Correlation Between the Degree of Disc Degeneration and the Degree of Facet Joint Arthritis in Spinal Magnetic Resonance Imaging (MRI) and Oswestry Disability Index (ODI) Scores at Wahidin Sudirohusodo General Hospital, Makassar

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Abstract

Objective: The primary aim of this study is to assess the correlation between the degree of disc degeneration and the degree of facet joint arthritis in spinal MRI examinations and the functional status of patients using the Oswestry Disability Index (ODI) score.

Methods: This observational analytic study employed a cross-sectional design, utilizing secondary data from medical records at Wahidin Sudirohusodo Hospital, Makassar. The total sample comprised 55 respondents, collected from January 2023 to March 2024, who met the inclusion criteria. Inclusion criteria included patients with MRI findings of disc degeneration and facet joint arthritis in the lumbosacral vertebrae, aged over 40 years. Exclusion criteria involved patients with non-lumbosacral vertebrae pain sources, pain due to trauma, infection, occupation, smoking, and spinal tumor metastasis, as well as congenital abnormalities.

Results: The degree of facet joint arthritis was assessed based on Pathria's classification, while disc degeneration was evaluated using Pfirrmann's classification on spinal MRI. Correlations between disc degeneration and facet joint arthritis, as well as their respective correlations with functional status based on the ODI, were analyzed.

On univariate analysis, this study showed that at lumbar level 1-2 the most found is 3rd degree disc degeneration at 43.9%. Respondents with minimal disabilities experienced grade II disc degeneration the most at 43.03%, meanwhile respondents with moderate disabilities experienced grade III degeneration the most at 41,79%.

Bivariate analysis was done in this study, the degree of disc degeneration at each level of lumbar vertebrae have significant correlations with facet joint arthritis with a p value <0.05 with a very strong positive correlation indicated by a correlation coefficient value of 0.938 in level of lumbal 1-2, but does not have a significant relationship with the functional degree with a p value of >0.05. Body mass index did not have a significant relationship to disc degeneration with value p of 0.217. Occupation has a significant relationship to disc degeneration with grades p of 0.002, with a weak positive correlation indicated by a correlation coefficient value of 0.047. Gender has a significant relationship to disc degeneration with value p of 0.014.

From multivariate analysis, there is no significant relationship between the age group variables 41-50, 51-60, 61-70, 71-80, 81-90 on the incidence of grade II-IV disc degenerations (P value >0,05). There was also no significant relationship between normal body mass index, overweight, obese 1, obese 2 with grade II-IV disc

degenerations (P value >0,05). Female respondents were more likely to suffer from grade II disc degeneration (P 0,036; OR 7.8) and grade III (P 0,034; OR 8) compared to men. There is no significant correlation between disc degeneration (Pfirrmann grade 2-5) and moderate disability as measured by ODI (P values of 0.532, 0.673, 0.465), nor between facet joint arthritis (Pathria classification) and moderate disability (P values of 0.897, 0.979). Similar results were found for severe disability, with no significant correlation between disc degeneration and severe disability (P values of 0.417, 0.776, 0.272), nor between facet joint arthritis and severe disability (P values of 0.151, 0.978).

Conclusion: This study found a significant correlation between disc degeneration and facet joint arthritis with a strong positive correlation coefficient between the two variables at the lumbar 4-5 level. However, no significant correlation was found between disc degeneration and functional status, nor between facet joint arthritis and functional status, based on the Oswestry Disability Index. Correlations were found between gender, age, body mass index, and activity level with disc degeneration, with female respondents more likely to suffer from grade II and grade III disc degeneration compared to males.

Introduction

Intervertebral disc degeneration is closely related to facet joint arthritis due to the intrinsic biomechanical effects that occur. This relationship was initially described as a degenerative cascade initiated either by the facet joint or by the disc itself. It is believed that facet joint arthritis usually follows disc degeneration, with facet overloading due to the inability of the disc to bear weight. Includes degenerative changes that occur in the intervertebral discs located anteriorly and the facet joints located posteriorly. The stability of each spinal motion segment depends on these two components1,2,3.

The facet joints are also an important component of the spinal motion segments. Facet joints typically support 3%-25% of segmental load which can increase to 47% when disc degeneration occurs. Facet joint degeneration can progress to arthritis and trigger lower back pain4,5.

