RELIABILITY AND VALIDITY OF THE VISUAL ANALOGUE SCALE IN NON-MYOGENIC LOW BACK PAIN PATIENTS

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Abstract

Introduction**:* Non-myogenic low back pain is a health issue characterized by the primary complaint of pain in the lower back, extending from the costal area to the buttocks, typically radiating down to the legs. LBP can lead to decreased function, reduced work productivity, and high treatment costs. Non-myogenic LBP is classified into four categories based on its causes: herniated nucleus pulposus, spondylitis, spondylosis, and spondylolisthesis. ***Objective: To determine the reliability and validity of VAS scales in the case of intra rater and inter rater in non-myogenic LBP patients. ***Methods:*** This type of research is an observational study with the approach of methodological research and uses purposive sampling, total samples of 55 people. Visual analogue scale is used to measure the pain scale of non-myogenic lbp patients. ***Results**:* Intra- rater or test-retest VAS reliability was very high (Cronbach's alpha: 0.951, ICC: 0.951, 95% CI: 0.916-0.971, $p<0.001$) and inter-rater VAS reliability was very high (Cronbach's alpha: 0.959, ICC: 0.959, 95% CI: 0.929-0.976, $p<0.001$). The validity test seemed VAS was valid for intra-rater and inter-rater with $p<0.05$ and r calculated was higher than r of table ($r=0.260$). SEM value: 0.19 and MDC: 0.55. ***Conclusion**:* The visual analogue scale demonstrates reliability and validity for both intra-rater (test-retest) and inter-rater evaluations as a measurement tool for pain scale in patients with non-myogenic LBP.

Keyword: reliability, validity, low back pain, visual analogue scale

Introduction

Low back pain (LBP) or lower back pain is a disease with pain as the main complaint that most people often suffer from. Pain can be described as discomfort in the back from the bottom of the ribs to the top of the gluteus (1). The painful sensation that is felt spreads to the feet. Apart from pain, LBP also has an impact on decreased function, reduced work productivity and becomes a burden due to high treatment costs. According to the cause, LBP is divided into two, namely myogenic LBP and non-myogenic LBP. Non-myogenic LBP is caused by problems with bone structure (HNP), infection or inflammation (spondylitis), trauma (spondylosis & spondylolithesis), and so on (2). Increasing age increases the risk of suffering from LBP with recurring pain intensity. The largest population of LBP sufferers are women aged 40 years, while most men are found to be over 50 years old. However, cases of LBP that do not affect daily activities are quite common, with a percentage of 14% of the population experiencing short episodes of LBP and experiencing weakness (3). The World Health Organization (WHO) also stated that the prevalence of LBP in industrialized countries in 2013 was quite high, ranging from 60% - 70%, with a prevalence of 15% - 45% per year. The incidence rate in the elderly is 5% per year, children and adolescents have a lower incidence rate than adults.

Pain is the main complaint of non-myogenic LBP, from various causes the complaints felt will be the same but with different areas and different sensations. The area of pain in non-myogenic LBP is usually in the sacroiliac area, lumbar five (L5) to sacrum one (S1), and spreads to the feet (4). These complaints cause various problems such as impaired reflexes, tenderness, spasms, limited range of motion (ROM), changes in walking patterns and decreased daily activities (5). LBP pain is one of the biggest complaints in America and Canada and is a cause of physical limitations and absence from work (1). LBP pain intensity can be measured using various measuring instruments, one of which is the visual analogue scale (VAS). VAS is a simple pain measurement tool that is easy for patients to understand with a point (0-10 cm) when shifted towards a larger end point indicating unbearable pain (6). However, several studies consider the VAS to be less objective because it is subjective from the patient's perspective (7) so this is related to the reliability of the VAS. Reliability is a condition where the measuring instrument can be trusted with consistent results and does not change much when measured over a certain period of time (8). In Robinsoon and colleagues' research, there was insufficient relevance in measuring pain intensity which affected the reliability of VAS in measuring (9). However, other research shows superiority without affecting gender and level of education or literacy skills with results of $p>0.05$ and a correlation of 0.693 (6). Regardless of the good and bad on the VAS scale. VAS is often used in the examination and evaluation of pain such as screening before hospital treatment (10), measuring pain in neck pain (11), evaluating pain after total hip arthroplasty (12), measuring

