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How age and body mass index are the highest risk for low back pain

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Abstract
Low Back Pain (LBP) is one of the foremost common musculoskeletal disorders within the community. At slightest around 80% of the world's populace has experienced LBP at slightest once. Risk factors that can cause LBP are Age and Body Mass Index. The purpose of this study was to decide whether the risk factors of Age and Body Mass Index (BMI) were related to the frequency of LBP at the Cempaka Putih District Health Center. This research uses case control method. The results of this study indicate that the results of the Mann Whitney statistical test showed that there was a significant difference in the mean between the LBP and Normal groups on the variables of age and body mass index (p-value < 0.001). ROC analysis illustrates that age and BMI variables are included in the poor category in predicting the incidence of LBP (Area 0.60 – 0.70; p-value < 0.001). The cut-off value (rounded) of the risk of LBP incidence for age is 48 years. and for the body mass index is 25 kg/m2 . The results of the Pearson Chi Square with Yates Correction statistical test concluded that there was a significant relationship between a minimum age of 48 years and a minimum BMI of 25 kg/m2 on the incidence of Low Back Pain (p-value < 0.001) with the risk magnitude of the age variable being 3,430 (1,974 - 5.960) and variable BMI of 3.195. The results of the diagnostic test showed that the diagnostic ability of the age variable was sens 65.31; spec 64.57; PPV 58.72; NPV 70.69 – and the diagnostic ability of the variable body mass index is sens 61.22; species 66.93; PPV 58.82; NPV 69.11. The conclusion of this study shows that there is a relationship between age and BMI with the incidence of LBP at the Cempaka Putih District Health Center.

Keywords: Low back pain (LBP), risk factors, age, body mass index (BMI)

Introduction
Low Back Pain (LBP) is a health problem that is often found in the society. This can be seen from the presentation of the occurrence of LBP which is quite high. It is estimated that 80% of people in western countries have experienced LBP, and in the UK about 17.3% have experienced LBP. Meanwhile in Indonesia, the incidence of LBP varies between 7.6 – 37%. Risk factors that can cause low back pain incorporate environmental variables, occupational variables, and individual variables. Individual variables comprise of gender,age, a long time of service,Body Mass Index (BMI), education history, smoking propensities, wage level, physical movement and injury history. Occupational variables include work position, workload, length, and redundancy movement. Environmental variables incorporate commotion and vibration. (Ones *et al.*, 2021) [11].
Body mass index is one of the risk factors for various diseases, ranging from hypertension, cardiovascular disease, neurological diseases, and others. (Agustian *et al.*, 2020; Firmansyah *et al.*, 2021; Firmansyah & Halim Santoso, 2020; Gosal *et al.*, 2020; Pratiwi *et al.*, 2020) [1, 4, 5, 6, 14]

Body Mass Index is one of the risk factors causing LBP, excess BMI will move the center of gravity to be pushed forward, increasing the occurrence of lumbar lordosis where there is emphasis on the spine when receiving a load, resulting in mechanical stress on the back, lower back, and causes low back pain (Pratiwi *et al.*, 2020) [14].
Another risk factor that can cause LBP is age, usually someone will experience LBP complaints at the age of 25-65 years. The emergence of LBP complaints usually occurs at the age of 35 years, as you get older the complaints will increase, at the age of 60 there is a decrease in muscle strength, with increasing age there is also a decrease in bone elasticity which then causes LBP complaints (Saputra, 2020) [15]. However, in Indonesia, research related to this has not been done much.

Therefore, based on this background, the researcher wanted to know the relationship between Age and Body Mass Index with Low Back Pain at the Cempaka Putih District Health Center in Jakarta Indonesia.

2. Research method

This research is a preliminary study with a case control research design to measure age and minimum BMI as a risk factor for the occurrence of Low Back Pain. This research was carried out at the Cempaka Putih Health Center, Central Jakarta in the period of January 2021 to March 2021. The sample in this study was all LBP patients aged more than 18 years who were diagnosed either by a Health Center doctors or by a specialist/general practitioner elsewhere, while the sample was The controls in this study were patients without any signs of LBP with a minimum age of 18 years. The sampling method in this study was using a non-random purposive sampling method. The inclusion criteria in this study were all LBP and non-LBP patients for control cases who were treated at the Cempaka Putih District Health Center. The exclusion criteria in this study were incomplete medical record data, especially on research variables.

