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ORIGINAL ARTICLE

Correlation Between Serum Leptin With Severity of Knee Osteoarthritis

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Abstract

Background: **Knee osteoarthritis (OA) is a joint degeneration in the knee due to progressive articular cartilage loss. Knee OA patients' quality of life may be impacted by pain, physical restrictions, subpar treatment results, and more medication.**

Objective: **Correlation of serum leptin level with severity of knee osteoarthritis.**

Patients and methods: **This study involved 100 adult participants (40−60 years old) presented to the Egyptian Railway Medical Center at the outpatient clinics to correlate the serum level of leptin with the severity of knee osteoarthritis.**

Results: **Our study also showed that the cutoff leptin level between OA patients and the normal population is 13.6 mg/dl, and it has 92.68% sensitivity and 90% specificity to OA. Although we cannot rule out the psychological component in measuring pain in included patients it is important to consider that the study patients were not subjected to psychological assessment. In addition, researches in the future with a larger sample size are necessary to confirm our findings, although there are also, as far as we are aware, several studies that were conducted to investigate the function of leptin in the pathophysiology of osteoarthritis.**

Conclusion: **Considering this study, knee OA patients had a higher level of serum leptin level. Also, there is a significant link between OA degree with high levels of leptin.**

Keywords: Knee osteoarthritis, Leptin, Osteoarthritis, Years lived with disability

1. Introduction

Osteoarthritis (OA is one of the most common joint disease types as a sequel of injury to joint cartilage. It is a 'whole joint disease' meaning that every joint-related tissue is impacted by OA and plays a part in its pathogenesis. In the case of knee OA, joint cartilage, subchondral bone, synovial membrane, even incorporating joint capsule's outer fibrous layer, ligaments mainly intra-articular ligaments, menisci, and the pads of intra-articular fat are susceptible to being impacted by inflammatory processes.[1]

Joint osteoarthritis of the knee and hip joints is the third most common musculoskeletal condition, and according to years lived with a disability (YLD), it is ranked eleventh. Knee OA was responsible for 83% of the disease burden. Knee OA also has a high socioeconomic burden as a direct cost because OA made up 1.7% of the costs of the Program of French Health Insurance in 2002. They were comparable to the cost of coronary artery disorders.[2]

Knee OA's actual etiology is yet unknown; nevertheless, it is thought that numerous systemic and local variables interact in charge of the disease. While it is thought that systemic variables make joints more prone to injury, local factors, which have biomechanical characteristics, impact the joint's applied forces.[3]

In recent years, biochemical biomarkers have shown promise as osteoarthritis diagnosis tools, which are more sensitive and accurate than plain

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Table 1. Patient demographic information under study.

	Number = 80
Age in years	
Mean ± SD	48.50 ± 5.67
Range	40–60
Sex	
Female	35 (43.8%)
Male	45 (56.2%)

radiographs to identify alterations to joints that happen in OA. Osteoarthritis biomarkers may help in earlier detection of damage in the joint, disease prognosis, and progress observation, which might be identifiable using a preliminary biochemical test.[4]

The 16-kDa (kilodalton) protein leptin is highly dispersed all around body tissues and is produced especially by the placenta and fat tissue.

Leptin controls dietary intake, boosts energy consumption at the hypothalamic nuclei, and regulates the amount of adipose tissue and BMI. In addition, it encourages the creation of collagen, bone ossification, and osteoblast regrowth.[5]

Researchers have looked into leptin's function in lipodystrophy, and its relationship to the metabolic disorders associated with obesity has been assessed. Leptin is engaged in osteoarthritis progression and pathogenesis. Leptin is assumed as an important inflammatory mediator with catabolic sequence on cartilage and remodeling of bone, which all are connected to its pathophysiology.[6]

Leptin is crucial to understand the pathophysiology of OA. OA patients have higher serum leptin levels because humans' articular chondrocytes express the prolonged form of LEPR (leptin receptor), which the chondrocytes in cartilage also express, although earlier research indicated a catabolic role of that hormone in human cartilage.[7]

The effects of leptin on CPCs (chondrogenic progenitor cells) differentiation and proliferation can elucidate the part leptin plays in the etiology and progression of OA.

The CPCs' potential to migrate was lowered by high amounts of leptin, which inhibits their capability for chondrogenesis and enhances the osteogenic capability, indicating that leptin alters the consequences of CPC differentiation, which helps to induce OA.[8]

This work aimed to correlate serum leptin levels with osteoarthritis in knee severity.

2. Patients and methods

This study included 100 adult patients and control people (40–60 years).

