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Daily Living Activity Improvement After William Flexion Exercise in Low Back Pain Patients

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Abstract: Low Back Pain (LBP) is a leading cause of functional limitation, often impairing Activities of Daily Living (ADL). Evidence regarding ADL outcomes following combination physiotherapy in Indonesian hospital settings remains limited. This study evaluated the effect of William Flexion Exercise (WFE) combined with physiotherapy modalities on ADL among LBP patients at Mataram University Hospital. A quantitative quasi-experimental one-group pretest–posttest design was conducted with 11 participants recruited through consecutive sampling. ADL was assessed using the validated Barthel Index and analyzed using descriptive statistics and the McNemar test. Before intervention, all participants (100%) were categorized as having mild dependence. After combination therapy administered twice weekly for four weeks, eight participants (72.7%) achieved independence, while three (27.3%) remained mildly dependent. Statistical analysis demonstrated a significant improvement in ADL following the intervention (McNemar, $p = 0.008$). These findings suggest that WFE combined with physiotherapy modalities may improve functional independence in LBP patients. However, the small sample size and absence of a control group limit causal inference and generalizability. Further randomized controlled studies with larger samples are recommended to confirm these findings.

Keywords: Activities of daily living; Barthel Index; Low back pain; Physical therapy modality; William flexion exercise.

Introduction

Low Back Pain (LBP) remains one of the most prevalent musculoskeletal disorders globally, with lifetime prevalence estimates reaching 50–80% among adults aged 20 years and older (Hasmar et al., 2023). LBP is characterized by pain arising in the region spanning from the twelfth thoracic vertebra to the inferior margin of the gluteal fold, frequently radiating toward the proximal lower extremity (Cahyani et al., 2022). The etiology of LBP is multifactorial, encompassing biomechanical stressors such as improper load lifting, prolonged static posture, and sustained non-ergonomic sitting, as well as intrinsic contributors including advanced age, systemic disease, and musculoskeletal trauma (Hasmar et al., 2023).

Central obesity further aggravates LBP through dual mechanisms: excessive abdominal fat accumulation increases mechanical load on the lumbar spine while simultaneously promoting the release of pro-inflammatory cytokines that amplify spinal pain sensitization (Lee & Cha, 2023). Global data confirm that the disability burden attributable to elevated body mass index has risen substantially since 1990 and is projected to continue through 2036 (Zhang et al., 2024).

The prevalence of LBP in 2020 was found to be 619 million people and in 2050 it is predicted that the incidence of LBP will increase to 843 million people (WHO, 2023).

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The prevalence of LBP was found to be the highest in 2017, namely in Latin America around 13.47%, Asia Pacific followed with data around 13.16%, East Asia found data around 3.92%, and Central Latin America obtained data of 5.62% (Wahid et al., 2023). In Indonesia, national health surveillance data from the 2018 Basic Health Research (Riskesdas) recorded a point prevalence of LBP at approximately 3.71% of the adult population aged 15 years and above, which when applied to the national population base reflects a considerably large absolute burden. This figure positioned LBP as the second most frequently reported musculoskeletal complaint in Indonesian primary health care settings, following influenza (Goin et al., 2019).

The impact of LBP extends beyond the working-age population, as it is equally prevalent among older adults managing non-communicable diseases. In this elderly group, functional capacity tends to decline proportionally with the accumulation of comorbid conditions, as evidenced by progressively lower Barthel Index scores in individuals with multiple concurrent diagnoses (Putri et al., 2024). At its core, LBP manifests as localized pain in the lower back region, spanning from the twelfth thoracic vertebra to the inferior gluteal line, and in many cases radiates further toward the proximal segment of the lower limb (Silvia et al., 2024).

LBP is classified based on the duration of pain into acute (less than one month), subacute (one to six months), and chronic (more than six months). It is further categorized by etiology into specific and non-specific LBP, where specific LBP refers to pain attributable to an identifiable pathological cause, while non-specific LBP accounts for the majority of cases without a definitive structural diagnosis (Hasmar et al., 2023).

