



# The Relationship Between Chronic Low Back Pain and Bone Mineral Density in Young and Middle-Aged Males

## Genç ve Orta Yaş Erkeklerde Kronik Bel Ağrısı ve Kemik Mineral Yoğunluğu Arasındaki İlişki

Özcan HIZ, Levent EDİZ, Songül ERCAN, Mehmet ARSLAN\*, Serhat AVCU\*\*, İbrahim TEKEOĞLU

Yuzuncu Yil University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Van, Turkey

\*Yuzuncu Yil University Faculty of Medicine, Department of Neurosurgery, Van, Turkey

\*\*Yuzuncu Yil University Faculty of Medicine, Department of Radiology, Van, Turkey

### Summary

**Objective:** In this study, we investigated the relationship between chronic low back pain and bone mineral density in a young and middle-aged male population.

**Materials and Methods:** A total of 104 male patients with chronic low back pain were enrolled in the study. All subjects completed the Oswestry Disability Index (ODI). Additionally, the intervertebral disc degeneration (DD) was graded according to the Thompson's classification. After bone mineral density was measured the patients were divided into two groups: normal (n=50) and low (n=54) bone density groups. In addition, for comparing the data of patient sub-groups, bone mineral density was measured in 30 healthy subjects.

**Results:** T and Z-scores of the L2 -L4 and the femoral neck were found to be significantly lower in the patient group compared to the control group. In the patient group, there was a positive correlation between the ODI score and the DD score. There were negative correlations between both the ODI score and the DD score and L2-L4 and femoral neck T scores and Z-score. The DD and ODI scores were found to be significantly higher in a patient with low bone density compared to a patient with normal bone density.

**Conclusion:** We think that the low bone mineral density in young and middle-aged male patients with chronic lower back pain is related to disability and physical inactivity. *Türk J Phys Med Rehab 2012;58:294-8.*

**Key Words:** Chronic low back pain; lumbar disc degeneration; bone mineral density; physical inactivity; disability; male

### Özet

**Amaç:** Bu çalışmada genç ve orta yaş erkek popülasyonunda kronik bel ağrısı ve kemik mineral yoğunluğu arasındaki ilişki incelenmiştir.

**Gereç ve Yöntem:** Çalışmaya alınan kronik bel ağrılı toplam 104 erkek hasta Oswestry Disability Index (ODI) sorgulama formunu doldurdu. Ayrıca, intervertebral disk dejenerasyonu Thompson's sınıflamasına göre derecelendirildi. Hastalar kemik mineral yoğunluğu (KMY) ölçüldükten sonra normal kemik dansiteli (n=50) ve düşük kemik dansiteli (n=54) olmak üzere iki gruba ayrıldı. Ek olarak hasta alt gruplarının verileri ile karşılaştırılmak üzere 30 sağlıklıda da KMY ölçümü yapıldı.

**Bulgular:** L2-L4 ve femur boynu T ve Z skorları, hasta grubunda kontrol grubuna kıyasla anlamlı derecede daha düşük olarak bulundu. Hasta grubunda, ODI skoru ve DD skoru arasında pozitif korelasyon vardı. Hem ODI skoru hem de DD skoru ile L2-L4 ve femur boynu T ve Z skorları arasında negatif korelasyonlar vardı. DD ve ODI skorları normal kemik dansiteli hasta ile kıyaslandığında, düşük KMY'li hastada anlamlı derecede daha yüksek olarak bulundu.

**Sonuç:** Biz, kronik bel ağrılı genç ve orta yaş erkek hastalardaki düşük KMY'nin, fiziksel aktivite azlığı ve yetersizliğe bağlı olduğunu düşünüyoruz. *Türk Fiz Tıp Rehab Derg 2012;58:294-8.*

**Anahtar Kelimeler:** Kronik bel ağrısı; lomber disk dejenerasyonu; kemik mineral yoğunluğu; fiziksel inaktivite; özürüllük; erkek

## Introduction

Lumbar disc pathology is a chronic medical problem and one of the most common causes of chronic low back pain presenting with acute and subacute relapses (1). The most common cause of lumbar disc pathology is strain during flexion. Repeated strains result in tendency towards herniation leading to strain of the posterior longitudinal ligament and degeneration of the annulus fibrosus. Pain increases in positions enhancing intra-disc pressure, such as lifting weights by bending forward, sitting forward, or coughing and sneezing, and this pain significantly inhibits daily activities. Fear of physical activity and lack of confidence lead patients to avoid physical activities. Lifting heavy material is avoided by patients with low back pain and this may negatively affect the bone mass (2,3).