Degeneration on three-lumbar-joint complexes including discs and facet joints is a multifactorial pathological process. Previous studies have shown that intervertebral disc degeneration and facet joint degeneration are often related, but this correlation is still not fully understood, especially in the context of spinal MRI examination and ODI scores. A cross-sectional study with a dominant population aged more than 50 years, the results showed that there was no correlation between disc degeneration and facet joint arthritis. However, other studies report that facet joint arthritis is significantly worsened with the progression of the degree of disc degeneration. The height of the intervertebral disc significantly decreased with the progression of the degree of facet joint degeneration, except for grades 0 and 1.2

The primary aim of this study is to assess the correlation between the degree of disc degeneration and the degree of facet joint arthritis in spinal MRI examinations and the functional status of patients using the Oswestry Disability Index (ODI) score.

Materials and methods

This study was an analytical observational study with a cross-sectional design, conducted to evaluate the at RSUP Dr. Wahidin Sudirohusodo Makassar. The study included all patients with interpreted results of disc degeneration according to the Pfirrmann classification and facet joint arthritis according to the Pathria classification on spinal MRI examination. Patients were selected based on the inclusion criteria, who had spinal pain caused by a degeneration process at the level of the lumbosacral vertebrae, features of degeneration in the discs and facet joints with complete medical records including MRI results, and >40 years old at the time of diagnosis. The degree of facet joint damage and disc degeneration is then assessed and the clinical symptoms of patients with this degree are evaluated using the Oswestry Disability Index (ODI) to determine functional status. Data collection involved recording

demographic characteristics. All included patients underwent standardized diagnostics to ensure consistency in data acquisition and analysis.

Exclusion criteria involved patients with non-lumbosacral vertebrae pain sources, pain due to trauma, infection, occupation, smoking, and spinal tumor metastasis, as well as congenital abnormalities.

Statistical analysis

The study analyzed frequency and percentage distributions of mean values and regression coefficient using descriptive statistics. Categorical variables were presented as frequencies and percentages, while numerical variables were expressed as means and standard deviations or medians with interquartile ranges for non-normally distributed data. Descriptive analysis compared genders, age, activity, and BMI, which were displayed in tables. Statistical analysis was performed using SPSS version 27, with normality assessed through the Kolmogorov-Smirnov test. Statistical analysis was carried out by calculating descriptive statistics, categorical frequency distributions and spearman correlation test to assess the relationship or correlation of two variables and the statistical results are significant if the p value <0.05.

Results

Univariate Analysis

The total population in this study was 55 respondents with the entire population being used as samples. Patient characteristics for each research variable include gender, age, activity, body mass index (BMI), degree of disc degeneration, and degree of facet joint arthritis was summarized in (Table 1).

Table 1. Sample Characteristics

Criteria	n = 55	Percentage
Age		
41-50 y.o	5 samples	9.1%
51-60 y.o	22 samples	40%
61-70 y.o	23 samples	41.8%
71-80 y.o	3 samples	5.5%
81-90 y.o	2 samples	3.6%
Gender		
Male	19 samples	34.5%
Female	36 samples	65.5%
Body Mass Index		
Normal	12 samples	21.8%
Overweight	17 samples	30.9%
Obesity gr I	24 samples	43.6%
Obesity gr II	2 samples	3.6%
Activity		
Light activity	53 samples	96.4%
Moderate activity	2 samples	3.6%
The degree of Disc Degeneration		
2		
3	8 cases	14.5%
4	13 cases	23.6%
5	25 cases	45.5%
	9 cases	16.4%
The degree of facet joint arthritis		
1		
2	10 cases	18.2%
3	41 cases	74.5%

	4 cases	7.3%

This study showed that at lumbar level 1-2 the most found is 3rd degree disc degeneration at 43.9%, at lumbar level 2-3 the most found is 4th degree disc degeneration at 36.2%, at lumbar level 3-4 the most found is 4th degree disc degeneration at 42%, at lumbar level 4-5 the most found is 4th degree disc degeneration at 39.6%, at lumbar level 5-sacral 1 the most found is 3rd grade disc degenerations at 37.0% (Table 2).