Damage or disruption to key vertebral structures, including intervertebral discs, muscles, ligaments, and facet joints, commonly underlies the onset of pain, representing the body's physiological response to mechanical or structural compromise within the spinal column (Purwanto et al., 2024). Among the numerous risk factors associated with LBP, age and body mass index (BMI) hold particular significance in the context of the present study. Advancing age is associated with progressive degeneration of intervertebral discs and diminished musculoskeletal resilience, rendering older adults more susceptible to recurrent or chronic LBP (Hutasuhut et al., 2021).

Elevated BMI, particularly in the overweight and obese categories, amplifies axial loading on the lumbar spine and promotes a pro-inflammatory state that accelerates structural deterioration (Zhang et al., 2024). Given that the sample in this study comprised individuals predominantly aged 50–60 years with BMI distributions skewed toward the overweight and obese categories, both age and BMI represent potential confounding variables that may have independently influenced the observed outcomes, and their uncontrolled presence constitutes a recognized limitation of the study design.

Activities of Daily Living (ADL) is a basic skill needed to take care of oneself independently such as standing, sitting, bathing, and other daily activities (Altinbilek & Murat, 2020). In the context of LBP, persistent pain in the lumbar region directly restricts a patient's capacity to perform fundamental physical movements, including bending, prolonged standing, transitioning between sitting and standing positions, and carrying out personal hygiene routines. This pain-driven limitation progressively erodes the individual's functional independence, as even routine self-care tasks become physically demanding and psychologically burdensome, ultimately reducing overall quality of life (Purwanto et al., 2024). LBP can affect ADL which will have an impact on learning activities at school, work, and other activities (Silvia et al., 2024). ADL can be measured using the barthel index. ADL disorders caused by LBP include obstacles in activities such as walking, climbing stairs, and controlling body balance, so interventions that are able to effectively suppress pain are the main key to restoring the patient's functional abilities (Kaple & Phansopkar, 2023).

The Barthel Index is a widely validated and reliable instrument designed to assess functional independence across a broad spectrum of clinical populations, measuring an individual's capacity to perform basic ADL

tasks such as feeding, bathing, grooming, mobility, and continence management (Edemekong et al., 2023). Unlike condition-specific tools, the Barthel Index demonstrates strong psychometric properties including high inter-rater reliability and concurrent validity across diverse patient groups, ranging from stroke survivors to individuals with chronic musculoskeletal disorders, making it equally applicable and clinically meaningful in the assessment of functional limitations experienced by LBP patients (Harale et al., 2024). This questionnaire can measure the patient's functional abilities, such as the patient's ability when sitting, sleeping, walking, and other daily activities. The results in the form of scores will later be used to determine the severity of the patient's functional disorders (Rahmawati, 2021).

Physiotherapists occupy a central role in the clinical management of LBP, applying evidence-based physical interventions aimed at alleviating pain and restoring the patient's functional capacity. Among the therapeutic modalities commonly utilized in physiotherapy practice for LBP, Transcutaneous Electrical Nerve Stimulation (TENS), Microwave Diathermy (MWD), and Infrared Radiation (IR) have each demonstrated considerable clinical value through distinct yet complementary mechanisms. TENS exerts its analgesic effect primarily through activation of the descending inhibitory pathway and suppression of central excitability, thereby meaningfully attenuating the subjective perception of pain in affected individuals (Liebano et al., 2024).

MWD, in contrast, delivers electromagnetic energy capable of penetrating deep tissue layers to generate therapeutic heat that conventional superficial modalities cannot reach, producing superior outcomes in terms of muscle relaxation and functional disability reduction (Halimah et al., 2022; Zhang et al., 2024). IR has similarly demonstrated effectiveness in reducing lumbar pain intensity and enhancing spinal muscle flexibility, with clinical evidence indicating that its therapeutic benefit is further amplified when combined with structured physical exercise compared to exercise intervention alone (Setiawan & Widiyanto, 2022).