The procedure for this research is starting from taking care of licensing with the Health Center and medical records. Furthermore, secondary data in the form of medical records were viewed successively to see data in the form of anamnesis complaints, physical examinations and supporting examinations. The independent variables in this study included age and body mass index. The dependent variable in this study is the incidence of LBP.

Prior to the statistical test, the Kolmogorov-Smirnov test and the Shapiro-Wilk test were used to test the normality of the data, and the Levene test was used to perform an analysis of variance between the groups. The data analysis or statistical test performed in this study is an independent T - Test test format for calculating the difference between the two means when the data are normally distributed and the alternative Mann-Whiney test when the data are aberrant. If the relationship between the two variables is determined to have a significant difference in mean or p-value < 0.05 between the two groups, then the variables will be tested again for its predictor ability using ROC for their ability to predict the occurrence of LBP. ROC or AUC values are considered to be good predictive if the angular deviation is greater than 45 degrees and the p-value is <. It's 0.05. The accuracy of the test is then divided into 5 groups if the AUC value of 0.90 - 1.00 is considered very good (excellent), 0.80 - 0.90 is considered good, 0.70 - 0.80 is considered sufficient (fair), 0.60 – 0.70 is considered bad (poor), and 0.50 – 0.60 is considered a failure (fail). Advanced determination to determine the intersection point of the sensitivity and specificity curves using the Build Chart method. The rounded results from the Build Chart were retested using the Pearson Chi Square method with Yates Correction and an alternative test in the form of Fisher's Exact. The clinical outcomes were in the form of 4 values of the diagnostic test elements. The statistical output results are said to be meaningful if the p-value <0.05. This research has obtained permission from the management of the Cempaka Putih District Health Center.

3. Results

There were 225 respondents who participated in the study and met the inclusion criteria. Respondents are generally female (57.4%) and diagnosed with LBP in 98 (43.6%) respondents. All descriptive data of respondents are presented in table 1.

Table 1: Characteristics of Respondent Data

Variable	N (%)	Mean (SD)	Med (Min – Max)
Gender			
• Male	96 (42, 7%)		
• Female	129 (57, 4%)		
Diagnosis			
• LBP	98 (43, 6%)		
• Normal	127 (56, 4%)		
Profession			
• Working	147 (65, 3%)		
• Not Working	78 (34, 6%)		
Marital Status			
• Married	124 (55, 1%)		
• Not Married	101 (44, 9%)		
Age		45,67 (15,94)	46 (18 – 78)
Weight		63,91 (10,59)	63 (40 – 96)
Height		159,64 (7,33)	160 (140 – 177)
BMI		25,11 (4,11)	24,44 (16,33 – 37,97)

The results of the data normality test of the independent variable of the dependent variable using the Kolmogorov-Smirnov test showed that the data distribution was not normal for all test variables. Therefore, the statistical test used in this study is the Mann-Whitney statistical test as an alternative to the independent t-test statistical test. The results of the Mann-Whitney statistical test showed that there was a significant mean difference between the LBP group and the normal group in the age and obesity index variables (p-value <0.001). (Table 2)

Table 2: Differences in Mean Age and BMI between LBP and Normal Patients

Parameter	Normality	Disease				p-value
		LBP		Normal		
		Mean (SD)	Med (Min-Max)	Mean (SD)	Med (Min-Max)	
Age	< 0,05	51,47 (14,37)	52 (18 – 78)	41,20 (15,7)	36 (18-73)	< 0,001
BMI	< 0,05	26,18 (4,21)	26,67 (16,63 – 36,36)	24,3 (3,84)	22,84 (16,33 – 37,97)	< 0,001

The results of statistical tests on the mean difference between the two groups showed that BMI and age variables could be used as references to predict the onset of LBP. The two variables were retested using the ROC curve method. This test is used to test how powerful the model for each of these variables is in predicting LBP. From the results of the ROC analysis, it was found that BMI and age had deviations above 45 degrees, which means they have minimal predictive test ability in predicting the incidence of LBP. ROC analysis provides an illustration that the variables of age and BMI are included in the poor category in predicting the incidence of LBP (Area 0.60 – 0.70; p-value < 0.001) (Figure 1 and Table 3).

