

**STUDY OF EFFECT OF WEIGHT REDUCTION ON PRIMARY OSTEOARTHRITIS HAND AND KNEE IN OBESE PATIENT**V. K. Verma<sup>1</sup>, Hemlata Verma<sup>2</sup>, H. Rao<sup>3</sup>, U. S. Shukla<sup>4</sup>, T. N. Singh Gaur<sup>5</sup>**HOW TO CITE THIS ARTICLE**

V. K. Verma, Hemlata Verma, H. Rao, U. S. Shukla, T. N. Singh Gaur. "Study of Effect of Weight Reduction on Primary Osteoarthritis Hand and Knee in Obese Patient". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 50, June 22; Page: 8745-8752, DOI: 10.14260/jemds/2015/1267

**ABSTRACT: INTRODUCTION:** Obesity, a major risk factor, is increasing the prevalence of osteoarthritis. Obese people are at high risk for developing osteoarthritis of certain joints of hand and knee. **AIM:** The purpose of the present study is to determine the relationship between hand osteoarthritis, Knee osteoarthritis and obesity for understanding the etiology. **METHOD:** 50 female patients were included in the study who had clinically diagnosed osteoarthritis of knee and hand, divided into two groups after taking informed written consent. Presence of osteoarthritis and graded according to Kellgren-Lawrence grading system. BMI was monitored at WHO classification of BMI by using formula-BMI=weight in kg/height in cm<sup>2</sup>. **PAIN:** Pain was assessed at Numerical rating scale (NRS). **RESULT:** Group I or control group were included 20 patients with clinically diagnosed osteoarthritis of knee and hand and were not willing to reduce weight. In control group at the time of registration mean weight 68.85±3.801 and mean BMI was 28.9±1.522. In group II or study group, 30 patients were included who were willing to reduce weight. Mean age 51.866±6.4097, Mean weight 69.2±2.917 and mean BMI was 29.11±1.26405. **CONCLUSION:** This study showed a relationship between osteoarthritis of knee and hand with Obesity. Prevention of osteoarthritis may be achieved by maintain normal body weight and prognosis of osteoarthritis can be improved by reduce body weight.

**KEYWORDS:** Obesity, Osteoarthritis, BMI, Weight reduction.

**INTRODUCTION:** Primary osteoarthritis is the most common type of arthritis. Its high prevalence, especially in the elderly, related to disease make it a leading cause of disability. Recent survey showed it to be very common in both males (53.5%) and females (60.9%) and affecting the relatively young obese people.<sup>(1)</sup> Obesity, a major risk factor, is increasing the prevalence of osteoarthritis. Current research suggests that obesity is a risk factor for development of hand osteoarthritis, and for both the development and progression of osteoarthritis knee.<sup>(2)</sup> Obese people are at high risk for developing osteoarthritis of certain joints of hand. As these joints are non-weight bearing, this suggests a metabolic rather than mechanical association between obesity and osteoarthritis.<sup>(3)</sup> Each pound of weight increases the loading across the joint three to six fold. Weight loss may have a commensurate multiplier effect on unloading both knee and hips. If weight loss substantial, may lessen symptoms of knee, hip and hand. There is evidence to support weight loss as an effective treatment for knee and hand osteoarthritis.<sup>(4)</sup> The exact mechanism of the relationship between obesity and osteoarthritis is not completely understood, but likely involves both biomechanical and biochemical factors.<sup>(5)</sup> Leptin is a peptide hormone produced by adipocyte, which has received much attention in attempts to understand the relationship between obesity and osteoarthritis. It plays a major role in regulating appetite through activation of hypothalamic receptors, but also participates in various other biological process-inflammation and immune function in particular.<sup>(6)</sup> There is

## ORIGINAL ARTICLE

---

growing body of evidence to suggest that leptin has a detrimental effect on articular cartilage, and a role in the pathogenesis of osteoarthritis.<sup>(7)</sup>

**AIMS:** This work was carried out with an aim directed to Study the effect of weight reduction on osteoarthritis of knee and hand in obese patients. The purpose of the present study is to determine the relationship between hand osteoarthritis, Knee osteoarthritis and obesity for understanding the etiology.