Many studies have examined the relationship between disc degeneration (DD) and bone mineral density (BMD), and conflicting results have been reported. These conflicting results may have arisen from methodological features of the studies. Negative correlations between osteoporosis and intervertebral DD scores have been reported in some studies (4-6). Miyakoshi et al. (7) reported a positive correlation between spondylotic changes and spine and femoral BMD in postmenopausal women.

In many previous studies in which the relationship between intervertebral DD and BMD was investigated, the patient population was chosen from postmenopausal women and older men, and the spine was evaluated by radiography, however, the disc was not visualized (6, 8-10). Magnetic resonance imaging (MRI) was used in a few subsequent studies, however, pre- and post-menopausal patients were chosen as the patient population (11,12). To date, in relation to disc pathologies, BMD has not been studied in a young or middle-aged male population.

In this study, we searched the relationship between intervertebral DD and BMD in a young and middle-aged male population with chronic low back pain due to intervertebral disc pathologies.

## Material and Method

This study was performed between 2008 and 2010 and it was approved by the local ethics committee. The patients were informed in detail about the study and written informed consents were obtained. A total of 104 male patients aged 30-45 years were included in the study. The patients had suffered from low back pain for 2-5 years, and were diagnosed with lumbar intervertebral disc pathology (intervertebral DD and/or intervertebral disc herniation) by MRI. A 1.5 Tesla superconductive imaging system (Siemens Symphony, Erlangen, Germany) was used for visualization of the spine using 5 mm sections. T2-weighted midsagittal images were used for anatomical evaluation. MRI images of all subjects were evaluated by the same radiologist. Subjects, who had osteophyte formations on the spine, ligament calcifications, spinal stenosis, spondylolysis, spondylolisthesis and fractures, were excluded from the study.

Degenerations of the L1-2, L2-3, L3-4, L4-5 and L5-S1 discs were graded between 1 and 5 according to the Thompson classification (13). The grading was as follows: Grade 1: 0 point; grade 2: 1 point; grade 3: 2 points; grade 4: 3 points; grade 5: 4 points. The total DD score was calculated as the mean of the individual scores.

Risk factors that could affect BMD were questioned using a standard form. Age, weight, height and body mass index (BMI) of each patient was recorded. Exclusion criteria included: Immobility due to other diseases (neurological, rheumatological, or muscular), androgen insufficiency, inflammatory low back disease (i.e. ankylosing spondylitis), diseases affecting the bone metabolism (endocrine, hepatic, renal, or gastrointestinal), infectious disease of the spine, hip pathologies, drugs affecting bone metabolism (heparin, corticosteroid, methotrexate, thyroid hormones, calcium, vitamin D), cigarettes/alcohol addiction, consumption of more than 3 cups of coffee a day. C-reactive protein, complete blood count, alkaline phosphatase, gamma-glutamyl transaminase, parathyroid hormone, 25-OH vitamin D and testosterone levels were tested. Subjects with normal laboratory values were included in the study. All exclusion criteria for the patient group were also applied to the control group. Since there are no reference values of BMD for males in our country, the measurements were made in a control group of 30 male subjects without low back pain and having similar age, BMI, sun-bathing, dress, and nutrition characteristic of the region from which the patient group was obtained.

BMD of the patients (n=104) was measured at the lumbar spine and femur using a DXA scan (Norland, XR-46, USA). The patient group was divided into subgroups: 1. normal bone density and 2. low bone density. Then, BMD measurement was performed in 30 healthy volunteers. The L2-L4 and femoral neck T-scores and Z-scores were used for comparisons. All patients were asked to complete the Oswestry Disability Index (ODI) in order to determine the effect of low back pain on daily life. The Turkish version of the ODI has good comprehensibility, internal consistency, and validity and is an adequate and useful instrument for the assessment of disability in patients with low back pain (14).

### Statistical Analysis

Statistical significance was accepted as 5% and calculations were performed using the SPSS 15 for Windows. Descriptive statistics were defined as mean, standard deviation, minimum, and maximum values. In independent group comparisons that do not meet the normal distribution, the Kruskal-Wallis test for more than 2 group comparisons and the Mann-Whitney U test for 2-group comparisons were used. Spearman's rho coefficient was presented for the relationship levels.

