% Confidence Interval	
				Lower Bound	Upper Bound
<18.5 Underweight	18.5 to 24.9 Normal weight	-0.71121	0.636	-2.1168	0.6944
	25 to 29.9 Overweight	-0.93069	0.362	-2.3303	0.4689
	30 to 39.9 Obese class1	-2.48269*	<0001*	-3.8948	-1.0706
	>39.9 Obese class2	-4.33167*	<0001*	-6.0728	-2.5905
18.5 to 24.9 Normal weight	25 to 29.9 Overweight	-0.21949	0.804	-0.7642	0.3252
	30 to 39.9 Obese class1	-1.77149*	<0001*	-2.3474	-1.1955
	>39.9 Obese class2	-3.62046*	<0001*	-4.7907	-2.4502
25 to 29.9 Overweight	30 to 39.9 Obese class1	-1.55200*	<0001*	-2.1131	-0.9909

	>39.9 Obese class2	-3.40097*	<0001*	-4.564	-2.238
30 to 39.9 Obese class1	>39.9 Obese class2	-1.84897*	<0001*	-3.0269	-0.671

P-value was calculated by Post Hoc test (Tukey's HSD Test) for multiple comparison

Table 6. Association between BMI (Kg/m^2) and serum uric acid (mg/dl)

Association	r	P-value
Body mass index (kg/m²) and serum uric acid (mg/dl)	0.552	<0.001*

"r" =Pearson's Correlation co-efficient, "*" indicate the statistical significant difference

Association between body mass index (kg/m²) and serum uric acid (mg/dl) was presented in Table 6. that showed the positive strong association r=0.552 that was statistically significant with p-value <0.001.

DISCUSSION

The study was conducted on 375 diagnosed knee osteoarthritis patients and it was performed in hospitals of Gujranwala division. Female participants were 256 and male participants were 119. The weight and height were recorded using weight machine and measuring tape and serum uric acid report values were noted the patient who came in OPD.

According to the results of this study the gender affected more is females than males Out of 119 males 21 have high uric acid levels and out of 256 females 43 have high uric acid values. According to previous study it was reported that hyperuricemia was more common in males than females (12.80% vs. 8.56%) with a prevalence of 10.24% in a rural Chinese population because this study was conducted on normal population not on knee OA patients[14].

This current study concluded that the women are more likely than men to get osteoarthritis ofthe knee. There are 256 females (68.3%) and 119 men (31.7%) are prone to knee osteoarthritis of total sample size of 375. Authors published their study and reported that women are likely to suffer knee osteoarthritis than men especially those who are over 50yrs. A large-scale population based cohort study was conducted on 2126 Japanese men and women analyzed and they described that the incidence of knee osteoarthritis in men was 5% and in women was 11.3%[15].

My study shows strong positive link between BMI and serum urate levels. The study was published they found that BMI was closely related to serum urate levels in healthy participants. In more recent studies a significant positive relationship was seen between serum uric acid and obesityin population of china, japan, India, Pakistan, Iraq and united states[12, 16]

More studies were in-line with our that knee OA is slightly less common in men as comparedto women and there are lesser symptoms experienced by men which includes pain and disability based on these observations it was established that gout and knee OA was more common in women as compared to men due to the high tendency to form severe knee OA in women[17].

In our study knee osteoarthritis was more common in age group of (61 to 70yrs), the total frequency of this age group more affected was 101 and 26.9% and this study relates to prior study[18].

In this study those participants with the BMI (25 to 29.9) overweight was more affected and diagnosed with knee OA including both male and female. The study conducted in past also shows similar outcomes like our study[19]. Weakness of this study was considered non-probability sampling technique that was used to select the participants and strength of current study was the found the strong statistical tests.

CONCLUSIONS:

On the basis of findings of this study it was concluded that there was found strong positive relation between high uricemia and body mass index. Management of knee osteoarthritis in females by reducing the work load on joints especially after menopause because the estrogen in body falls down. Good dietary intake can reduce the chances of hyperuricemia and proper screening otherwise symptoms can worse.

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