Patients were classified randomly into two groups:

Group one: patient group (80 patients) with knee osteoarthritis, who were divided into **two subgroups** according to BMI: 40 obese patients and 40 non-obese patients.

Group two: control group (20) normal population.

2.1. Exclusions criteria

Concomitant rheumatic diseases, malignancy, posttraumatic, diabetes mellitus.

All patients and control were exposed to history taking, clinically examined, and their pain assessed by:

The visual analog scale (VAS).[9]

Pain Quality Assessment Scale (PQAS).[10]

The Western Ontario and McMaster Universities Arthritis Pain Scale (WOMAC).[11]

Investigations were done:

Knee plain X-ray: classified by (Kellgren-Lawrence Classification of Osteoarthritis) to 4 grades.[12]

Serum leptin level: Levels of leptin would be assessed in fasting using the enzyme-linked immunoassay (ELISA). The sample of serum was aspirated. Leptin was assessed in the serum.

All data were collected and statistically analyzed.

Table 2. Relationship between control and patients' group regarding pain score, X-ray grade, and leptin level.

	Control group Number = 20	Patients' group Number = 80	Test value	*P* value	Sig.
Pain score (1–10)					
Median (IQR)	1 (1–2)	7 (6–8)	−6.985≠	0.000	HS
Range	1–2	3–9			
Severity of knee osteoarthritis (X-ray) (1–4)					
Grade zero	15 (75.0%)	0 (0.0%)	88.281*	0.000	HS
Grade 1	5 (25.0%)	3 (3.8%)			
Grade 2	0 (0.0%)	26 (32.5%)			
Grade 3	0 (0.0%)	37 (46.2%)			
Grade 4	0 (0.0%)	14 (17.5%)			
Leptin (ng/ml)					
Mean ± SD	10.29 ± 3.48	38.96 ± 14.91	−8.509•	0.000	HS
Range	5.6–19	10.8–67.4			

Table 3. Relationship between age and sex with obesity in control and patient groups.

	Obesity			Test value	*P* value	Sig.
	Control group Number = 20	Obese Number = 39	Not obese Number = 41			
Age in years						
Mean ± SD	49.40 ± 5.57	49.69 ± 5.46	47.37 ± 5.69	1.948•	0.148	NS
Range	41–59	41–59	40–60			
Sex						
Female	10 (50.0%)	17 (43.6%)	18 (43.9%)	0.253*	0.881	NS
Male	10 (50.0%)	22 (56.4%)	23 (56.1%)			

Table 4. Relationship between pain score, severity of knee OA, and leptin levels.

	Obesity			Test value	*P* value	Sig.
	Control group Number = 20	Obese Number = 39	Not obese Number = 41			
Pain score (1–10)						
Median (IQR)	1 (1–2)	8 (7–9)	7 (5–7)	61.881≠	<0.001	HS
Range	1–2	4–9	3–9			
Severity of knee osteoarthritis (X-ray) (1–4)						
Grade 0	15 (75.0%)	0 (0.0%)	0 (0.0%)	105.202*	<0.001	HS
Grade 1	5 (25.0%)	1 (2.6%)	2 (4.9%)			
Grade 2	0 (0.0%)	9 (23.1%)	17 (41.5%)			
Grade 3	0 (0.0%)	16 (41.0%)	21 (51.2%)			
Grade 4	0 (0.0%)	13 (33.3%)	1 (2.4%)			
Leptin (ng/ml)						
Mean ± SD	10.29 ± 3.48	45.47 ± 9.53	32.76 ± 16.50	54.497•	<0.001	HS
Range	5.6–19	14.9–61.2	10.8–67.4			
Post hoc analysis						
	Control VS Obese	**Control VS Not obese**		**Obese VS Not obese**		
Pain score (1–10)	<0.001	<0.001		<0.001		
Leptin (ng/ml)	<0.001	<0.001		<0.001		

3. Results

Our study included 80 patients diagnosed with OA (45 males and 35 females). The mean age of the included patients was 48.50 ± 5.67 years (Table 1).

Analysis of the results of knee OA patients included in the study showed that, statistically, there was a difference between the control and patients' groups regarding pain score, X-ray grade, and leptin level with a *P* value of 0.000 in each of them (Tables 2 and 3).

In addition, we found that patient and control groups were highly significant statistically different in pain score, severity of knee OA, and leptin levels with *P* value (<0.001) in each of them (Table 4).

Also, the results of the patient group showed no significant difference between age and pain score with leptin levels. No statistically significant difference existed between leptin levels in obese persons with pain scores with a *P* value (<0.279), but statistically significant with age *P* value (<0.017). There was a nonstatistically significant difference in the nonobese patient group regarding leptin level with age and pain score with *P* values (<0.331) and (<0.556), respectively (Table 5).