## Results

There was no difference between the patient and control groups in terms of age and BMI ( $p>0.05$ ). The duration of degenerative disc disease was between 2 and 5 years in all patients. The L2-L4 or femoral neck T-scores were  $>-1$  in 50 patients (normal BMD), between  $-1$  and  $-2.5$  in 48 patients, and  $<-2.5$  in 6 patients (a total 54 patients had low BMD). DD score, ODI score, L2-L4 T-score and femoral neck T-score differences

between the groups were statistically significant ( $p < 0.001$ ). DD and the ODI scores in patients of low BMD group were higher than that of patients with normal BMD. A summary of the parameters measured in patients and controls is listed in Table 1. When evaluated the correlations between parameters measured in the patient group, we found a positive correlation between the ODI scores and the DD scores; and ODI scores and DD scores were negatively correlated with the L2-L4 and femoral neck T-scores and Z-scores. The correlations between the scores are shown in Table 2.

## Discussion

The results of this study demonstrated that L2-L4 and femoral neck T-scores and Z-scores negatively correlated with disability due to chronic low back pain in young and middle-aged males. This negative correlation was shown both in lumbar T and Z-scores and the femoral neck T and Z-scores. Moreover, the disability scores (ODI) were found to be significantly higher in the low BMD subgroup of the patient group (Group 2) compared to the subgroup with normal BMD values (Group 1).

Different results have been reported in previous studies about the relationship between BMD and DD disease. This situation may have arisen from the different age groups and different imaging methods used in these studies (4-7). Furthermore, most of these studies were carried out based on radiological findings without taking the symptoms and disabilities of the patients into consideration.

There have been studies reporting that the high BMD values at the spine and the other sites are in patients with DD disease (4-7). These studies were performed on postmenopausal women and/or older men, and there was a study compared

premenopausal and postmenopausal women (12). However, studies comparing control and patient groups are necessary to distinguish a relationship between DD and BMD in a young population, since DD begins in the early twenties (15). Our study was well-controlled for factors that could affect BMD. Our study population was more homogenous, since we excluded patients with conditions that could lead to low back pain, except DD disease, and other conditions that affect BMD in male population aged 30-40 years. The patient group was drawn from subjects presenting to our clinic with complaints of low back or leg pain, who met the inclusion criteria. Healthy volunteers with the same inclusion criteria were also included in the study. Healthy volunteers were selected from the relatives of

**Table 2. Correlation between scores in the patient group.**

Patient group		DD score	ODI score
ODI score	Spearman's rho	0.527	1.000
	p	<0.001	-
L2-L4 T-score	Spearman's rho	-0.643	-0.571
	p	<0.001	<0.001
Femur Neck T-score	Spearman's rho	-0.314	-0.463
	p	<0.001	<0.001
L2-L4 Z-score	Spearman's rho	-0.674	-0.714
	p	<0.001	<0.001
Femur Neck Z-score	Spearman's rho	-0.349	-0.512
	p	<0.001	<0.001

DD: Disc Degeneration; ODI: Oswestry Disability Index

**Table 1. Demographic data of the patient and control groups and scores of measured parameters.**

	Group 1 (Normal BMD) n=50 Median (Min-Max)	Group 2 (Low BMD) n=54 Median (Min-Max)	Control Group n=30 Median (Min-Max)	p
Age	38.72±3.89 36 (30-45)	38.52±3.91 38 (31-45)	39.33±3.81 40 (32-44)	0.174
BMI	26.32±3.84 27.24 (20.21-35.50)	26.38±2.93 26.65 (21.80-33.75)	25.10±2.74 24.26 (22.00-30.88)	0.082
DD score	3.08±1.03 3.00 (1.00-4.00)	3.67±0.67 4.00 (2.00-5.00)	- -	0.003
ODI skoru	37.72±7.02 38.00 (26.00-48.00)	48.33±7.18 46.00 (36.00-62.00)	- -	<0.001
L2-L4 T-score	-0.06±0.62# -0.33 (-0.96-1.12)	-0.71±0.47*\$ -0.70 (-1.54-0.29)	0.20±0.32# 0.25 (-0.34-0.82)	<0.001
Femur Neck T-score	-0.13±0.75#\$ -0.34 (-0.97-1.62)	-1.47±0.85*\$ -1.29 (-2.79-0.76)	0.56±0.61*# 0.50 (-0.29-1.88)	<0.001
L2-L4 Z-score	-0.03±0.58#\$ -0.18 (-0.34-0.84)	-0.52±0.78*\$ -0.89 (-2.12-0.74)	0.45±0.38*# 0.45 (-0.13-87)	<0.001
Femur Neck Z-score	-0.16±0.48#\$ -0.34 (-0.56-1.12)	-1.48±0.46*\$ -1.24 (-2.13-0.68)	0.55±0.12*# 0.48 (-0.12-1.56)	<0.001

BMI: Body Mass Index; DD: Disc Degeneration; ODI: Oswestry Disability Index

\* Different from the normal BMD group

# Different from the low BMD group

§ Different from the control group

patients, with the aim of reflecting the general population. The L2-L4 and femoral neck T-scores and Z-scores of the patient group were found to be significantly lower than that of the control group ( $p < 0,001$ ). The detection of low BMD values in both sites may be related to the activity of the patients rather than the local effect of DD.