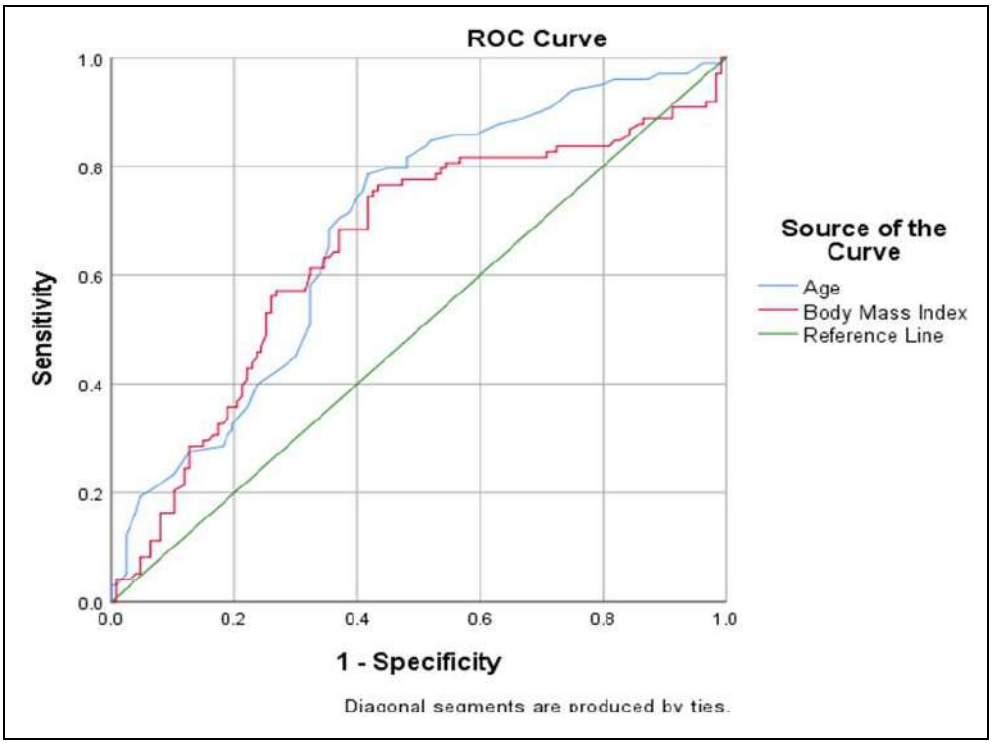

Fig 1: ROC Curve of LBP. Event Predictor Parameters

Table 3: Area under Curve (AUC) Predictor Parameters for LBP Incidence

Variable	Area	Std. Error[a]	*p-value*	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
Age	.686	.035	.000	.617	.756
BMI	.648	.038	.000	.573	.722

The results of the bargaining of sensitivity and specificity are presented in Figures 2 and 3 which illustrate the best risk magnitude for BMI and age in predicting the incidence of LBP. From the graph it is known that the cut-off value (rounded up) of the risk of LBP incidence for the age variable is 48 years (Figure 2) and for the body mass index variable is 25 kg/m2 (Figure 3).