Table 2. Characteristics of disc degeneration based on the Pfirrmann classification for each lumbosacral vertebral level

Vertebrae levels	Disc Degeneration (Pfirrman Classification)			
	2nd degree	3rd degree	4th degree	5th degree
Lumbal 1-2	31,7%	43,9%	24,4%	0
Lumbal 2-3	27,7%	31,9%	36,2%	4,2%
Lumbal 3-4	18%	34%	42%	6%
Lumbal 4-5	13,2%	35,9%	39,6%	11,3%
Lumbal 5-Sacral 1	21,7%	37,0%	30,4%	10,9%

The following table (Table 3) shows that respondents with minimal disabilities experienced grade II disc degeneration the most at 43.03%, grade III of 26.74%, grade IV of 25.58% and grade V of 4.65%. While respondents with moderate disabilities experienced 10.27% of grade I disc degeneration, 40.41% of grade II, 41.79% of grade III, 7.53% of grade IV.

Table 3. Characteristics of research respondents based on functional status

ODI	**Disc Degeneration**			
	2nd degree	3rd degree	4th degree	5th degree
Minimal disability	43,03%	26,74%	25,58%	4,65%
Moderate disability	10,27%	40,41%	41,79%	7,53%

Bivariate Analysis

In this study, female respondents were more likely to suffer from grade II disc degeneration (P 0,036; OR 7.8) and grade III (P 0,034; OR 8) compared with men. Certain age groups have a significant relationship to disc degeneration with grades p of 0.042, with a weak positive correlation indicated by a correlation coefficient value of 0.263. Body mass index did not have a significant relationship to disc degeneration with value p of 0.217. Occupation has a significant relationship to disc degeneration with grades p of 0.002, with a weak positive correlation indicated by a correlation coefficient value of 0.047. Gender has a significant relationship to disc degeneration with value p of 0.014, with a very weak positive correlation indicated by a correlation coefficient value of 0.162. The correlation of each characteristic is shown in Table 4.

Table 4. Samples' Characteristic Correlation with Disc Degeneration

	Spearman Coefficient	P
Age	0,263	0,042
Body Mass Index	0,289	0,047
Activity	0, 274	0,002
Gender	0,162	0,014

The degree of facet joint arthritis was assessed based on Pathria's classification, while disc degeneration was evaluated using Pfirrmann's classification on spinal MRI. Correlations between disc degeneration

and facet joint arthritis, as well as their respective correlations with functional status based on the ODI, were analyzed. There is a significant relationship between the degree of disc degeneration at all lumbar vertebral levels and facet joint arthritis with a p value of 0.000 to 0.001 (Table 5).

Table 5. Correlation of Disc Generation, Facet Joint Arthritis, and Functional Status

Disc Degeneration	Facet Joint Arthritis		Functional Status	
	Spearman coefficient	P	Spearman coefficient	P
Lumbal 1-2	0,938	0,001	0,207	0,194
Lumbal 2-3	0,887	0,000	0,401	0,105
Lumbal 3-4	0,899	0,000	0,295	0,180
Lumbal 4-5	0,876	0,000	0,152	0,216
Lumbal 5-Sacral 1	0,847	0,000	0,275	0,064

The degree of disc degeneration at each level of lumbar vertebrae have significant correlations with facet joint arthritis with a p value <0.05 with a very strong positive correlation indicated by a correlation coefficient value of 0.876 in level of lumbal 4-5, but does not have a significant relationship with the functional degree with a p value of >0.05. They can be seen in Table 5.

Meanwhile, facet joint arthritis at lumbar vertebral in every level does not have a significant relationship to functional status with a p value of >0.05 (Table 6).

Table 6. Correlation of Facet Joint Arthritis and Functional Status

Facet Joint Arthritis	Functional Status	
	Spearman coefficient	P
Lumbal 1-2	0,138	0.191
Lumbal 2-3	0,375	0,109
Lumbal 3-4	0,219	0,127
Lumbal 4-5	0,068	0,128
Lumbal 5-Sacral 1	0,170	0,249

Multivaritae Analysis

There is no significant relationship between the age group variables 41-50, 51-60, 61-70, 71-80, 81-90 on the incidence of grade II disc degeneration found in this study with P value of 0.985; 0.992 ; 0.988 ; 0.926. There was no significant relationship between normal body mass index, overweight, obese 1, obese 2 and grade II disc degeneration with a P value of 0.402; 0.641; 0.478. There was no significant relationship between moderate and vigorous activity and grade II disc degeneration with a P value of 0.879. There is a significant relationship between male gender and grade II disc degeneration with a P value of 0.036, with a negative regression coefficient of – 2.007 and an odds ratio of 0.125, this shows that male respondents have a chance of suffering from grade II disc degeneration that is 0.125 times greater than female respondents or that female respondents have a chance of suffering from grade II disc degeneration that is 8 times greater than male respondents (Table 7).