**OBJECTIVE:**

1. To establish the relationship between Primary osteoarthritis of hand, Knee and obesity.
2. To note the clinical effect of weight reduction on osteoarthritis of hand and Knee.
3. To note the Clinical changes in the above joints after weight reduction.

**MATERIALS AND METHODS:**

**Inclusion criteria:** Primary osteoarthritis of Knee, and hand up to grade III.

Female obese patients with Primary osteoarthritis of Knee and hand who are willing to reduce weight were included. Patients who were willing to participate in study.

**Exclusion Criteria:**

- Unwilling or unable to change eating habits and physical activity and
- Significant cognitive impairment.
- Not willing to give written consent Patients of systemic disease and infectious disease.
- Secondary osteoarthritis of Knee and hand.

**METHODS:** 50 female patients were included in the study who had clinically diagnosed osteoarthritis of knee and hand, divided into two groups after taking informed written consent. Both groups were investigated for pain, X-ray (Knee/hand), lipid profile and weight and height. The patients were screened for DM, hypertension, or any other chronic illness.

Group I was treated by only NSAID. This was the control group.

Group II was treated with reduction in weight and NASID, Study group.

All patients clinically diagnosed as Osteoarthritis of Knee and Hand were subjected to Radiography which were studied for the presence of osteoarthritis and graded according to Kellgren-Lawrence grading system.

**Grade 0:** Normal.

**Grade I:** Minute osteophytes of doubtful significance.

**Grade II:** Definite osteophytes mild reduction in joint space.

**Grade III:** Moderating narrowing of joint space.

**Grade IV:** Greatly reduced joint space and subchondral bone sclerosis.

BMI was monitored at WHO classification of BMI by using formula;

BMI=weight in kg/height in cm<sup>2</sup>.

BMI-Normal range-18.50-24.99, Overweight-≥25, Obese≥30.

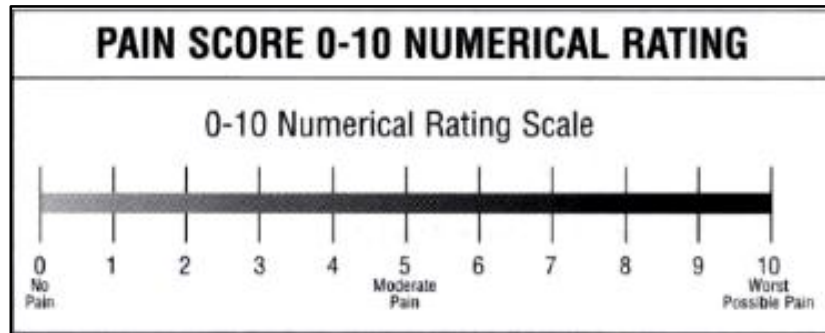
**Pain:** Pain was assessed at Numerical rating scale (NRS).

## ORIGINAL ARTICLE

### All patients are to have a functional activity score recorded:

- A. No limitation meaning the patient's activity is unrestricted by pain.
- B. Mild limitation means the patient's activity is mild to moderately restricted by pain.
- C. Severe limitation means the patient ability to perform the activity is severely limited by pain.

**Numerical Rating Scale (NRS):** Instruct the patient to choose a number from 0 to 10 that best describes their current pain. 0 would mean 'No pain' and 10 would mean 'Worst possible pain'.



**STUDY DESIGN:** Present study is prospective randomised control study was undertaken in the department of Orthopaedics PCMS, Bhopal. 50 cases fulfilling the inclusion criteria were included in the study. The duration of study was 1 years. The statistical analysis was done by Mann whitne 'u' test and SPSS 20.0 software was used. The association between Osteoarthritis and incremental increase in BMI will be carried out using multiple regression analyzing using SPSS 20.0 computer package.

