



## CORRELATION BETWEEN BODY MASS INDEX WITH KNEE PAIN IN OSTEOARTHRITIS KNEE: AN OBSERVATIONAL STUDY

### Orthopaedics

<b>Gupta A K</b>	Associate Professor and Head of Department of Physical Medicine and Rehabilitation, KGMU, Lucknow (UP), India.
<b>Asthana S S</b>	Junior resident , Department of Physical Medicine and Rehabilitation, KGMU, Lucknow (UP), India.
<b>Kumar D</b>	Assistant professor , Department of Physical Medicine and Rehabilitation, KGMU, Lucknow (UP), India.
<b>Mishra S R</b>	Assistant professor , Department of Physical Medicine and Rehabilitation, KGMU, Lucknow (UP), India.
<b>Yadav G</b>	Lecturer , Department of Physical Medicine and Rehabilitation, KGMU, Lucknow (UP), India.
<b>Srivastava M K</b>	Junior resident , Department of Physical Medicine and Rehabilitation, KGMU, Lucknow (UP), India.

### ABSTRACT

**OBJECTIVE :** This study was aimed to determine correlation between knee pain in osteoarthritis knee with body mass index.

**METHODS:** Total 109 patients of knee pain with radiological diagnosis of OA knee were enrolled. Evaluation was done by Kallgren and Lawrence grading, numerical pain rating scale. Analysis were performed on SPSS software (windows version 17.0).

**RESULTS :** Pearson correlation analysis showed a significant and positive (direct) correlation between BMI and NPRS ( $r=0.67, p<0.001$ ). Regression analysis showed that BMI alone may account 45.0% of total variations of NPRS ( $r^2=0.45$ )

**CONCLUSION :** Higher body mass index showed higher knee pain levels in study population. Weight reduction must be a part of life style modification.

### KEYWORDS:

Osteoarthritis(OA) , Body mass index(BMI) , Numerical pain rating scale(NPRS)

### INTRODUCTION

Knee osteoarthritis (OA), a degenerative disease, is the most common form of arthritis in the knee [1]. Knee pain was reported by up to a half of the individuals aged over 50, among which severe and disabling knee pain accounted for approximately 50%. The prevalence of obesity has been growing alarmingly in the world, concurrently with increasing predisposition to multiple co-morbidities [2]. Knee OA has been associated with various risk factors, such as advancing age, female gender, genetic predisposition, prior knee injury, certain occupations, biomechanical gait and alignment defects, and obesity. Of these, obesity is perhaps the most important risk factor associated with the incidence of radiological OA knee [3]. Obesity is seen as the primary modifiable trait to prevent or reduce the effects of knee OA [4]. The hypothesis is that individuals with higher body mass index (BMI) will have greater knee OA pain.

### MATERIAL AND METHOD

This observational study was performed in a tertiary care teaching institution of northern India. Subjects were enrolled from the patients attending the outpatient facility of the department of Physical Medicine and Rehabilitation of this institution after obtaining written informed consent. Inclusion criteria for study are age  $\geq 35$  years, radiological evidence of knee OA with knee pain. Exclusion criteria for the study were: smoking, history of trauma over knee, intra-articular injection (corticosteroids, hyaluronidase, prolotherapy) within 6 months, HLA B 27+ / inflammatory arthropathy, Gout, knee joints infections. Data collection included demographic details, roentgenogram of knee joints, and clinical examination. Knee OA was graded according to Kellgren and Lawrence grading [7]. Pearson correlation analysis and simple linear regression analysis were done to assess association between BMI and numerical pain rating scale (NPRS). A two-tailed ( $\alpha=2$ )  $p<0.05$  was considered statistically significant. Analyses were performed on SPSS software (Windows version 17.0).

### RESULTS

Total of 109 subjects were enrolled in the study.

The subjects were comparable with respect of age, weight and BMI.

Among patients 64 (58.7%) were females and 45 (41.3%) were males. Female to male ratio is 1.42:1. The age of subjects ranged from 35-90 years with mean ( $\pm$  SD)  $50.58 \pm 10.87$  years and median 50 yrs. Weight, height and BMI of patients ranged from 46.0-93.1 kg, 1.3-1.9 m and 18.3-35.8 kg/m<sup>2</sup> with mean  $66.84 \pm 11.08$  kg,  $1.57 \pm 0.12$  m and  $26.98 \pm 2.81$  kg/m<sup>2</sup> and median 67 kg, 1.56 m and 27 kg/m<sup>2</sup> respectively (table 1 & 2). Among patients 55% presented with bilateral knee pain, 25.7% with right knee pain and 19.3% with left knee pain. Kallgren-Lawrence Grade of OA knee of 9 (8.3%) patients was grade 1, 41 (37.6%) were grade 2, 28 (25.7%) were with grade 3 and 31 (28.4%) were with grade 4 severity. The NPRS of study population ranged from 2-9 with mean  $5.92 \pm 1.75$  and median 6. Mean NPRS score in female subjects was seen to be  $5.83 \pm 1.77$  as compared to  $6.04 \pm 1.72$  in male subjects (Table 1).