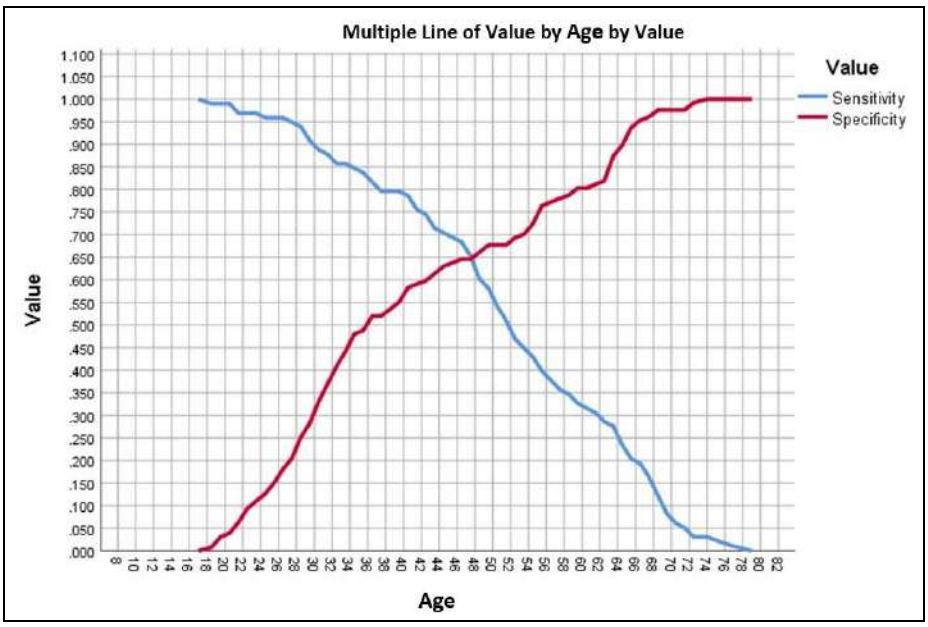

Fig 2: Sensitivity and Specificity of Age Variables on LBP

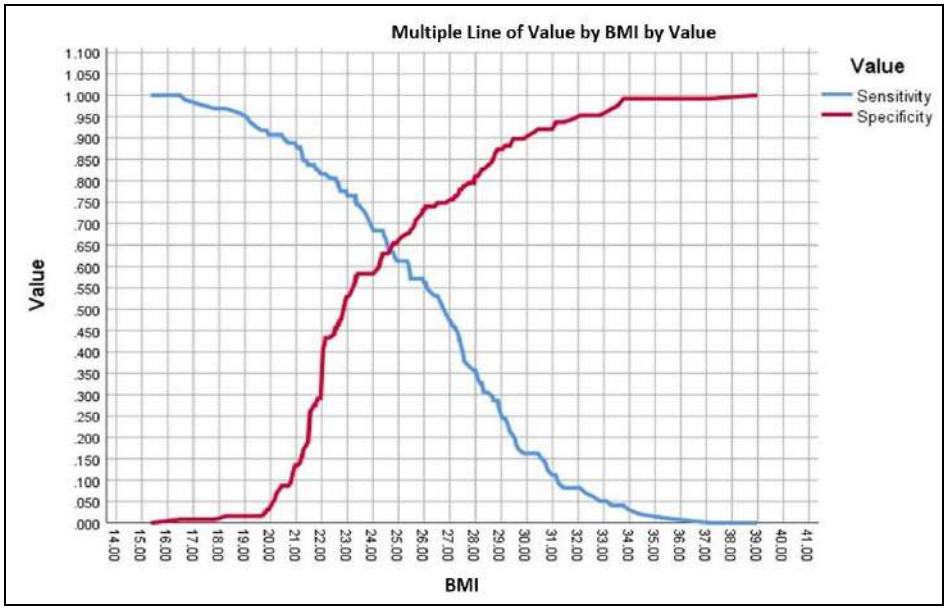

Fig 3: Sensitivity and Specificity of BMI Variables to LBP

A follow-up test in the form of a Pearson Chi Square with Yates Correction statistical test was carried out to see how closely the statistical significance was between a minimum age of 48 years and a minimum BMI of 25 kg/m2 with the incidence of Low Back Pain. The results of the Pearson Chi Square with Yates Correction statistical test concluded that there was a significant relationship between a minimum age of 48 years and a minimum BMI of 25 kg/m2 on the incidence of Low Back Pain (p-value < 0.001) with the risk magnitude of the age variable being 3,430 (1,974 - 5,960) and the BMI variable is 3,195 (1,845 – 5,535). Diagnostic tests were also carried out to see how big the ability of age and BMI in diagnosing the incidence of LBP. The results of the diagnostic test showed that the diagnostic ability of the age variable was sens 65.31; spec 64.57; PPV 58.72; NPV 70.69;AUC 0,649 – and the diagnostic ability of the variable body mass index is sens 61.22; species 66.93; PPV 58.82; NPV 69.11; AUC 0,641 (Table 4-5 and Figure 2)

Table 4: Diagnostic Test Value

Research Variable		Disease		OR	p-value	Diagnostic Test Value			
		LBP	Normal			Sens	Spesi	PPV	NPV
Age	≥ 48 years old	64 (28, 4%)	45 (20, 0%)	3,430 (1,974 – 5,960	< 0,001	65,31	64,57	58,72	70,69
	< 48 years old	34 (15, 1%)	82 (36, 4%)						
BMI	≥ 25 kg/m^2	60 (26, 7%)	42 (18, 7%)	3,195 (1,845 – 5,535)	< 0,001	61,22	66,93	58,82	69,11
	< 25 kg/m^2	38 (16, 9%)	85 (37, 8%)						