**RESULT:** During the study 50 female patients who had osteoarthritis with obesity were included. Patients were divided into two group, Group I or control group were included 20 patients with clinically diagnosed osteoarthritis of knee and hand and were not willing to reduce weight. Patients of control group were treated with NSAID. In group II or study group 30 patients were included who were willing to reduce weight, patients of group II also were prescribed NSAID initially for pain.

Group Statistics						
	Group	N	Mean	Std. Deviation	T Value	P value
BMI Base line	Test	30	29.1153	1.26405	0.544	0.589
	Control	20	28.9	1.52281		
BMI After 3 Months	Test	30	27.167	1.2292		
	Control	20	28.9	1.52281	4.437	<0.0001*
BMI After 6 Months	Test	30	25.0907	1.03226		
	Control	20	28.9	1.52281	10.559	<0.0001*
BMI After 1 Years	Test	30	23.0497	0.78725		
	Control	20	30.33	0.13416	40.828	<0.0001*

**Table 1: Distribution of BMI in different time Periods in different Group**

## ORIGINAL ARTICLE

Ranks						
	Group	N	Mean Rank	Sum of Ranks	U Value	P value
Pain Score Ist visit	Test	30	26.17	785	280	0.659
	Control	20	24.5	490		
	<b>Total</b>	<b>50</b>				
Pain Score after 1 week	Test	30	28.45	853.5	211.5	0.046*
	Control	20	21.08	421.5		
	<b>Total</b>	<b>50</b>				
Pain Score after 2 week	Test	30	19.67	590	125	<0.0001*
	Control	20	34.25	685		
	<b>Total</b>	<b>50</b>				

**Table 2: Distribution of Pain in different time Periods in different Group**

Ranks						
	Group	N	Mean Rank	Sum of Ranks	U Value	P value
X-ray knee after 1 week	Test	30	24.67	740		
	Control	20	26.75	535	275	0.568
	<b>Total</b>	<b>50</b>				
X-ray knee after 6 months	Test	30	24.67	740		
	Control	20	26.75	535	275	0.568
	<b>Total</b>	<b>50</b>				
X-ray knee after 1 Years	Test	30	18.3	549		
	Control	20	36.3	726	84	<0.0001*
	<b>Total</b>	<b>50</b>				

**Table 3: Distribution of X – ray Knee in different time Periods in different Group**

Ranks						
	Group	N	Mean Rank	Sum of Ranks	U Value	P value
X-ray hand after 1 week	Test	30	24	720	255	0.161
	Control	20	27.75	555		
	<b>Total</b>	<b>50</b>				
X-ray hand after 6 months	Test	30	24	720	255	0.161
	Control	20	27.75	555		
	<b>Total</b>	<b>50</b>				
X-ray hand after 1 Years	Test	30	24	720	255	0.161
	Control	20	27.75	555		
	<b>Total</b>	<b>50</b>				

**Table 4: Distribution of X–ray Hand in different time Periods in different Group**

## ORIGINAL ARTICLE

In control group at the time of registration mean weight was  $68.85 \pm 3.801$  and mean BMI  $28.9 \pm 1.522$ . Pain score of patients at Numerical rating scale was measured, out of 20 patients. Twelve patients (60%) were scored at 8 and eight patients (40%) were scored at 7. All these patients were treated with NSAID after 7 days, ten (50%) patients had 2, One patient (5%) had 1 and nine (45%) had 3 score at numerical pain scale. All these patients required NSAID frequently for pain throughout the study and pain of maximum patients was measured between 3-4 at pain Numerical rating scale invariably during the study. All patients clinically diagnosed as osteoarthritis of Knee / and Hand were radiological studied for the presence of osteoarthritis and graded according to Kellgren-Lawrence grading system. At first visit, eleven (55%) patients had grade II and nine (45%) patients had grade I osteoarthritis of knee. At the end of study maximum patients were deteriorate from grade II to grade III. Fourteen (70%) patients were investigated for grade I and six (30%) patients were for grade II osteoarthritis hand. At first visit and at the end of study eight (40%) patients had grade II and eight (40%) grade III osteoarthritis and four (20%) patient had no change in grade.