The table also shows that there is no significant relationship between the age group variables 41-50, 51-60, 61-70, 71-80, 81-90 on the incidence of grade III disc degeneration with a P value of 0.996; 0.983; 0.998 ; 0.938. There was no significant relationship between normal body mass index, overweight, obese 1, obese 2 and grade III disc degeneration with a P value of 0.907; 0.794; 0.366. There was no significant relationship between moderate and heavy activity and grade III disc degeneration with a P value of 0.879. There is a significant relationship between male gender and grade III disc degeneration with a P value of 0.034, with a negative regression coefficient of – 2.062 and an odds ratio of 0.127, this shows that male respondents have a chance of suffering from grade III disc degeneration that is 0.127 times greater than that of female gender or that female respondents have a

chance of suffering from grade III disc degeneration that is 7.874 times greater than that of male respondents (Table 7).

Aside from that, it also showed that there was no significant relationship between the age group variables 41-50, 51-60, 61-70, 71-80, 81-90 on the incidence of grade IV disc degeneration with a P value of 0.833; 0.777; 0.825; 0.781. There was no significant relationship between normal body mass index, overweight, obese 1, obese 2 and grade IV disc degeneration with a P value of 0.248; 0.266; 0.165. There is no significant relationship between moderate and vigorous activity and grade IV disc degeneration with a P value of 0.850. There was no significant relationship between gender and grade IV disc degeneration with a P value of 0.079 (Table 7).

Table 7. Correlation between age group, occupation and gender with disc degeneration

Disc Degeneration	Variable	Regression Coefficient	P	OR
II degree	41-51 years old	1.860	.958	6.426
	51-60 years old	-.361	.992	.697
	61-70 years old	-.014	.988	.686
	71-80 years old	-3.301	.926	.037
	81-90 years old	-	-	-
	Normal BMI	1.912	.402	6.769
	Overweight	1.007	.641	2.737
	Obese 1	1.602	.478	4.964
	Obese 2	-	-	-
	Moderate activity	1.045	.789	.973
	Vigorous activity	-	-	-
	Male	-2.077	.036	.125
	Female	-	-	-
III degree	41-51 years old	-.179	.996	.836
	51-60 years old	-.727	.983	.483
	61-70 years old	-.102	.998	.903
	71-80 years old	-2.643	.938	.071
	81-90 years old	-	-	-
	Normal BMI	-.251	.907	.778
	Overweight	.520	.794	1.682
	Obese 1	1.892	.366	6.630
	Obese 2	-	-	-
	Moderate activity	1.602	.879	.867
	Vigorous activity	-	-	-
	Male	-2.062	.034	.127
	Female	-	-	-
IV degree	41-51 years old	-6.676	.833	.001
	51-60 years old	-8.967	.777	.000
	61-70 years old	-7.010	.825	.001
	71-80 years old	-8.790	.781	.000
	81-90 years old	-	-	-
	Normal BMI	2.325	.248	10.225
	Overweight	2.152	.266	8.600
	Obese 1	2.848	.165	17.260
	Obese 2	-	-	-
	Moderate activity	.218	.850	1.243

	Vigorous activity	-	-	-
	Male	-1.718	.079	.179
	Female	-	-	-

Table 8. Correlation of Degrees of Disc Generation, Degrees of Facet Joint Arthritis, and Functional Status Degrees.

Disc Degeneration	**Variable**	**Regression Cefficient**	**P**	**OR**
Moderate Disability	Pfirrmann grade 2	481	.532	1.953
	Pfirrmann grade 3	.596	.673	1.814
	Pfirrmann grade 4	.725	.465	2.064
	Pfirrmann grade 5	-	-	-
	Pathria grade 1	-1.790	.897	.281
	Pathria grade 2	1.331	.979	1.765
	Pathria grade 3	-	-	-
Severe Disability	Pfirrmann grade 2	1.276	.417	3.583
	Pfirrmann grade 3	.401	.766	1.493
	Pfirrmann grade 4	1.000	.272	2.718
	Pfirrmann grade 5	-	-	-
	Pathria grade 1	-1.787	.151	.167
	Pathria grade 2	1.891	.978	2.931
	Pathria grade 3	-	-	-

The analysis showed in Table 8, there is no significant correlation between disc degeneration (Pfirrmann grade 2-5) and moderate disability as measured by ODI (P values of 0.532, 0.673, 0.465), nor between facet joint arthritis (Pathria classification) and moderate disability (P values of 0.897, 0.979).