pain in spondylolysis patients (13), and so on. However, seeing that there has not been much research in Indonesia regarding the reliability of the VAS scale in non-myogenic LBP patients, this research aims to determine the intra- and inter-rater reliability of the VAS in non-myogenic LBP patients. Thus, VAS can be a reference tool for measuring pain scales used in non-myogenic LBP patients.

Methods

The research was conducted on the basis of research permission and has been approved by the ethics committee of Dr. Moewardi with number 110/I/HREC/2024. This research uses the Observational study with the Research Methodology approach. The research was conducted at the Pandan Arang Boyolali District General Hospital, Central Java from February to March 2024. The population in this study of LBP patients was 157, using non-probability sampling. Then insert a large sample that has been formulated by Arifin in 2023 https://wnarifin.github.io/ssc/ssicc.html using a web that facilitates researchers with only having to parse an exceptable minimum of 0.6. Exceptable reality 0.8, significance level 0.05, power 80%, and drop out 10% so the number of samples in this study is 55 samples (14).The variable consists of the independent variable visual analogue scale and its dependent variable non-myogenic LBP. The study used several research instruments, namely: (1) Visual analogue scale or VAS, which is a simple and easy-to-understand pain measurement device with a point (0-10 cm) when moved toward a larger end point indicating unbearable pain (6). (2) Writing tool, a bulpoin and a small notebook used to write respondent data and respondent pain measurements. (3) Informed consent, is an explicit consent document in which respondents obtain information and understand the research. This consent must be given voluntarily and reconsiderable, allowing respondents to withdraw at any time during the research process. The data analysis technique consists of univariate analysis, namely the presentation of data in the form of frequency (n), average (mean), minimum (min), maximum (max), and standard deviation (sd) (15). The cronbach's alpha reliability test is used to test the reliability of a device consistently by a single meter with a constant coefficient value as well as a minimum reliability value of 0.6, if below 0.6 is said to be unreliable (16). Interpretations of crobach' s alpha constant cofficient values are 0.00-0.20 very low, 0.201-0.40 Low, 0.401-0.60 Moderate, 0.601-0.80 High, and 0.801-0.90 Very High (16). The reliability test intraclass correlation coefficient (ICC) is used to test the reliability of a tool when used by two raters so that it can see the relationship between two or more raters (agreement) with an ICC value interpretation <0.5 poor, 0.5-0.75 moderate, 0.75-0.90 good, >0.90 excellent, and a minimum value of 0.5, if a value below 0.5 is said to be less reliable. (Wang et al ., 2020). The validity test is performed using pearson product moment tests on intra

rater and inter rater VAS values. VAS is said to be valid if $p<0.05$ and r counts larger than table r (17).

The research is designed so as not to interfere with the comfort of hospital and patient service, so that the research obtains data that is objective and in accordance with the criteria of the respondents.