In group II or study group, 30 patients were included who were willing to reduce weight. Mean age  $51.866 \pm 6.4097$ , mean weight  $69.2 \pm 2.917$  and mean BMI was  $29.11 \pm 1.26405$  at the time of registration. All the patients were subjected to reduce weight. At the time of first visit ten (33.33%) patients had BMI between 30- 35 and twenty (66.66%) patients had BMI between 25-30. At Second visit twenty eight (93.33%) patients had BMI between 25-30 and two (6.6%) patient had BMI between 24-25. Fifteen (50%) patients had BMI between 25-30 and 15 (25%) had between 20-25 at third visit. At the end of study all the patients had reduced weight and had BMI less than 25, mean BMI was  $23.04967 \pm 0.787254$  and  $p < 0.0001$ . Out of 30 patients, fourteen (46.66%) patients were scored for pain 8, eleven (36.66%) patients for 7, four (13.33%) patients for 9 and one (3.33%) patients for 6 at pain Numerical rating scale. All these patients were treated by NSAID for pain. At second visit, nineteen (63.33%) at 3, nine (30%) patients at 2 and two (6.66%) patients had score 1. one (6.66) patients was required NSAID for pain throughout the study and five (16.66%) patients needed add on NSAID. All the patients were subjected to X-Ray at the time of registration fourteen (46.66%) patients had grade II and sixteen (53.33%) had grade I osteoarthritis of knee. Twenty seven patients had grade I osteoarthritis of hand and only three patient had grade II osteoarthritis of hand. During the study on X-Ray there was no significant change seen in hand and knee X-ray and clinically all the patients were improved in function and pain.

**DISCUSSION:** The purpose of present study is to evaluate the prognosis of osteoarthritis in obese patient after weight reduction and establish relationship between Primary osteoarthritis of hand, Knee and obesity. Osteoarthritis is the major chronic metabolic disorder leading to musculoskeletal morbidity and functional loss, its effects increasing with age.

Obesity is a global health issue, with 315 million adults are classified as obese, defined as a body mass index (BMI) of  $\geq 30$  kg/m<sup>2</sup>.<sup>(8,9)</sup> As BMI values increase, joint pain symptoms and severity increase<sup>(10)</sup> is comparable to our study in our study we found in control group severity of osteoarthritis increased, and patients of control group required drugs therapy for pain. Joint pain may reflect the underlying pathological process of osteoarthritis. For every 5kg weight gain, there is a commensurate 36% increased risk for developing osteoarthritis.<sup>(11)</sup> In obese individuals, pain is most prevalent in the load-bearing joints including the lower limb and the low back,<sup>(11,12)</sup> but can manifest in upper extremity joints, hand and digits.<sup>(12)</sup> Obesity is associated with faster osteoarthritis progression than normal weight. Pain-related physical incapacitation worsens obesity, subsequent

## ORIGINAL ARTICLE

---

gait abnormalities and muscle weakness.<sup>(13)</sup> Importantly, pain may mediate obesity-induced impairment of physical functioning and deterioration of health-related quality of life.<sup>(14, 13)</sup> Weight loss sets in motion a cascade of events that can prevent osteoarthritis onset or combat existing osteoarthritis symptoms and disability, these events include reduction of mechanical and biological stressors. In our study we found relationship between osteoarthritis and obesity. The patients who reduced weight, they had no change in X-ray grading, improvement in pain, joint movement and Improve the quality of life. However, being overweight does not necessarily increase load across joints in the hand, suggesting involvement of other factors. In our study we found X-ray grading hand of test group were not changed significantly. In control group 70% patients were investigated for grade I and 30% patients were for grade II osteoarthritis of hand at first visit and at the end of study 40% patients had grade II and 8(40%) grade III osteoarthritis and 4(20%) patient had no change in grade. There is increasing evidence that systemic factors such as chronic inflammation or other metabolic processes are involved in development or progression of osteoarthritis.

