

The Effectiveness of the William Flexion Exercise in Alleviating Chronic Low Back Pain in Workers

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ABSTRACT

Introduction: Chronic low back pain (CLBP) is a common musculoskeletal disorder experienced by workers with highly sedentary lifestyles and obesity. The William Flexion Exercise (WFE) is a physiotherapy intervention aimed at reducing pain and improving function in patients with CLBP. To determine the effectiveness of WFE in reducing pain, improving lumbar flexibility, and reducing functional disability in rattan craftspeople with CLBP. **Methods:** This study employed a quasi-experimental, single-group, pre-test–post-test design involving 25 rattan craftspeople. The WFE intervention was delivered twice a week for 6 weeks. Pain was measured using the Numeric Rating Scale (NRS), lumbar flexibility using the Schober Test, and functional disability using the Oswestry Disability Index (ODI). Data analysis utilised the Wilcoxon test for non-normally distributed data and the paired t-test for normally distributed data. **Results:** There was a significant reduction in pain across all components of the NRS ($p < 0.0001$), an improvement in lumbar flexibility in flexion ($p = 0.003$) and extension ($p < 0.0001$), and a reduction in functional disability ($p < 0.0001$). **Conclusion:** WFE twice a week for 6 weeks effectively reduces pain, improves lumbar flexibility and reduces functional disability in rattan craftspeople with CLBP, prolonged sitting and obesity.

Keywords: Chronic Low Back Pain, William Flexion Exercise, Lumbar Flexibility, Functional Disability, Obesity

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INTRODUCTION

Chronic low back pain (LBP) is one of the most common musculoskeletal disorders found amongst the working population, particularly amongst those with highly sedentary lifestyles. The prevalence of CLBP amongst office workers and those in static seated positions ranges from 7.6 per cent to 37 per cent in Indonesia, with the main risk factors including prolonged sitting, non-ergonomic posture, and individual characteristics such as Body Mass Index (BMI) (Prihati et al., 2023). Administrative staff, online ride-hailing drivers and batik artisans are groups of workers who spend 6–8 hours a day in a static seated position, placing them at high risk of experiencing lower back pain. Prolonged sitting places a continuous static load on the

musculoskeletal structures, particularly in the lumbar region. Non-ergonomic sitting postures lead to increased pressure on the intervertebral discs and tension in the paravertebral muscles, which ultimately trigger pain and musculoskeletal dysfunction. Research indicates that daily sitting duration is a significant predictor of the incidence of low back pain (LBP), with each increase in sitting duration raising the likelihood of developing lower back pain (Pratiwi et al., 2020).

Another factor that exacerbates CLBP is obesity. Individuals with a high body mass index experience increased mechanical stress on the spine, particularly the lumbar segment, thereby accelerating the degenerative process and increasing pain intensity (Ruiz-Fernandez et al., 2025). The combination of prolonged sitting and



obesity leads to an increased risk of chronic pain, which has a significant impact on an individual's functional ability. Increased pain intensity in CLBP sufferers is closely associated with a reduction in functional ability when carrying out daily activities (Hartanto et al., 2022). This restricted range of motion is often accompanied by reduced lumbar flexibility due to muscle spasms, soft tissue stiffness, and the body's protective mechanisms to avoid pain. This condition can ultimately reduce an individual's quality of life and work productivity (Efendi & Halimah, 2023).

One physiotherapy intervention that can be used to address these issues is the William Flexion Exercise (WFE). This exercise aims to reduce lumbar lordosis, improve the flexibility of the lower back muscles and hamstrings, and strengthen the abdominal muscles, thereby reducing pain and improving function (Li et al., 2023). Several studies have shown that the WFE is effective in reducing pain intensity and improving functional ability in patients with LBP (Utami & Ambardini, 2025). However, the majority of previous studies have been conducted on the general population of LBP patients, obese patients, or office workers, and there are still few studies that specifically evaluate the WFE in workers with high levels of sedentary activity accompanied by obesity, particularly among rattan craftspeople—who are informal workers with a static sitting duration of 7–10 hours per day. Furthermore, this study measured three outcomes simultaneously: pain intensity (NRS), lumbar flexibility (Schober Test), and functional disability (ODI). Against this background, it is important to examine the effect of WFE sessions, conducted twice a week, on pain levels, functional ability and lumbar flexibility in workers with CLBP who have a habit of prolonged sitting and are obese.