Another physical therapy intervention commonly employed in the management of LBP is William Flexion Exercise (WFE), a structured and progressive exercise program specifically designed to alleviate lumbar pain through targeted strengthening and flexibility training. WFE is a physical exercise made to relieve pain and strengthen the gluteus maximus and abdominal muscles, as well as stretch the extensor muscles. The effectiveness of WFE has been proven in a variety of clinical contexts; in non-specific LBP patients, WFE has been shown to improve ROM, muscle strength, and functionality (Halimah et al., 2022), while in the case of LBP due to spondylolisthesis, the application of WFE in the multimodal physiotherapy approach was able to reduce the Oswestry disability score from the category of severe disability to minimal disability (Harale et al., 2024).

Even at the community level, WFE education and training provided to the elderly has been proven to be able to increase understanding and reduce pain levels independently (Wahid et al., 2023). This physical exercise consists of several movements, including hamstring stretch, hip flexor stretch, single knee to chest, double knee to chest, Pelvic Tilting, Partial Sit Up, and squats. Combination therapy of WFE and modalities can make LBP patients more comfortable in moving (Wibisono et al., 2025). This will trigger an increase in the patient's functional activity (Cahyani et al., 2022).

Although prior studies have individually examined the effects of WFE on pain reduction and ROM improvement (Halimah et al., 2022), as well as the role of physical therapy modalities in reducing functional disability (Altinbilek & Murat, 2020), evidence specifically addressing the combined effect of WFE and multimodal physiotherapy on ADL outcomes as measured by the Barthel Index remains limited. Most existing studies focused on pain intensity as the primary outcome, with relatively fewer investigations systematically documenting functional independence changes using a standardized ADL instrument in a clinical rehabilitation setting. Furthermore, research conducted within the Indonesian hospital context, particularly in eastern Indonesia

where patient demographic profiles including age distribution and BMI patterns may differ substantially from Western or East Asian populations, remains scarce. The present study therefore addresses this evidence gap by evaluating the improvement in ADL among LBP patients receiving combination therapy of WFE and modalities at Mataram University Hospital, utilizing the Barthel Index as a validated functional outcome measure, thereby contributing contextually relevant clinical evidence to the existing body of literature on multimodal physiotherapy for LBP.

Materials and Methods

This study employed a quantitative approach with a quasi-experimental one-group pretest-posttest design, aimed at evaluating the improvement in Activities of Daily Living (ADL) among LBP patients receiving combination therapy of William Flexion Exercise (WFE) and physiotherapy modalities. The study was conducted at the Rehabilitation and Physiotherapy Polyclinic of Mataram University Hospital from March to May 2026.

The study population consisted of LBP patients who attended the Rehabilitation and Physiotherapy Polyclinic of Mataram University Hospital and had undergone one complete therapy cycle from the time of initial diagnosis. Sample size was determined using a paired categorical analytical formula with the following parameters: significance level alpha set at 0.05, statistical power at 80%, expected proportion of ADL improvement based on prior literature at 70%, and a minimum clinically meaningful effect size of 20%. These parameters yielded a minimum required sample of 11 respondents. To account for potential attrition, a 10% drop-out anticipation was incorporated into the calculation, resulting in a final target of 12 respondents. However, given the limited patient flow at the study site during the recruitment period, 11 respondents who fully met the eligibility criteria were ultimately enrolled and completed the entire study protocol without dropout.

Sampling was conducted using a consecutive sampling technique, whereby all eligible patients presenting at the clinic during the recruitment period from March to May 2026 were systematically screened and enrolled until the required sample size was reached. This technique was selected due to its practicality in clinical settings with limited patient availability and its ability to minimize selection bias compared to convenience sampling (Elfil & Negida, 2016). Inclusion criteria comprised patients diagnosed with LBP, aged 30 to 60 years, capable of completing the Barthel Index questionnaire, and willing to participate by signing informed consent. Exclusion criteria included patients with severe neurological deficits, those who had undergone spinal surgery, and those with contraindications to the applied modalities. Of all patients screened during the recruitment period, 11 met the inclusion criteria and none declined participation or were excluded after enrollment.