Similar results were found for severe disability, with no significant correlation between disc degeneration and severe disability (P values of 0.417, 0.776, 0.272), nor between facet joint arthritis and severe disability (P values of 0.151, 0.978). Additionally, the study compared which condition had a greater impact on functional status and analyzed other variables related to disc degeneration and facet joint arthritis.

Discussion

This study analyzed patient characteristics and analyzed the relationship between disc degeneration and facet joint arthritis as well as based on functional status Oswestry Disability Index (ODI) which was held in January 2023 – March 2024 and is presented in tabular form.

Genders

In this study, a significant relationship was found between male and female gender on disc degeneration and value P=0,014. Previous studies have shown that the prevalence of disc degeneration and facet joint arthritis often differs between men and women. According to Alpayc et al. (2015), women tend to experience back pain more often than men, which can be related to biological and hormonal differences. This may explain the higher proportion of women in the study, as they may be more susceptible to the condition. Likewise, research conducted by Anastasia et al, 2022, found that women experienced more back pain but there was no significant relationship between back pain and gender and the value of P=0,255.6

A systematic review conducted by Lin-Yu Jin, (2020), explains that low back pain is more dominant in women due to a combination of biological, hormonal, psychosocial and body structure

factors. This difference causes women to be more susceptible to experiencing back pain that is more frequent, more intense, and more chronic than men. Factors such as hormonal fluctuations, pregnancy, menopause, as well as psychosocial and socio-economic stress play an important role in increasing the risk of low back pain in women.7

Another study conducted by Wang et al, (2011), explained that the relationship between female gender and disc degeneration is significantly influenced by hormonal changes, especially during and after menopause. This research shows that women experience more severe disc degeneration than men, largely due to a lack of estrogen, which accelerates the degenerative process in the spine. Estrogen is a hormone that plays an important role in maintaining the health of intervertebral discs. In women, especially after menopause, estrogen levels drop significantly. This may lead to increased susceptibility to disc degeneration as estrogen is believed to help maintain disc structure and function. Estrogen functions in helping regulate the synthesis of proteoglycans and collagen, which are important for disc hydration and structural integrity.8

Estrogen stimulates the synthesis of proteoglycans, which are important components of the extracellular matrix of the intervertebral disc. These molecules help retain water and provide structural support, contributing to the disc's ability to withstand mechanical stress. Apart from that, estrogen also affects the activity of chondrocytes, cells responsible for producing and maintaining extracellular matrix, including proteoglycans. By improving chondrocyte function, estrogen ensures adequate production of these important molecules, which helps maintain hydration and integrity of the intervertebral disc. Estrogen also functions to help maintain the balance between synthesis and degradation of extracellular matrix by inhibiting the activity of matrix metalloproteinase (MMP), an enzyme that breaks down proteoglycans and collagen. This inhibition is critical to prevent excessive degradation of the disc matrix, which can lead to degeneration.8

Age

There is a significant relationship between age and disc degeneration with value P=0.042 in this study. Aged 61-70 years the degenerative process is more advanced, with many individuals experiencing symptoms of lower back pain, stiffness, or even impaired mobility. This condition is greatly influenced by physiological aging, where the body's ability to repair damaged tissue is reduced, causing more individuals to develop facet joint arthritis and disc degeneration. The age group 51-60 represents a significant percentage (40%), which is in line with the fact that at this age, disc degeneration and facet joint arthritis begin to be more common. In this age range, the spinal discs begin to show signs of wear, while the facet joints also experience decreased function, which can cause pain or limited movement. The 41-50 years age group shows a presentation of 9.1% where disc degeneration and facet joint arthritis begin to appear, but usually still in mild to moderate form. Risk factors for this condition begin to develop at this age, but are not yet dominant. Several factors such as poor posture, an inactive lifestyle, or previous injuries can accelerate degeneration at this age. Meanwhile, the age groups 71-80 years (5.5%) and 81-90 years (3.6%) show smaller percentages in this distribution, but tend to have a higher prevalence of degenerative conditions such as severe disc degeneration and facet joint arthritis.2,8