Genetic factors are the main determinants of BMD and bone mass, however, environmental factors have significant effects on the quality and strength of the bone. For this reason, life style and nutritional habits play important roles in providing and maintaining peak bone mass (16,17). Patients with low back pain usually purposefully reduce their physical activities since activities increase their pain, despite the health professionals' recommendations about exercise. Physical activity has positive effects on the musculoskeletal system, including an increase in BMD (2,3).

Regular and weight-bearing exercises create an osteogenic effect (18,20). There are trials in the literature reporting a positive relationship between regular physical activity and BMD (2,3,21-23). Studies showing the positive effects of exercise on BMD have reported that physical activity was important for the maintenance of bone mass (24-28). Tervo et al. (29) reported that decreased physical activity in men leads to decreased BMD in trabecular bone, but other studies may not support this contention (30-32). Karlsson et al. (33) reported that the benefits of strong exercise continued for 10-20 years, however, the risk of fracture was not lower than that of the general population.

Nordström et al. (34) found fracture risk to be lower in elderly athletes compared to a control group. In the study of Tervo et al. (29), performed to determine the effect of decreased physical activity on bone, they reported a decrease in BMD, especially at the trabecular bone in young males with reduced physical activity, and that the benefits of performing active sports continued on the cortical bones even eight years following cessation of sports activities.

In our study, we evaluated the effect of disability on BMD by comparing ODI and T and Z-scores in the lumbar disc herniation group. A positive correlation was found between the ODI scores and the DD scores in the patient group, and a negative correlation was found between the ODI scores and BMD. For detailed assessment, the patient group was divided into two subgroups: normal BMD and low BMD. DD and ODI scores of the low BMD group were found to be significantly higher than those of the normal BMD group. This suggests that DD leads to a decrease in BMD both at the spine and the femoral neck by causing more disability. Alternatively, these findings could suggest that young men with lower bone mass also have weaker disc structure and progress towards DD more readily. At this time, it is unclear if men with DD who do not respond to mechanical low back stress by making osteophytes or endplate sclerosis (and thus have lower BMD) are different from those who do.

In their study comparing the patients with low back pain and healthy control group, Gaber et al. (35) reported 52% osteopenia and osteoporosis in one or more sites in measurements of lumbar, femur and forearm BMD values of the patient group. On the other hand, they reported that there was

no relationship between low back pain and BMD according to the BMD measurements of forehands in patients with chronic low back pain (36). In another study (37), it was reported that there was no relationship between BMD of the patients with low back pain, low back pain reports, and disability, whereas in our study, a significant relationship was determined between both severity of degenerative disc disease and disability and lumbar spine and femoral neck T-scores. Osteopenia or osteoporosis was detected in one or two sites in 50% of our patients.

Our results are consistent with the results of some published studies, and inconsistent with some others. This may be due to the differences in the patient population, since we performed the study on a homogenous group consisting of young and middle-aged males having similar dress and nutritional characteristics, not having smoking and alcohol addiction, and having no other major skeletal risk factors for osteoporosis. Other studies were generally performed on less homogeneous groups of postmenopausal women. Furthermore, we evaluated the patients with MRI and excluded patients with osteophytes and ligament calcifications. We also excluded the patients with hip pain and motion disability. Thus, we excluded the other bone pathologies affecting the spine and femoral BMD.

A limitation of this study is that we did not know what BMD values were before the low back pain began. We tried to overcome this limitation by performing measurements in healthy subjects who have similar life styles and minimal osteoporosis risk factors. Another limitation is that, because of absence of an MRI and X-ray examination in the healthy subjects, a possible DD in this group could not be detected.

In conclusion, we suggest that low bone density in young and middle-aged male patients with chronic low back pain and DD may be related to their disability and decreased physical activity, even though previous studies have reported a negative correlation between osteoporosis and spinal degenerative disease. Fear of physical activity and lack of confidence significantly contributes to the patients' avoidance of physical activity. For this reason, exercise programs must be emphasized in the treatment of patients with low back pain. With exercise, disability can be reduced and the negative effect of the disability on BMD may be prevented.

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#### Conflict of Interest:

Authors reported no conflicts of interest.

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