Data on sex, BMI, and age were recorded from each respondent to support univariate descriptive analysis. Prior to the commencement of the intervention, all respondents completed the Barthel Index questionnaire to establish baseline ADL status. The intervention consisted of a structured combination therapy protocol comprising WFE and physiotherapy modalities administered over one therapy cycle of four weeks, with two supervised sessions per week, totaling eight sessions. Each session began with the application of physiotherapy modalities, followed by guided WFE. The modalities applied included TENS with a frequency of 80–100 Hz, pulse duration of 50–100 microseconds, and intensity adjusted to the patient's sensory threshold for 20 minutes; MWD delivered at a non-thermal to mild thermal dose for 15 minutes over the lumbar region; and IR applied at a distance of 45–60 cm from the lumbar surface for 15 minutes. Following modality application, respondents performed the WFE protocol consisting of seven sequential movements: hamstring stretch, hip flexor stretch, single knee to chest, double knee to chest, pelvic tilting, partial sit-up, and squat, each held for 10 seconds and repeated 10 times per movement under direct physiotherapist supervision. Adherence to the full protocol was monitored through attendance records maintained by the supervising physiotherapist throughout the intervention period.

At the conclusion of the fourth week, respondents completed the Barthel Index questionnaire for the second time to assess post-intervention ADL status. The independent

variable in this study was the combination therapy intervention of WFE and physiotherapy modalities, while the dependent variable was the change in ADL as measured by the Barthel Index category before and after the intervention.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software. Univariate analysis was conducted to describe the distribution of respondent characteristics including sex, age, and BMI, as well as ADL categories before and after intervention, presented in frequency and percentage tables. Bivariate analysis employed the McNemar test to assess whether a statistically significant improvement in ADL occurred following the intervention, with the level of significance set at $p < 0.05$.

Prior to data collection, ethical clearance was obtained from the Ethics Committee of the Faculty of Medicine and Health Sciences, University of Mataram. All respondents received a thorough explanation of the study objectives, procedures, potential risks, and benefits before being asked to sign an informed consent form as formal acknowledgment of their voluntary participation.

Results and Discussion

Univariate Analysis

Categories of Barthel Index Before Intervention

The results in table 1 are the conditions of Activities of Daily Living (ADL) of the study respondents which were measured using the barthel index questionnaire before receiving a combination therapy of William Flexion Exercise (WFE) and modalities for one cycle. The measurement process was carried out by means of direct interviews with each research respondent. Of the total 11 (100%) respondents, the condition of Activities of Daily Living (ADL) was in the category of mild dependence.

Table 1. Frequency Distribution of Barthel Index Categories Before Intervention

Categories	Frequency	Percentage (%)
Mild dependence	11	100,0

The Barthel Index categorizes functional independence into four levels: total dependence (score 0–20), severe dependence (score 21–60), moderate dependence (score 61–90), mild dependence (score 91–99), and full independence (score 100). In the pre-intervention assessment, all 11 respondents (100%) were classified within the mild dependence category, while the remaining categories of total dependence, severe dependence, moderate dependence, and full independence recorded zero respondents, indicating a relatively homogeneous baseline functional status across the study sample prior to the administration of combination therapy.

Barthel Index Categories After Intervention

The results in table 2 are the conditions of Activities of Daily Living (ADL) of the study respondents which were measured using the barthel index questionnaire after completing a combination therapy of William Flexion Exercise (WFE) and modalities for one cycle. The measurement process was carried out by means of direct interviews with each research respondent. Of the total 11 respondents, three (27.3%) had the Activities of Daily Living (ADL) condition in the mild dependency category, and eight people (72.7%) had the Activities of Daily Living (ADL) condition in the independent category.

Table 2. Frequency Distribution of Barthel Index Categories After Intervention

Categories	Frequency	Percentage (%)
Mild dependence	3	27,3
Self-Sufficient	8	72,7
Total	**11**	**100,0**

Gender

The results in table 3 are the gender conditions in the study respondents. Of the total 11 respondents, five were male (45.5%), and six were female (54.5%). The gender distribution between males and females is still relatively balanced and the risk of bias due to the sexes is smaller.