METHODS

Research Design

This study employed a quasi-experimental design using a one-group pre-test-post-test design ($n = 25$), with sample size determined using the Slovin formula and a 5 per cent margin of error, to evaluate the effectiveness of the WFE intervention in reducing pain and

functional limitations among rattan craft workers with chronic low back pain (CLBP), who had risk factors including prolonged sitting and a Body Mass Index (BMI) in the obese category.

Population & Sample

The study subjects were rattan craftspeople in Trangsan Village, Gatak, Sukoharjo, who met the following inclusion criteria: (1) aged 40–65 years; (2) with a BMI ≥ 25 kg/m² (overweight/obese); (3) sitting for ≥ 6 hours per day; (4) experiencing lower back pain for ≥ 3 months (chronic); (5) able to communicate and follow exercise instructions. Exclusion criteria included: (1) a history of spinal surgery; (2) congenital abnormalities or spinal deformities; (3) pain due to 'red flags' (fractures, tumours, infections); (4) currently participating in another exercise programme. Sampling was carried out using purposive sampling.

Research Protocol

This study has received ethical approval (Ethical Clearance) from Moewardi Hospital No: 2.169/X/HREC/2025.

Measurement Instruments

The instrument used to measure pain intensity was the Numeric Rating Scale (NRS), whilst functional limitations were measured using the Oswestry Disability Index (ODI).

Intervention Procedure

The WFE intervention was delivered over 6 weeks at a frequency of twice a week (a total of 12 sessions). Each session lasted 50 minutes and was led by a physiotherapist and directly supervised by the researcher. Each session consisted of three stages: warm-up (5 minutes), core exercises (40 minutes) and cool-down (5 minutes).

Stage 1 - Warm-up (5 minutes): The subject performs lumbar joint mobilisation (flexion–extension–gentle rotation) and gentle stretching of the lower back muscles and hamstrings.

Stage 2 - WFE Core Exercises (40 minutes): The subject performs 7 William Flexion Exercise movements, including (pelvic tilt, single knee to chest, double knee to chest, partial sit-up, hamstring stretch, hip flexor stretch, squat), with



10 repetitions and a 60-second rest period between sets.

Stage 3 - Cool-down (5 minutes): Participants perform light stretching and relaxation of the lower back muscles.

Supervision and Compliance: All sessions were led by a physiotherapist and directly supervised by the researcher. Subjects were also given a home programme in the form of exercise sheets to be carried out at home 1–2 times a week, and compliance was recorded in a daily logbook.

Data Analysis

Data analysis was performed using SPSS version 27. The Shapiro-Wilk test was used to assess normality as the sample size was < 50 ($n=25$). Decision criteria: $p > 0.05$ = data are normally distributed; $p \leq 0.05$ = data are not normally distributed. The Wilcoxon Signed-Rank Test was used for variables that were not normally distributed (Resting, Compression and Movement Numeric Rating Scales), whilst the Paired t-test was used for variables that were normally distributed (Schober flexion and extension, Oswestry Disability Index). A p-value < 0.05 was considered statistically significant. The results are presented in tables showing frequency distributions, mean $\pm$ SD, and p-values.

RESULTS

Table 1. Characteristics of Respondents

Variable	WFE (n=25)			
	Min	Max	Mean	SD
Age	42.00	63.00	53.32	5.513
BMI	21.90	33.60	26.15	2.815
Duration of sitting	7.00	10.00	8.36	1.07
NRS				
Resting	1.00	3.00	2.24	0.66
Pressure	2.00	4.00	2.72	0.67
Movement	2.00	7.00	4.60	1.32
Schober Test (cm)				
Flexion	3.80	5.60	4.63*	0.52
Extension	1.70	2.60	2.08	0.25
ODI (%)	9.00	58.00	28.36	13.63

*Highest mean.

Note: Values are presented as minimum, maximum, mean, and standard deviation (SD). NRS = Numeric Rating Scale; ODI = Oswestry

Disability Index; Schober Test measures lumbar flexion and extension mobility;

Table 2. Normality Test

Variable	WFE (n=25)	
	Pre	Post
	Shapiro-Wilk.	
NRS		
Resting Pain	<0.0001	<0.0001
Pressure Pain	<0.0001	<0.0001
Movement Pain	0.03	<0.0001
Schober Test		
Flexion	0.26*	0.40*
Extension	0.10*	0.61*
ODI	0.16*	0.13*

* The data are normally distributed.