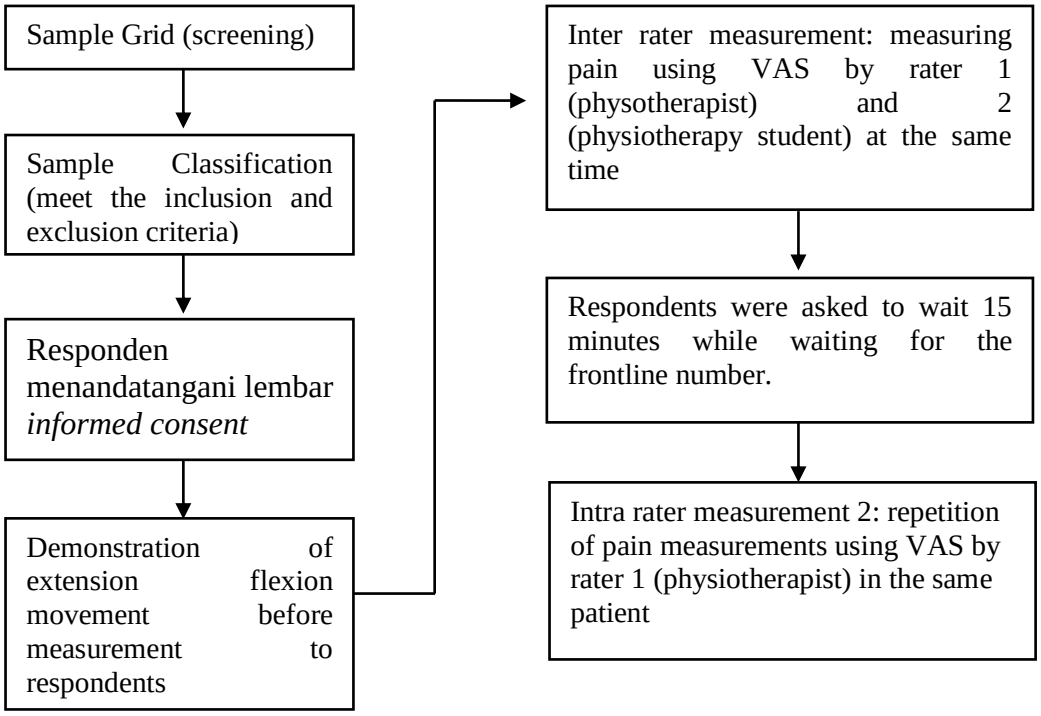

Figure 1. Research Stream

The initial sampling is carried out by pre-screening through the process of assessment of samples that have been made and adjusted to the inclusion criteria and exclusion criteria. The researchers have established the criteria of inclusion and exclusion for the classification of the samples required, as follows: Criteria of inclusion; a) Age ranging from 40 to 75 years; b) Diagnosis with HNP, spondylitis, Spondylosis, Spondylolisthesis; c) Confirmed diagnosis with X-ray or MRI; d) Pain in the L4-S1 area with a value of more than 3 using the VAS scale; e) Feeling pain when moving (flexion and extension); f) Chronic back pain for more than threemonths; g) And male and female. For exclusion criteria; a) Receiving corticosteroid injections at least 24-48 hours after administration; b) patients taking corticoid drugs at least 5-6 hours after ingestion; c) patients having neurological diseases (stroke, Parkinson's, cerebral ataxia); d) patients suffering from spinal abnormalities (tumors and bone tuberculosis); e) no other musculoskeletal diseases; f) post-operative; g) and patients unable to communicate properly.

The study consists of two types of reliability and validity tests, namely intra-rater (test-retest) and inter-rater. Inter-rater measurements were first performed by rater 1 (physiotherapist)

and rater 2 (professional student) at the same time. The patient briefly described the usefulness of VAS in expressing the values of pain experienced by the respondent. Respondents were educated before measuring how the procedure of using such a tool systematically, in this pain measurement the researchers used a modified VAS that the way of operation was easier because only shifted VAS to the left (do not feel pain) and to the right (unbearable pain). Before the measurement, the patient was asked to move the flexions and extensions that had been disassembled, and the researcher was switched by the physiotherapist alternately, then the patient was asked to shift the VAS as described according to the pain felt during the flexion and extension movements. Then the patient is measured back by rater 1 (physiotherapist) after 15 minutes.

Results

This research was conducted based on previous studies and field conditions that warranted further investigation. The results of the study are presented in tables to summarize the findings and facilitate understanding for the readers.