Another study conducted by Foizer et al, (2022), found that the 51-60 years age group suffered more from lower back pain where the majority of patients (87%) experienced moderate to severe disc degeneration, especially in the L4-L5 and L5-S1 segments, which is often associated with higher pain and disability. A systematic review conducted by Balagué et al, (2012), found that low back pain is more common in young adults to middle age, reaching a peak at the age of 40-60 years, then its prevalence can decrease in old age. Age is one of many risk factors for back pain, but its effects are influenced by lifestyle, physical activity, and genetic factors. This research further shows that in old age, lower back pain can also be influenced by psychosocial factors, such as social isolation or depression.9,10

Type of activity

In this study it was found that work had a significant relationship to disc degeneration and grades p of 0.002. Research conducted by Pfirrmann et al, (2001), shows that the relationship between physical activity and disc degeneration is often related to risk factors. Physical activities that involve repetitive loads or stress on the spine, such as lifting heavy weights or activities that involve excessive

bending of the body, can worsen degenerative disc conditions. This can speed up the degeneration process and increase the strain on an already damaged disc, triggering further pain and discomfort. However, light activity, such as walking, swimming, or core strengthening exercises, tends to be beneficial for preventing or slowing the progression of disc degeneration by maintaining bone stability and mobility. This is similar to research conducted by Kalichman et al, 2007, showing that facet joint osteoarthritis occurs more often in people who have mechanical risk factors, such as activities involving repetitive movements or excessive load on the lower back. Physical activities that involve repetitive movements that place stress on the facet joints, such as lifting heavy weights or excessive body bending, can worsen this condition by causing further damage to the joint cartilage and accelerating the progression of arthritis.3,11

BMI in disc degeneration

In this study, a significant relationship between Body Mass Index (BMI) and disc degeneration was found with value P of 0.047. Research conducted by Vismara et al, 2010, measuring spinal movement during standing, forward flexion and lateral bending found that obesity and low back pain both affect spinal mobility. Obesity has been shown to reduce the flexibility and mobility of the spine, possibly due to the heavy load placed on the spine and its structures, which can cause discomfort and movement restrictions. Additionally, low back pain exacerbates mobility limitations because the pain can prevent the individual from performing full spinal movement.12

The results of this study are the same as the research of Takatalo et al. (2013) which shows that men with a BMI of more than 30 have a higher risk of experiencing low back pain, with an odds ratio of 1.34, while women with a BMI of more than 30 show a lower risk, but still increased with an odds ratio of 1.22. In addition, research by Sheng et al, (2016), found that obesity is associated with disc degeneration in all parts of the spine, showing that the distribution of body fat, especially in the abdominal area, plays a major role in increasing mechanical stress on the spine, which leads to a decrease in disc height, herniation, and enlargement of spinal ligaments. In individuals who are overweight (overweight), the chance of experiencing lower back pain is higher (odds ratio= 0.218, $p < 0.01$) and disc degeneration (odds ratio= 0.441, $p < 0.05$). Meanwhile, in obese individuals, the odds of experiencing lower back pain increased more (odds ratio/logged odds = 0.395, $p < 0.001$) and disc degeneration also increased (odds ratio/logged odds = 0.528, $p < 0.001$).13,14

Disc degeneration, facet joint arthritis and functional status

Most of the patients in this study experienced higher grade disc degeneration (grade 4) with a percentage of 45.5%, with grade 4 disc degeneration mostly found at lumbar level 3-4. Spinal degeneration includes disc degeneration (DD), facet joint osteoarthritis, changes in muscle components and degeneration processes in ligaments. The degenerative process in the facet joints is characterized by cartilage damage and changes in the subchondral bone, accompanied by the formation of osteophytes and cysts. The anatomical shape of the joint will change to hypertrophy.15,16,17

Research conducted by Saleem et al, (2013), shows that lumbar disc degeneration is a common condition that significantly impacts quality of life, especially in the older population. The most common location of degeneration is the lower lumbar discs, particularly L4-L5 and L5-S1. This is due to the anatomical and mechanical characteristics of the lumbar spine, where the lower segments bear the greatest load and pressure during daily activities, leading to increased wear and tear over time.18