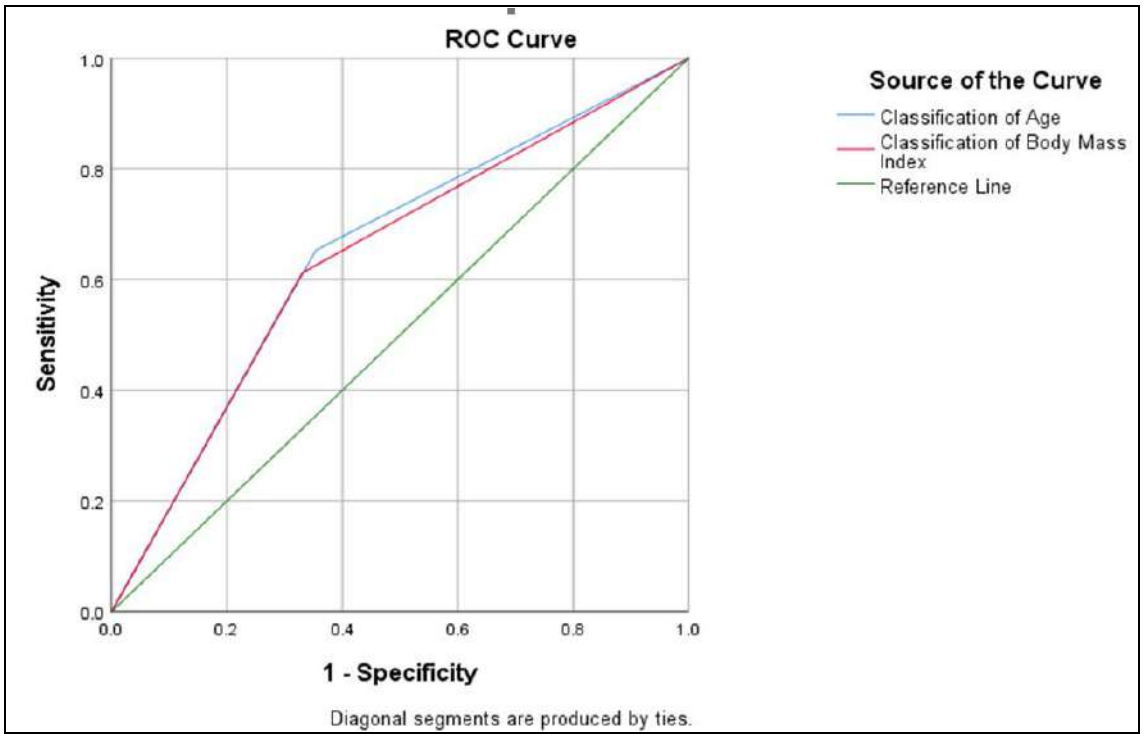

Fig 4: ROC Curve of LBP (Classification of BMI and Age)

Table 5: Area Under Curve (AUC) Predictor Parameters (Classification of BMI and Age) for LBP Incidence

Variable	Area	Std. Error[a]	p-value	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
Classification of Age	.649	.037	.000	.577	.722
Classification of BMI	.641	.037	.000	.567	.714

4. Discussion

The new thing found from this study was that the incidence of Low Back Pain (LBP) had a significant relationship with age and body mass index (p-value < 0.001). m2 is the highest risk of LBP with (p-value < 0.001) with BMI variable sens 61.22 and spev 66.93 and age variable sens 65.31; 64.57 specs. This is consistent with a study conducted by Bento TPF *et al.* on "Low back pain and its associated factors: is there a difference between the genders?", found that the by and large predominance of LBP was 60.9% in ladies and 28.8% to 39.0% in men. Variables surveyed in female respondents were work exercises including lifting overwhelming weights (PR = 1.80 [1.03-3.16]), sitting pose inclining forward (PR = 2.17 [1.24-3.82]), standing pose inclining forward (PR = 2.04 [1.20-3.44]), and sitting before a computer at slightest 3 or more days in 1 week (PR = 4.00 [1.44-11.11]), in male variables evaluated were smoking (PR = 2.47 [1.20-5.11]), less a long time of formal education (0–4 a long time) (PR = 6.37 [2.15-18.62]), age between 36 and 59 years (PR = 3.00 [1.31–6.88]) and over 60 (PR = 4.52 [2.02-10.12]) and high blood pressure (hypertension) (PR = 2.27 [1.15] -4.50]). Separated or widowed members were more likely to report LBP, both in men (PR = 3.06 [1.40-6.66]) and ladies (PR = 2.11 [1.15-3.88]). (Bento *et al.*, 2020) [2].