Table 2. Characteristic data of non-myogenic lbp patients

Variable	Min	Max	Mean±SD	N%
Age (years)	45	75	62.02±7.04	-
Gender				
Female	-	-	-	28 (50.9%)
Male	-	-	-	27 (49.1%)
Job				
Work	-	-	-	25 (45.5%)
Not working	-	-	-	30 (54.5 %)
Diagnosis				
HNP	-	-	-	54 (98.2%)
Spondylolisthesis	-	-	-	1 (1.8%)
Visual Analogue Scale (VAS)	3	9	5.1±1.42	-

Table 2 shows that the average age of respondents is 62, with the number of female respondents being 28 compared to 27 male respondents, respondents are almost equal to men and women. Non-working status is higher than working status. The cause of LBP condition is

dominated by HNP (98.2%) with an average pain scale of 5.1.

Table 3. Test reliability and validity of the Visual Analogue Scale

Test Variable	Crombachs Alpha	ICC	95% CI	*p-value*	r
Intra-Rater (R1-$R1_{15}$)	0.951	0.951	0.916-0.971	<0.001	-
Inter-Rater (R1-R2)	0.959	0.959	0.929-0.976	<0.001	-
Intra-rater validity	-	-	-	<0.001	0.907
Inter-rater validity	-	-	-	<0.001	0.921

Table 3 shows that the results of intra-rater and inter-rater VAS reliability tests in non-myogenic LBP patients. Both reliability tests show very high reliability because Cronbach's Alpha value is above 0.9 (excellent) with an Intra-Class Correlation rating of more than 0.9 (excellent). The inter-rater is performed at the same time between rater 1 and rater 2. The analysis of the relationship between test 1 and test 2 using Pearsonproduct-moment results in a significant value ($p<0.001$) of both inter-rater and intra-raters. The value of the correlation coefficient (r-count) on the intra-rater and inter-raters is above 0.9 and greater than the r-table ($r=0.260$) for a sample of 55 people. So it can be stated that VAS has good validity for measuring pain in non-myogenic LBP patients.

Table 4. SEM and MDC_{95} values

	Nilai
SEM	0.19
MDC95	0.52

The SEM search yielded a value of 0.19, indicating a very low probability of error. Moreover, the MDC95 search resulted in a 0.52 value, which means that the probability for a change in this study is small.

Discussion

Discussions in this study found that it was a characteristic factor of respondents with an average age of 62, with 45 years as the minimum age and 75 as the maximum age. According to KEMENKES in 2016, age 60 is already in the elderly category. At that age, a person will experience a physiologically decreased function, such as ageing disc fibrochondrosites, so that the pressure on the annulus fibrosus becomes high and causes pain in the lower back area (18). It