Research conducted by Anastasia, (2022), shows that the distribution of facet joint arthritis mostly occurs at the lumbar 4-5 and lumbar 5-sacral 1 levels. This is similar to research conducted by Kalichman et al, (2007), where the research shows that degenerative spondylolisthesis is associated with facet joint arthritis at the lumbar 5-sacral level 1. Where in this study the value was found. $P < 0.005$ which means there is a significant relationship between vertebral level and facet joint arthritis. This research is also supported by Fujiwara et al, 1999, it was found that the degree of facet joint arthritis at the L4-5 level was significantly higher than at L3-4 ($P < 0.05$), while no significant differences were found between L3-4 and L5-S1, as well as between L4-5 and L5-S1.19,11,3

There is a significant association between the degree of disc degeneration at all levels of the lumbar spine and facet joint arthritis in this study. Respondents with minimal disability mostly experienced grade II disc degeneration at 43.03%. However, in this study there was no significant relationship between disc degeneration, facet joint arthritis and functional status.

This study is in accordance with what was found by Fujiwara et al, 1999, who found that there was a significant correlation between the severity of disc degeneration and facet joint arthritis ($p < 0.001$). The calculated correlation coefficient values are 0.584 at the L3-4 level, 0.460 at the L4-5 level, and 0.310 at the L5-S1 level. This is confirmed by findings by Li et al, 2011, who stated that facet joint arthritis is associated with intervertebral disc degeneration, especially at the 4-5 lumbar level. Statistical results show a significant correlation between age, intervertebral disc degeneration, and facet joint arthritis with a correlation coefficient of 0.33. A similar study conducted by Yu et al, 2012, found that there was a significant correlation between disc degeneration and facet joint arthritis. The results showed that facet joint arthritis most commonly occurred in grades IV and V of the Pfirrmann grading scale, with no facet joint arthritis found in cases without disc degeneration. The correlation between the severity of disc degeneration and the degree of facet joint arthritis was shown to be statistically significant, with correlation coefficient values of 0.584 at lumbar level 3-4, 0.460 at lumbar 4-5, and 0.310 at lumbar 5-sacral 1. This indicates that the more severe the disc degeneration, especially at higher lumbar levels, the greater the likelihood of osteoarthritis of the facet joints.3,20,21

Research by Foizer et al, (2022), shows that there is no relationship between disc degeneration at lumbar levels 4-5 (p 0.412), lumbar 5-sacral 1 (p 0.375) with functional status. However, at lumbar level 1-2, there is a significant relationship p 0.008 with a correlation coefficient of 0.288 indicates a weak positive relationship between the two variables. Foizer et al, 2022, said that low back pain is multifactorial. This means that, in addition to disc degeneration, other factors such as age, physical activity, musculoskeletal structure and patient psychology also play an important role. Another study conducted by Gebrewold et al (2022), found that no significant correlation was found between ODI scores and other MRI parameters such as foraminal stenosis, disc draining, bulging, bulging, or modic changes.9,22

Different things were found by another study conducted by El-Hady et al, (2023), which found that there was a significant relationship between disc degeneration and functional degree ($p < 0.0001$) and a coefficient of co-operation of 0.584, where this research shows that there is a relationship between functional status and body mass index ($p < 0.0001$) and a correlation coefficient of 0.320. Middendorp et al, (2017), found that there was a weak positive relationship between disc degeneration and functional degree according to the ODI score.23,24

Conclusion

This study found a significant correlation between disc degeneration and facet joint arthritis with a strong positive correlation coefficient between the two variables at the lumbar 4-5 level. However, no significant correlation was found between disc degeneration and functional status, nor between facet joint arthritis and functional status, based on the Oswestry Disability Index. Correlations were found between gender, age, BMI, and activity level with disc degeneration, with female respondents more likely to suffer from grade II and grade III disc degeneration compared to males.

Ethics approval

This study was conducted in accordance with ethical principles and guidelines to ensure the protection of participants' rights, safety, and well-being. Ethical approval was obtained from the Institutional Review Board (IRB) of Hasanuddin University prior to the commencement of the study.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study is presented as part of the article.

Declaration of artificial intelligence use

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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