No. of patients (n=109)	Mean $\pm$ SD
Age (yrs)	$50.58 \pm 10.87$
Weight (kg)	$66.84 \pm 11.08$
Height (m)	$1.57 \pm 0.12$

Table 1

Grade	No.	BMI (Mean $\pm$ SD)	NPRS (Mean $\pm$ SD)
1	9	$23.99 \pm 1.12$	$3.78 \pm 1.30$
2	41	$26.00 \pm 1.97$	$4.88 \pm 1.26$
3	28	$27.67 \pm 2.03$	$6.36 \pm 1.28$
4	31	$28.69 \pm 3.24$	$7.52 \pm 1.12$
Overall	109	$27.03 \pm 2.74$	$5.92 \pm 1.75$

Table 2

Correlating the NPRS score with BMI, Pearson correlation analysis showed a significant and positive (direct) correlation between BMI and NPRS ( $r=0.67, p<0.001$ ) suggesting that as BMI increases, NPRS may also increase (Fig. 1). Further, regression analysis showed that the NPRS in OA knee patients can be estimated significantly from their respective BMI as BMI alone may account 45.0% of total variations of NPRS ( $r^2=0.45$ ).

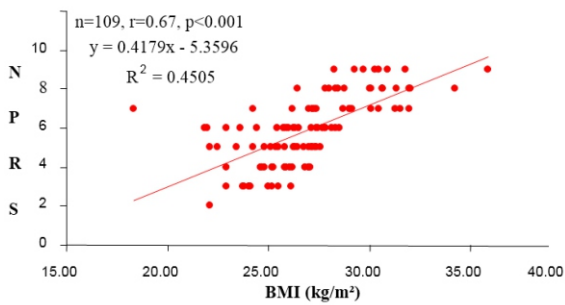


Figure 1

## DISCUSSION

Osteoarthritis is a degenerative disease of elderly population. Anatomical, structural, environmental factors contribute to the development and progression of disease process. Some factors influencing the disease outcome include injury to the knee, dietary intake, level of physical activity and occupation.

This study demonstrates evidence to the known observation about the correlation of BMI with the severity of pain in OA patients. The sample taken from a population subset nearby the centre (King George's Medical University) to decrease the confounding factor of genetic and environmental variability found in the subjects from differences in origin and environmental conditions.

BMI is perhaps the most important modifiable factor found in OA knee. Research papers have attributed overweight conditions in >50% of knee replacement surgeries [8]. Excessive vertical loading forces over osteoarthritic knee joint can induce inflammatory response (Berebaum F, Eymard F)[9]. Further, Leptins, found in adipose tissue, have been implicated in subtle chronic inflammatory state of osteoarthritis (Gaumond I, Arsenault P)[10]. Obesity, as well as female sex, tend to have higher body fat to muscle mass ratio, correlating with increased OA severity and pain.

Three to six times body weight is transmitted across the knee during single leg stance. Any increase in weight may be multiplied by this factor to reveal excess force across the knee in overweight person during walking. Increase in obesity causes increased joint destruction and pain and therefore decreased physical activity. This reduction in physical activity further increases body weight considering no change in eating habits. Thus, a vicious circle develops resulting in increased BMI, increased disease and symptoms.

Elizabeth Weiss in 2014 conducted a study on 4769 individuals with radiological evidence of knee OA. ANCOVA multiple regressions with controls reveal that even when taking into account OA severity, individuals with higher BMI experience greater pain than individuals with lower BMI [5]. In this study regression analysis showed that the BMI alone may account for 45.0% of total variations of NPRS ( $r^2=0.45$ ). Matthew et al in 2008 conducted a cross-sectional study on 576 individuals with radiological evidence of knee OA. Patients were divided into categories based on WHO classification of BMI. Pain subjects presented with a higher mean BMI (30.4 kg/m<sup>2</sup>) compared with no Pain subjects (27.5 kg/m<sup>2</sup>) ( $p < 0.0001$ ). Unadjusted and adjusted odds ratios demonstrated a positive association between BMI group and pain for each successive elevated BMI category. Adjusted odds Pre-obese group had  $p < 0.05$  and for the Obese III group  $p < 0.0001$  [6]. In this study we concluded that BMI has direct correlation with NPRS in symptomatic knee OA pain with  $p < 0.001$ .

## CONCLUSION

This study provide further evidence that BMI has a significant and positive (direct) correlation between BMI and pain levels suggesting that as BMI increases, NPRS may also increases. Although OA severity cannot be reversed and will increase, a lower BMI should reduce pain in knee OA patients. Patients should be encouraged to lose weight to manage knee OA pain and weight reduction must be a part of life style modification. Effective exercise program may be designed involving more of non-weight bearing joints and muscles to burn out excess fat and reduce BMI. Adequate bracing and assistive devices should be used to decrease mechanical stress and pain and to increase

activity level. Bariatric treatment options should be considered early along with other treatment methods in high BMI patients.

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