Table 3. Gender Frequency Distribution

Gender	Frequency	Percentage (%)
Male	5	45,5
Women	6	54,5
Total	**11**	**100,0**

Age

The results in table 4 are age conditions in the study respondents. Of the total 11 respondents, four (36.4%) were aged between 30-39 years, two (18.2%) were aged between 40- 49 years, and five (45.5%) were aged 50-60 years. The age distribution of respondents in this study was uneven, so it could affect the results of the study.

Table 4. Age Frequency Distribution

Age	Frequency	Percentage (%)
30-39	4	36,4
40-49	2	18,2
50-60	5	45,5
Total	**11**	**100,0**

Given the small sample size of this study, neither age nor BMI was statistically controlled as a covariate in the analysis, which constitutes a recognized methodological limitation. The uneven distribution of these two variables across respondents introduces the possibility that observed improvements in ADL may have been partially influenced by age-related differences in physical resilience or BMI-related variations in lumbar mechanical loading, rather than solely attributable to the combination therapy intervention itself.

IMT

The results in table 5 are the BMI conditions in the study respondents. Of the total 11 respondents, one person (9.1%) had BMI in the underweight category, two people (18.2%) had BMI in the normal category, three people (27.3%) had BMI in the overweight category, and five people (45.5%) had BMI in the obesity category 1. The distribution of respondents' BMI in this study was uneven, so it could affect the results of the study.

Table 5. BMI Frequency Distribution

IMT	Frequency	Percentage (%)
Less weight	1	9,1
Normal	2	18,2
Excess weight	3	27,3
Obesity 1	5	45,5
Total	**11**	**100,0**

Bivariate Analysis

The results in Table 7 are ADL results based on Barthel Index categories before and after the administration of WFE and modality combination therapy interventions for one cycle (twice a week for four weeks). The results in Table 7 are the p-value results of ADL statistical analysis based on the Barthel Index category before and after therapy. Of the total 11 respondents, eight people (72.7%) experienced an increase in ADL, and three people (27.3%) did not experience an increase in ADL. The results of the ADL p-value based on the Barthel Index category before and after therapy showed a p-value of < 0.05, which was 0.008, indicating statistical significance.

Table 6. Bivariate Results of ADL Improvement Based on Barthel Index Score Before and After Therapy

	After: Independent	After: Mild Dependence	Total
Before: Mild Dependence	8	3	11
Before: Independent	0	0	0
Total	**8**	**3**	**11**

Table 7. ADL P-value Results Based on Barthel Index Score Before and After Therapy

	Test Statistics Before & After
N	11
Exact Sig. (2-tailed)	.008b

a. McNemar Test
b. Binomial distribution used.

Discussion

Prior to the intervention, all 11 respondents (100%) presented with mild dependence based on the Barthel Index assessment, reflecting a homogeneous baseline functional status across the study sample. Following one cycle of combination therapy comprising WFE and physiotherapy modalities administered twice weekly over four weeks, eight respondents (72.7%) demonstrated a categorical shift from mild dependence to full independence, while three respondents (27.3%) remained within the mild dependence category. This transition from mild dependence to independence is clinically

meaningful, as it signifies that patients who previously required partial assistance in performing basic daily tasks such as ambulation, stair climbing, and postural transitions were subsequently able to execute these activities autonomously, representing a tangible and functionally relevant improvement in quality of life for individuals living with LBP.

Bivariate analysis using the McNemar test confirmed a statistically significant improvement in ADL following the intervention, yielding a p-value of 0.008, which falls well below the predetermined significance threshold of $p < 0.05$. Beyond statistical significance, the proportion of respondents demonstrating ADL improvement reached 72.7% (8 out of 11), with a 95% Confidence Interval calculated using the Wilson score method ranging from 46.4% to 99.0%. It is important to note that this figure represents a descriptive proportion of improvement rather than a formally tested proportional significance, as no pre-specified clinical threshold or proportion test was conducted. Nevertheless, the fact that the majority of respondents surpassed the minimal clinically important difference threshold in Barthel Index categorization strengthens the practical relevance of the observed outcomes beyond mere statistical inference.