In several study Obesity is considered to be one of the most important risk factors for osteoarthritis in knee. Numerous longitudinal studies show a strong association between obesity, defined as a body mass index(BMI) above 30, and radiographic knee osteoarthritis, e.g. in the Framingham Study,<sup>(15)</sup> the Chingford Study<sup>(16)</sup>, the Baltimore Longitudinal Study of Aging,<sup>(17)</sup> the John Hopkins Precursors Study,<sup>(18)</sup> and in longitudinal studies in UK<sup>(19)</sup> and the Netherlands.<sup>(20)</sup> Thus, the WHO initiative on counteracting obesity also accepts osteoarthritis as a consequence of obesity<sup>(21)</sup> However, the relationship between obesity and osteoarthritis in hand and hip remains controversial.<sup>(22,23)</sup> Large cross-sectional studies have failed to show a significant association between obesity and hand osteoarthritis in either males or females whereas some prospective data have demonstrated that obesity predicted hand osteoarthritis.

**CONCLUSION:** This study showed a relationship between osteoarthritis of knee and hand with Obesity. Prevention of osteoarthritis may be achieved by maintain normal body weight and prognosis of osteoarthritis can be improved by reduce body weight. This study further need to establish a relationship between osteoarthritis and role of biochemical stressors.

### REFERENCES:

1. Harrison's, principals of internal medicine 17<sup>th</sup> edition page; 2158-2164.
2. Grotlem, Hagen KB, Natvig B et. al. Obesity and osteoarthritis in knee, hip and hand epidemiological study in the general population with 10 years follow-up. *BME Musculoskeletal Disorders* 2008; doi: 10.1186/1471-2474-9-132.
3. Dahaghin S, Bierma-Zeinstra SMA, Koe B et al. Do metabolic factors add to the effect of overweight on hand osteoarthritis? The Rotterdam study. *Ann Rheum Dis* 2007; 66: 916-920.
4. Christensen R Bartels EM, Astrap A et al. Effect of weight reduction in obese patients diagnosed with knee osteoarthritis: a systematic review and metaanalysis, *Ann Rheum* 2007; 66: 433-439.
5. Al. Arfaj A, Al-Bockai A. Prevalence of Radiographic knee osteoarthritis in Saudi Arabia. *Clin Rheumatol* 2002; 21: 121-123.
6. Lago R. Gomez R Lago Ft al. Leptin beyond body weight regulation current concepts concerning its role in immune function and inflammation. *Cell Immunol* 2007; doi'10.1016/J cellimm 2007.09.004.