Note: The Shapiro–Wilk test was used to assess normality. Decision criteria: $p > 0.05$ = normally distributed; $p \leq 0.05$ = not normally distributed. Pre = Baseline; Post = Post-intervention; NRS = Numeric Rating Scale; ODI = Oswestry Disability Index.

Table 3. Testing for Differences Before and After the Intervention

Variable	WFE (n=25)	
	Paired T-test	Wilcoxon test
	sig	p - value
NRS		
Resting Pain	-	$<0.0001^*$
Pressure Pain	-	$<0.0001^*$
Movement Pain	-	$<0.0001^*$
Schober Test		
Flexion	0.003*	-
Extension	$<0.0001^*$	-
ODI	$<0.0001^*$	-

*significant data.

Note: The paired t-test is used for normally distributed data, whilst the Wilcoxon test is used for non-normally distributed data. A p-value < 0.05 indicates a significant difference before and after the intervention. All variables showed statistically significant changes following the administration of the William Flexion Exercise.

The characteristics of the 25 rattan craftspeople with CLBP are shown in Table 1, with a mean age of 53.32 ± 5.51 years, a BMI of



$26.15 \pm 2.82 \text{ kg/m}^2$, and a sitting duration of 8.36 ± 1.07 hours per day; NRS scores for rest, pressure and movement were 2.24 ± 0.66 ; 2.72 ± 0.67 ; and 4.60 ± 1.32 , respectively; lumbar flexion range of motion $4.63 \pm 0.52 \text{ cm}$ and extension $2.08 \pm 0.25 \text{ cm}$; and an ODI score of $28.36 \pm 13.63\%$. The results of the Shapiro-Wilk normality test (Table 2) showed that the NRS was not normally distributed ($p < 0.05$), whilst the Schober and ODI were normally distributed ($p > 0.05$). Furthermore, the pre-post difference test (Table 3) showed a significant decrease in all components of the NRS (Wilcoxon; $p < 0.0001$), a significant increase in Schober flexion ($p = 0.003$) and extension ($p < 0.0001$), and a significant decrease in the ODI (Paired t-test; $p < 0.0001$).

DISCUSSION

Research findings indicate that a 6-week WFE intervention, carried out twice weekly, results in positive changes in terms of pain reduction, improved lumbar flexibility and reduced functional disability. The study found that WFE had a significant effect in reducing CLBP symptoms following a 6-week intervention (twice weekly). A comparative study between WFE and McKenzie exercises in 23 patients with LBP demonstrated a statistically significant reduction in pain scores in the group receiving the WFE intervention, with a p-value of 0.03 (Kurniawan et al., 2019) (Kurniawan et al., 2019; Yihunie et al., 2023). Research by Utami et al. also confirmed that WFE has a significant effect on pain reduction in patients with low back pain ($p < 0.05$) (Utami & Ambardini, 2025). In an obese population, a 6-week WFE intervention combined with a proper body mechanics programme demonstrated a significant reduction in pain as measured by the Visual Analogue Scale (VAS), with a p-value of 0.011 (Norha et al., 2024; Sakti et al., 2026).

Furthermore, WFE also contributes to improved lumbar flexibility through the stretching of tight back extensor muscles and the strengthening of the abdominal and gluteal muscles (Gou et al., 2024; Kaple & Phansopkar, 2023). Physiologically, the increase in lumbar flexibility and reduction in functional disability following WFE can be explained through four

mechanisms. Firstly, repeated stretching during the single/double knee-to-chest movement triggers autogenic and reciprocal inhibition, increases sarcomere length, and reduces the viscoelastic stiffness of tendons and fascia, thereby increasing the range of motion in lumbar flexion (Li et al., 2023). Secondly, strengthening of the core muscles (transversus abdominis, internal oblique, gluteus maximus) through pelvic tilt, partial sit-ups and squats improves the stability of the lumbar segment and reduces disc compression, thereby reducing pain and disability (Kaple & Phansopkar, 2023). Thirdly, regular flexion exercises stimulate the release of endorphins and enkephalins and activate the descending inhibitory pathway, which reduces nociceptor sensitivity and pain intensity ($p < 0.0001$). Fourthly, improved flexibility and core stability simultaneously improve functional movement patterns (bending, lifting, prolonged sitting), resulting in a significant reduction in ODI scores ($p < 0.0001$) (Ruiz-Fernandez et al., 2025).