This can be reliable with a study conducted by Husky MM, *et al.* in "Chronic back pain and its association with quality of life in a large French population survey", which found that a add up to of approximately 38.3% of grown-ups detailed low back pain. More seasoned age, female sexual orientation, having low education, manual work, populace thickness and manual work were altogether related with the dissemination of chronic lower back pain frequency. Persistent low back pain was related with a Mental Composite Score and a Physical Composite Score controlling for comorbid therapeutic conditions counting other sorts of constant torment as well as lower scores on all SF-36 cruel scores. (Husky *et al.*, 2018) [8].

This is in accordance with a study conducted by Zanuto EAC, *et al.* on "Prevalence of low back pain and associated factors in adults from a middle-size Brazilian city" found the predominance of people with low back pain detailed last year was 50.2% (95% CI: 46.6, 53.8), and last week 32.3% (95% CI: 28.9, 35.6). Whether the affiliation was between low back pain and more seasoned age, women (p esteem = 0.031), lower level of education, changes in rest patterns and being overweight, the balanced model found that individuals over 45 years of age (45 to 59.9 a long time, OR = 13.1 [1.72] -98.5] and 60 years, OR = 9.10 [1.15-71.7]), with a few alter in sleep pattern (OR = 3.21 [1, 84–5.61]) and obesity (OR = 2.33 [1:26 to 4:33]) shows up to be the risk group for the event of low back pain. The predominance of back pain is high in obese individuals matured over 45 years who have any sleep disorders which are a bunch at higher chance for the event of low back pain. (Zanuto *et al.*, 2015) [19].

This is in accordance with the research conducted by Saputra A, on "Work Attitude, Work Period, and Age to Complaints of Low Back Pain in Batik Craftsmen" which shows that there's a relationship between work demeanor, age and mass of work with complaints of low back pain (LBP) in batik craftsmen at Batik Semarang 16. With a p-value for age of 0.020, work attitude of 0.042, and a working mass of 0.016 (Saputra, 2020) [15].

This is contrary to the research conducted by Pandjukang AP, Hutasoit RM, Damarik EMB, on the "Relationship of Age and Sex in Low Back Pain Patients with comorbid diabetes mellitus in Prof. Hospital. DR. W.Z. Johannes Kupang in 2018" showed that there was no significant relationship between age and the incidence of LBP with comorbid DM in LBP patients. (Pandjukang *et al.*, 2020) [13].

This is in line with the research conducted by Hasimoto Y, *et al.* on the "Association between objectively measured physical activity and body mass index with low back pain: a large-scale cross-sectional study of Japanese men", in which 428 individuals had persistent LBP. A noteworthy negative dose-response relationship was found for PA and persistent LBP (P for linearity = 0.012). Regarding the BMI calculate, the odd proportion was appeared to be higher within the overweight/obese category of individuals (BMI ≥ 25 kg/m2) compared with the category of normal weight individuals (BMI < 25 kg/m2). When high PA was used as a reference within the typical weight category, the chances ratio for low PA and medium PA was within the normal weight category appeared to be high in individuals within the overweight/obese category, the chances proportion for each wellness level is additionally high as in people within the normal weight category. (Hashimoto *et al.*, 2018) [7].

This is in line with research conducted by Indra MDM, *et al.* on "The Relationship of Body Fat Percentage to the Risk of Non-Specific Low Back Pain in Students of the Physiotherapy Study Program, Faculty of Medicine, Udayana University" found that the rate of body fat is related with non-specific low back pain and a person's individuals with a high body fat rate have a more prominent risk of encountering non-specific low back torment compared to individuals with a low body fat rate (Indra *et al.*, 2021) [9].

This is in line with Ardalan S, *et al.* on "Prevalence rate of neck, shoulder and lower back pain in association with age, body mass index and gender among Malaysian office workers" found that there was a critical relationship between the severity of pain in sex and left shoulder (p=-0.041) and right (p=-0.046) . There was also a noteworthy relationship between the severity of pain within the lower back zone (p=-0.047) and BMI. it was found that the whole shoulder pain score was essentially related to the age of the person (p=-0.041). (Shariat *et al.*, 2018) [16].