## ORIGINAL ARTICLE

---

7. Gualillo O. Editorial –Further evidence for leptin involvement in cartilage homeostasis. *Osteoarthritis cartilage*.2007; 15: 857-86.
8. Andersen RE, Crespo CJ, Bartlett SJ, Bathon JM, Fontaine KR. Relationship between body weight gain and significant knee, hip, and back pain in older Americans. *Obesity Research*. 2003; 11(10): 1159–1162.
9. Hitt HC, McMillen RC, Thornton-Neaves T, Koch K, Cosby AG. Comorbidity of obesity and pain in a general population: results from the Southern Pain Prevalence Study. *Journal of Pain*. 2007; 8(5): 430–4368.
10. Haara MM, Heliövaara M, Kröger H, et al. Osteoarthritis in the carpometacarpal joint of the thumb. Prevalence and associations with disability and mortality. *Journal of Bone and Joint Surgery, American volume*. 2004; 86-A (7): 1452–1457.
11. Nebel MB, Sims EL, Keefe FJ, et al. The relationship of self-reported pain and functional impairment to gait mechanics in overweight and obese persons with knee osteoarthritis. *Archives of Physical Medicine and Rehabilitation*. 2009; 90(11): 1874–1879.
12. Heo M, Allison DB, Faith MS, Zhu S, Fontaine KR. Obesity and quality of life: mediating effects of pain and comorbidities. *Obesity Research*. 2003; 11(2): 209–216.
13. Felson DT, Zhang Y, Hannan MT, Naimark A, Weissman B, Aliabadi P, Levy D: Risk factors for incident radiographic knee osteoarthritis in the elderly: the Framingham Study. *Arthritis Rheum* 1997, 40: 728-733.
14. Ananda coomasamy A, Catterson ID, Leibman S, et al. Influence of BMI on health-related quality of life: Comparison between an obese adult cohort and age-matched population norms. *Obesity(Silver Spring)*2009 Apri; epub ahead of print.
15. Spector TD, Hart DJ, Doyle DV: Incidence and progression of osteoarthritis in women with unilateral knee disease in the general population: the effect of obesity. *Ann Rheum Dis* 1994, 53: 565-568.
16. Hochberg MC, Lethbridge-Cejku M, Scott WW Jr, Reichle R, Plato CC, Tobin JD: The association of body weight, body fatness and body fat distribution with osteoarthritis of the knee: data from the Baltimore Longitudinal Study of Aging. *J Rheumatol* 1995, 22: 488-493.
17. Gelber AC, Hochberg MC, Mead LA, Wang NY, Wigley FM, Klag MJ: Body mass index in young men and the risk of subsequent knee and hip osteoarthritis. *Am J Med* 1999, 107: 542-548.
18. Cooper C, Snow S, McAlindon TE, Kellingray S, Stuart B, Coggon D, Dieppe PA: Risk factors for the incidence and progression of radiographic knee osteoarthritis. *Arthritis Rheum* 2000, 43: 995-1000.
19. Cooper C, Snow S, McAlindon TE, Kellingray S, Stuart B, Coggon D, Dieppe PA: Risk factors for the incidence and progression of radiographic knee osteoarthritis. *Arthritis Rheum* 2000, 43: 995-1000.
20. Reijman M, Pols HA, Bergink AP, Hazes JM, Belo JN, Lievensse AM, Bierma-Zeinstra SM: Body mass index associated with onset and progression of osteoarthritis of the knee but not of the hip. The Rotterdam Study. *Ann Rheum Dis* 2007, 66: 158-62.
21. Woolf AD, Breedveld FC, Kvien TK: Controlling the obesity epidemic is important for maintaining musculoskeletal health. *Ann Rheum Dis* 2006, 65: 1401-1402.
22. Vingard E: Overweight predisposes to coxarthrosis. Body-mass index studied in 239 males with hip arthroplasty. *OrthopScand* 1991, 62: 106-109.

## ORIGINAL ARTICLE

23. Tepper S, Hochberg MC: Factors associated with hip osteoarthritis: data from the First National Health and Nutrition Examination Survey (NHANES-I). *Am J Epidemiol* 1993, 137: 1081-1088.

### AUTHORS:

1. V. K. Verma
2. Hemlata Verma
3. H. Rao
4. U. S. Shukla
5. T. N. Singh Gaur

### PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, PCMS, & RC Bhopal.
2. Assistant Professor, Department of Pharmacology, Gandhi Medical College, Bhopal.
3. Professor & HOD, Department of Orthopaedics, PCMS, & RC Bhopal.

### FINANCIAL OR OTHER

**COMPETING INTERESTS:** None

4. Assistant Professor (Statics), Department of Community Medicine, Government Medical College, Jhalawar.
5. Assistant Professor, Department of Orthopaedics, PCMS, & RC Bhopal.

### NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. V. K. Verma,  
HIG, C-6, PCMS Campus,  
Bhanpur, Bhopal.  
E-mail: vkverma0505@gmail.com

Date of Submission: 02/06/2015.  
Date of Peer Review: 03/06/2015.  
Date of Acceptance: 15/06/2015.  
Date of Publishing: 22/06/2015.