Table 5. Correlation between cases group leptin level, age, and pain score among obese group and nonobese group.

	Leptin (ng/ml) cases group	
	r	*P* value
Age (years)	−0.076	0.501
Pain score (1–10)	0.185	0.101
	Leptin (ng/ml) obese group	
Age (years)	**−0.381***	**0.017**
Pain score (1–10)	−0.178	0.279
	Leptin (ng/ml) not obese group	
Age (years)	−0.156	0.331
Pain score (1–10)	−0.095	0.556

4. Discussion

Despite the fact that arthritis's most prevalent type is osteoarthritis, little progress has been made in the development of pathogenesis-based therapeutics or diagnostic and prognostic biomarkers. The typical diagnosis is based on the clinical and radiological results, yet, traditional radiography is not accurate for detecting early illness and it is ineffective at figuring out what causes pain and forecasting how an illness would progress.[13]

In all, 100 adult patients and control people participated in this study (40–60 years old), who

presented to the Egyptian Railway Medical Center at the outpatient clinics to correlate the serum level of leptin with the severity of knee osteoarthritis. Regarding mean age and sex, the control group and patients' group did not differ statistically significantly from one another, but they were different regarding the pain score, X-ray grade, and leptin level, which was in agreement with *Min et al.*[5]

Also, *Gao et al.*[6] concluded in other research that updates on osteoarthritis with metabolic syndrome are related and the possible contribution of leptin to osteoarthritis that information at this time suggests a strong correlation between MetS and OA. Animal studies have shown similar outcomes.

Also, the *Hussein et al.*[14] study showed that BMI and serum leptin show a strong association. Leptin levels were high in obese patients and correlated with the amount of body fat and also the concentration of leptin lowered after losing weight. High leptin levels in their synovial fluid and serum were believed to regulate regional knee joint inflammation. It revealed that increasing levels of leptin may describe the role of metabolism of obesity in knee OA because obesity by itself does not predispose to OA.

Our review revealed that the patient's group is non-different statistically between age and pain score in regard to leptin levels.

This outcome was distinct from the *Lübbeke et al.*[15] outcomes, which revealed that SF leptin levels were highly related to elevated pain scores on both WOMAC and VAS scales.

However, this difference in both results is due to different methodologies as *Lübbeke et al.*[15] assessed leptin levels in the synovial fluid and our study assessed serum leptin levels.

In our investigation, we discovered that obese patients are statistically different in leptin levels with a pain score, which agreed with *Durmus et al.*[16] Our study found that body mass index (BMI) and disease duration were strongly connected with plasma leptin levels, whereas patient age and pain were not significantly correlated.

Our study found that there was a difference between leptin levels in obese patients with age and there was no difference in statistics between leptin level and sex, which was in agreement with *Argente et al.*,[17] in age but disagreement with the sex, who discovered that females had considerably greater leptin levels than males of the same age.

This disagreement may be due to the nature of the patients, who have been recruited from the railway hospital, mostly from railway male workers.

In our study, the difference between leptin level and severity of knee x-ray in patients' group was statistically significant and that was in agreement with the results of prospective study by *Obiegbu et al.*[18] This was carried out in order to indicate whether there is a link between leptin in serum and severity of osteoarthritis radiologically in the knee joint of obese persons and found that two of them are positively correlated. Also, we have been agreed by *Elmenawy et al.*,[19] in their study about leptin and adiponectin level in the plasma with the severity of disease in the primary KOA, who discovered a strong linkage between leptin level in serum and with all of pain, stiffness, and K-L criteria.

Also, we found a strong difference which is statistically significant between leptin level regarding the severity of knee radiograph in the obese group and supposed that there is a correlation between leptin level, and obesity in osteoarthritis patients and that was in agreement with *Zhang et al.*,[20] which showed that leptin and obesity have a close relationship.

Lambova et al.[21] in a broad cross-sectional research with 6408 patients found that high serum leptin levels were strongly related with OA and leptin and is considered the link between obesity and OA.

Manoy et al.,[22] furthermore, in a previous study revealed a strong relationship between OA patients' leptin levels and body mass index (BMI).

4.1. Conclusion

Based on this recent study, we demonstrated that leptin levels in serum were elevated among KOA patients. Also, there is strong association between OA degree and high leptin levels.

Authorship

All authors have a substantial contribution to the article.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

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Conflicts of interest

The authors declared that there were no conflicts of interest.

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