This is contrary to the research conducted by Pratiwi Y, *et al.* on "The Relationship of Length of Work and BMI with Low Back Pain in Taxi X Drivers Pekanbaru", which found that the predominance of Taxi X drivers who experienced LBP was 65.1% more noteworthy than the predominance of Taxi X drivers. who did not have LBP. Components related to LBP on X Pekanbaru Taxi drivers, are long working hours. BMI variable is not related to LBP (Pratiwi *et al.*, 2020) [14].

This is in line with the research conducted by Misra RK, *et al.* on "The role of body mass index (BMI), serum estrogen level and bone mineral density (BMD) in lumbar osteoarthritis and low back pain in postmenopausal women" which found that Postmenopause is related with an increased frequency of low back pain. Low estrogen levels, increased person BMI and low BMD are components that altogether relate with the occurence of lumbar osteoarthritis and low back pain in postmenopausal women. (Misra *et al.*,

2019) [10].
This is in line with the research conducted by Mambu ED, on "Factors of Causes of Myogenic Low Back Pain at Stella Maris Hospital Makassar", which found that this study showed that sufferers of low back pain myogenic by age group, showed that most of the respondents were aged 51-60 years, as many as 27 people (38%), for the gender group, it shows that the majority of respondents are women, namely 59 people (83%), while based on the body mass index (BMI) group the most is the obesity category, which is as much as 34 people (48%). The results of this study can be concluded that age, gender, and body mass index (BMI) are factors that cause low back pain myogenic. (Stella & Makassar, 2022) [17].
This is in line with research conducted by Ettore G.D, Vullo A, Pellicani V, *et al.* in "Acute low back pain among registered nurses Organizational implications for practice management", which found that the relationship between acute low back pain and night shifts, shifts that stretched, overweight; the application of a turning forward plan has been appeared to be compelling in minimizing the recurrence of acute low back pain. (d'Ettorre *et al.*, 2018) [3].
This is contrary to the research conducted by Syuhada AD, *et al.* on "Risk Factors for Low Back Pain in Tea Picking Workers at Ciater Tea Plantation, Subang Regency" who found that there was a relationship between back posture, work, overwhelming loads and low back pain (P<0.05). There was no relationship between , sexual orientation, age, smoking, physical action, and body mass index of individuals with low back pain (p> 0.05). Multivariate investigation utilizing calculated regression appeared that tenure could be a risk factor for the event of low back pain. The consider found that tea pickers had lower back pain issues. Arrangements for setting up lifting techniques and doing a lot of rest are required to avoid low back pain. (Syuhada *et al.*, 2018) [18].
This is also in line with research conducted by Cena PD, *et al.* in "Female Gender Is Associated with a Higher Prevalence of Chronic Neck Pain, Chronic Low Back Pain, and Migraine: Results of the Spanish National Health Survey, 2017" which found that Women detailed a higher predominance of Persistent Low Back Pain (CLBP), Persistent Neck Pain (CNP), and Headache Migraine MH (P < 0.001) than men. For both genders, destitute self-assessment of wellbeing and uneasiness and/or misery were related with altogether expanded predominance of CLBP, CNP and MH. For CNP and CLBP, the related components recognized were confinement of regular action and more seasoned age. For CNP and MH, the foremost common related factor was comorbid respiratory infection. (Palacios-Ceña *et al.*, 2021) [12].

5. Conclusions and suggestions

The results of the Mann Whitney statistical test showed that there was a significant mean difference between the LBP and Normal groups in the variables of age and body mass index (p-value <0.001). From the results of statistical tests regarding the mean difference between the 2 groups, it was found that BMI and age variables might be used as a reference to predict the incidence of LBP. ROC analysis provides an illustration that the variables of age and BMI are included in the poor category in predicting the incidence of LBP (Area 0.60 – 0.70; p-value < 0.001). From the graph it is known that the cut-off value (rounded) of the risk of LBP incidence for the age variable is 48 years and for the body mass index variable is 25 kg/m^2. The results of the Pearson Chi Square with Yates Correction statistical test concluded that there was a significant relationship between a minimum age of 48 years and a minimum BMI of 25 kg/m2 on the incidence of Low Back Pain (p-value < 0.001) with the risk magnitude of the age variable being 3,430 (1,974 - 5.960) and variable BMI of 3.195. From the results of research conducted at the Cempaka Putih District Health Center, it was found that age over 48 years and BMI above equal to 25 kg/m2 were the highest risk of LBP with (p-value < 0.001) with BMI sens 61.22 and spev 66, 93 and the age variable sens 65.31; 64.57 specs.

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