The therapeutic mechanisms underlying these improvements are well-supported by existing evidence. WFE contributes to lumbar stabilization through progressive strengthening of the abdominal, hamstring, and gluteus maximus muscles, alongside targeted relaxation of the paraspinal extensor musculature, collectively reducing mechanical stress on the lumbar spine and alleviating pain that restricts functional movement. Wibisono et al. (2025) reported that a two-week WFE program produced a 66% reduction in pain intensity based on the Visual Analogue Scale, with mean scores declining from 5.6 to 1.9 ($p < 0.004$). Andika et al. (2025) further demonstrated that the combination of Infrared therapy and WFE significantly enhanced functional capacity in non-specific LBP patients, with all participants showing measurable gains in lumbar muscle flexibility alongside reduced pain levels. Additionally, the integration of neuroscience-based pain education within physiotherapy frameworks has been shown to amplify overall therapeutic outcomes, particularly by attenuating kinesiophobia, a fear of movement that frequently impedes ADL recovery in chronic LBP populations (Halimah et al., 2022).

In addition, movements in WFE can make blood vessels vasodilate, so that blood circulation is smooth and nutrients are channeled optimally. This reduces pain and is followed by reduced muscle spasms (Lendraitienė et al., 2024). The modality can provide a relaxing effect, improve blood circulation, and reduce pain. This combination of therapy helps to lower pain more optimally (Wibisono et al., 2025). Combined interventions involving Proprioceptive Neuromuscular Facilitation (PNF), core stability exercises, and MWD have also been shown to significantly improve lumbar functional activity in people with CLBP (Kaple & Phansopkar, 2023), indicating that a multimodal combination approach consistently produces better clinical outcomes than a single modality (Islam et al., 2024).

These findings are consistent with prior investigations demonstrating the therapeutic value of WFE and physiotherapy modalities in LBP management. Altinbilek & Murat (2020) reported that modality-based physiotherapy significantly reduced pain intensity and functional disability relative to baseline, thereby facilitating measurable improvements in ADL. Wibisono et al. (2025) similarly indicated that combination therapy of WFE and modalities produced a statistically significant reduction in low back pain as measured by the Visual Analogue Scale, with a p-value of 0.001, and that this pain reduction was directly associated with improved functional activity. The underlying rationale is physiologically coherent: as pain diminishes, the inhibitory effect on neuromuscular activation decreases, enabling patients to execute daily functional tasks with greater ease, reduced compensatory movement patterns, and improved postural control, collectively translating into enhanced ADL performance.

The present study contributes contextually relevant clinical evidence supporting the application of WFE and modality combination therapy in hospital-based rehabilitation settings in Indonesia. However, several limitations must be acknowledged in interpreting these findings. The one-group pretest-posttest design without a control group precludes definitive causal

inference, as observed improvements cannot be exclusively attributed to the intervention in the absence of a comparator. The small sample size of 11 respondents further limits the generalizability of the results to broader LBP populations. Future studies employing randomized controlled designs with larger and more demographically homogeneous samples are warranted to substantiate these preliminary findings and establish stronger evidence for clinical practice guidelines.

Conclusion

This study demonstrated that the administration of combination therapy comprising William Flexion Exercise and physiotherapy modalities over one cycle of four weeks produced a statistically significant improvement in Activities of Daily Living among LBP patients at Mataram University Hospital, as evidenced by a McNemar test p-value of 0.008. Clinically, this improvement was reflected in a categorical shift from mild dependence to full independence in 72.7% of respondents based on the Barthel Index, signifying a meaningful restoration of functional autonomy in performing essential daily tasks. These findings contribute preliminary clinical evidence supporting the integration of WFE and multimodal physiotherapy as a structured rehabilitation approach for LBP patients in Indonesian hospital settings. Nevertheless, the interpretation of these results warrants appropriate caution, given the one-group pretest-posttest design without a control group and the small sample size of 11 respondents, both of which limit the strength of causal inference and the generalizability of the findings to broader populations. Future investigations employing randomized controlled designs with larger and more diverse samples are strongly recommended to substantiate and extend these preliminary findings.

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