A study of workers with work-related back pain showed that WFE, administered twice a week for three weeks, had a significant effect on improving functional trunk activity ($p = 0.000$) (Mubarok et al., 2022). Regarding the reduction in functional disability, a study of nurses with non-specific low back pain reported that WFE administered over four weeks resulted in a significant reduction in disability as measured by the Oswestry Disability Index (ODI), with a p-value of < 0.001 (Fontana Carvalho et al., 2020).

However, there are several limitations. Firstly, the effectiveness of WFE on functional disability does not always yield statistically significant results. A study on patients with low back pain and obesity reported that, although there was an improvement in functional scores in the group receiving WFE, the difference was not statistically significant compared with the control group ($p = 0.976$) (Utami & Ambardini, 2025). This discrepancy in results may be influenced by several factors. Firstly, the study used a control group that also received other interventions (rather than no intervention), making it more difficult to detect the additional effect of WFE. Secondly, the duration of the intervention and adherence to home exercises were not reported in detail, meaning the exercise dose received by the



subjects was likely sub-optimal. Thirdly, the characteristics of the subjects in that study were more heterogeneous, whereas this study specifically targeted workers with prolonged sitting durations and obesity who had more uniform patterns of pain and functional limitations, making the effects of WFE easier to detect.

Secondly, several studies have shown that WFE is less effective than other exercise techniques in reducing pain. A study comparing the Quantum Movement Technique (QMT) with WFE in 20 patients with low back pain showed that QMT was more effective in reducing pain than WFE ($p<0.05$) (Aras et al., 2020). Similarly, a study of Thai farmers reported that Progressive Abdominal Training (PAT) resulted in a greater reduction in pain than WFE, with an average pain reduction of 51.56 per cent for PAT compared with 38.11 per cent for WFE ($p<0.01$) (Chaikhot et al., 2025). This difference can be explained by the fact that QMT and PAT involve more complex and progressive exercise components, whilst WFE focuses more on lumbar flexion and stretching movements. Furthermore, QMT and PAT are generally delivered with a more structured progression of load, thereby providing a greater adaptive stimulus for pain reduction (Abinaya et al., 2023). However, WFE retains advantages in terms of simplicity, ease of implementation, and the fact that it requires no specialised equipment, making it more applicable for workers with limited access to healthcare facilities. Consequently, differences in effectiveness between WFE and other techniques do not necessarily imply that WFE is ineffective; rather, they reflect differences in the objectives, complexity and context of application of each intervention (Sutejo, 2022).

Regarding the improvement of lumbar flexibility, a comparative study between WFE and the McKenzie exercise programme showed that there was no statistically significant difference in the improvement of the range of motion of the lumbosacral joint between the two intervention groups ($p=0.317$) (Kurniawan et al., 2019). Furthermore, a critical review of the scientific evidence revealed several

methodological weaknesses, such as limited placebo controls, heterogeneity in intervention protocols, researcher bias, and clinical effect sizes that tended to be small despite being statistically significant (Kaple & Phansopkar, 2024). Furthermore, in workers with an obese BMI, additional challenges arise because excess weight can limit the ability to perform lumbar flexion movements correctly, making adherence to the exercise programme a significant determinant of success (Ruiz-Fernandez et al., 2025).

CONCLUSION

Based on the results of a study involving 25 rattan craft workers with chronic low back pain (CLBP) who had risk factors of prolonged sitting and a BMI in the obese category, it can be concluded that the William Flexion Exercise (WFE), administered twice a week for 6 weeks, had a significant effect on reducing pain intensity ($p<0.0001$), an improvement in lumbar flexibility in both flexion ($p=0.003$) and extension ($p<0.0001$) movements, and a reduction in functional disability as measured using the Oswestry Disability Index (ODI) with a p-value of <0.0001 . These results confirm that WFE is effective as a simple, easy-to-perform and practical exercise therapy intervention for workers with CLBP.

Based on the study findings and identified limitations, it is recommended that physiotherapy practitioners and healthcare professionals consider WFE as a safe and effective intervention option for managing CLBP in workers with high levels of sedentary activity, with a frequency of at least twice a week for 6 weeks, whilst combining it with education on body posture, proper body mechanics, and a weight management programme. For workers and employers, it is recommended that they provide workplace ergonomics programmes and facilitate regular WFE exercises as a form of prevention and self-management for lower back pain. Further research is recommended to include a control group, long-term follow-up, and measurement of exercise adherence to strengthen the evidence of WFE's effectiveness.



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