affects the quality of life such as day-to-day activities and work (5). The pain areas of non-myogenic LBP generally occur in sacroliaka, lumbar five (L5) to sacrum one (S1) that have a major role in daily activities such as sitting (4). According to the results of the above study of 55 respondents of 30 (54.5%) non-working respondents and 25 (45.5%), the difference is not significant but quite representative to conclude if pain in the lower thigh caused by non-myogenic LBP sometimes affects life although not significantly. 54 respondents (98.2%) or the majority of respondents had HNP and only 1 (1.8%) had spondylolithesis, with an average respondent age of 60 years. The study found that the prevalence of HNPs at age 60 was approximately 88% and only 23% suffered from spondyllolithosis due to day-to-day activities and work not done with ergonomic positions (19). Gender population turned out to be one of the characteristics to be taken into account, out of 55 respondents there were 28 female and 27 male. There are no significant differences in the number of female and male respondents, but there are more female respondents than men. Because women have a higher risk of developing LBP due to the daily activities performed by women and female muscle abilities that are not as good as men and there are factors of decreased levels of estrogen hormone in women (20). Pain is the main complaint of non-myogenic LBP, the pain is often squeezed but if you look at the results of the study the pain quite affects the daily activity of 55 respondents, the average feeling of pain is 5.1 and the maximum pain is felt 9 this is in line with the result of respondents who do not work as many as 30 respondents. In addition, it is in line with other studies that state that pain causes a variety of problems such as the presence of reflexes, tenderness, spasms, limitation of range of motion (ROM), changes in walking patterns to decreased daily activity (5). The complaint is one of the largest complaints in the United States and Canada, leading to physical constraints and absence from work (1). Intra rater is a pain measurement performed repeatedly by a rater or pain examiner in non-myogenic LBP patients using the VAS pain scale with a 15-minute interval between the first and second measurements to see the constant values of the measuring instrument (16). The results of this study on the case of intra rater VAS reliability test in non myogenic lbp patients have a very high reliability with cronbach's alpha value of 0.951 (21). The 15-minute interval is carried out because the measurement time is related to the sensation or memory of a person where less than 24 hours of the stimulus is performed quite clearly and recorded by the brain, if more than 24 minutes of the recorded memory will stack up with other memory and as age increases the memory capacity will decrease or decline (22). With this result VAS has reliability on cronbach's alpha in line with previous studies that obtained reliability consistency with cronbach's alfa value of 0.88 which means the reliability of the constant is very high (9) and the same vase if done in repeated measurements of pain in the same patient, with earlier studies that yielded the value of ICC 0.90 and SEMs 0.09 (22). Inter rater is a

measurement performed by two rater simultaneously and then the result is processed to know the relationship between the rater or the existence of agreement or certainty of perception in measuring (23). The results of this study on inter rater VAS in non-myogenic LBP patients have a very high reliability result with cronbach's alpha value of 0.959, which means VAS coefficient consistency to measure pain (16). For interrater values intraclass correlation cofficient has an excellent result with a value of 0,959 (excelleent), which means that VAS remains reliable even though performed by two rater at the same time (24). This study is in line with previous studies with a reliability rating for VAS of 0.77 (high) (25). In addition, another study found a 0.90 ICC result measuring patients' pain in the lumbo-sacral (Paungmali et al ., 2012). Reliability of a measuring instrument also takes into account the validity of the measuring device so that analytical tests are carried out to find factor validity. Factor validity is a pearson product moment test or count r value of intra rater and inter rater with r count greater than r table (26). This study yielded a significant result with a $p<0.001$ value in test 1 and test 2 (intra rater) yielding $r=0.907$ (larger than r-table, that is 0.260) (6). It describes that VAS is a valid pain measurement scale to measure pain in non-myogenic LBP patients. Similarly, a value between rater 1 and 2 or inter rater with a value $p<0.001$ and a value $r=0.921$ means high validity (26). The results of this study are consistent with previous studies denan a high relativity result of 0.90 (good), but have a questionable quality with a p-velue value > 0.05 due to the presence of weaknesses in the construction of the research (9). In another study VAS in measurement has a p -velue result ≤ 0.05 and a $r \pm 0.8$ value (shows a very good relationship) with the relationship between VAS disability and VAS pain at present (25). In addition to paying attention to reliability and validity values, we also pay attention to standard error of measurement (SEM) and minimum detectable change (MDC). SEM is an estimate of the expected spread of the measurements from a series of measures performed by individuals on the same instrument and MDC is the estimation of the smallest change in the score of a measuring instrument that exceeds the measuring error (27). In this study the SEM value was 0.19 which means there is no probability of error in this study because SEM value does not exceed the standard deviation value, and in line with the previous study that had SEM result 0.03 where the probability is very small (28). It can be concluded that VAS is reliable and valid to measure pain in non-myogenic LBP pains with the possibility of error and the presence of very small changes.

Conclusion

The conclusion of this study is the reliability and validity of the visual analogue scale in non-myogenic LBP patients at the Pandan Arang Regional General Hospital, it can be concluded that the visual analogous scale is reliable and valid in intra-rater and interrater cases to measure

pain in patients without myogenic lBP.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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